Research article

Gender Differences in Depressive Symptoms in U.S. Chinese Older Adults

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Abstract: Background: This study aim s to explore gender dif ferences in depressive sym ptoms in U.S. Chinese older adu lts. **Methods:** Data were from the PINE study, a population-based study of U.S. Chinese older adults aged 60 years and a bove. The PHQ-9 was used to m easure depressive symptoms. **Results:** Depressive symptoms were m ore prevalent in U.S. Chinese older wo men (59.2%) than in older m en (48.5%). Older wom en were more likely to present som atic depressive symptoms and to develop moderate to severe depressive symptoms. Older age ($r = 0.09$, $P < 0.001$), lower income ($r = 0.07$, $P < 0.01$), poorer health status ($r = 0.34$, $P < 0.001$), inferior quality of life ($r = 0.17$, $P < 0.001$) and worsening health ch anges over the past year ($r = 0.23$, $P < 0.001$) were positively correlated with any depr essive symptom in older wom en. **Conclusions:** This study emphasizes the need for developing tailored interv entions for depressive sym ptoms in the subgroup of U.S. Chinese older adults. Further longitudinal studies shoul d be conducted to better understand gender differences in risk factors and outcom es associated with depressiv e symptoms in U.S. Chinese older adults.

Keywords: gender; depressive symptoms; older adults; Chinese; depression

1. Introduction

Depression is a widespread m ental health issue and is predicted to be the second leading cause of disability worldwide by 2020 [1]. Older adults are disproportionally af fected by depressive symptoms [2]. It is estim ated that 15%–20% of older adults suf fer from significant depressive symptoms [3]. The presence of depressive symp toms may result in adverse health outcomes, including physical and cognitive impairment [4] increased levels of social isolation, the oc currence of other m ental health issues such as anxiety and hopelessness [5], and elder m istreatment [6,7]. More importantly, depressive symptoms are linked to increased mortality and suicide risks [8,9]. Yet

the study of depressive sym ptoms in older adults is fraught with many challenges, such as older adults tending to assume that depression is a part of the normal aging process and thus are less likely to seek treatment in a timely manner. In addition, detecting depressive symptoms in older adults may be very co mplicated, as depressive sym ptoms may be associated with m edical commodities, functional impairments and comorbid dementia disorders [10].

Gender may be one of t he most salient factors th at influence the occurrence, m anifestation and recognition of depressive symptoms. There is a large body of literature suggesting that wom en are more susceptible to depressiv e symptoms than men [11,12]. A variety of psychological factors, socio-cultural factors, and biologi cal factors s uch as hormonal ch anges may contribute to gender differences in rates of depressive sym ptoms. However, prior studies on gender dif ferences in depressive symptoms in late lif e have yielded inconsistent result s, with som e studies showing no gender difference in rates of depressive sym ptoms [13] and others sugge sting that older wom en experienced higher rates of depressive sym ptoms than older m en [14,15]. The variations m ay be attributed to dif ferences in setting s, sample procedures and assessm ent tools. T hus far, gender differences in depressive symptoms among older adults remain less clear.

The study on gender dif ferences in depressive symptoms cannot be separated from the familial and cultural context in which they oc cur. Traditional gender norms may play roles in shaping gender differences in depress ive symptoms. Historically, guided by patriarchal cultural values, Chinese women are expected to be subordi nate to m en and therefore of lo wer social status. The gender inequality in Chinese cultur e has resulted in wo men facing educational, econom ic and health care disadvantages [16]. Thus, social expectations of gender roles in Chinese culture m ay lead to variations in depressive sym ptoms among Chinese older m en and wom en. Prior studies on depressive symptoms consistently demonstrate gender differences in depressive symptoms varied by cultural context [17,18]. Y et existing knowledge of gender dif ferences in depressive sym ptoms among Chinese older adults, especially among U.S. Chinese older adults is scarce.

The Chinese population is the lar gest Asian American subgroup population in the U.S., numbering 4 m illion in 2010 [19] . Acculturation stress brought about by cultural and linguis tic barriers may predispose Chinese older adults to higher risk fo r depressive sym ptoms [20]. Additionally, disparities in health care access along with the influence of traditional values in emotional restraint may prevent Chinese o lder adults from seeking tim ely professional help. Depressive symptoms may be detrimental to individuals and families of U.S. Chinese older adults [10]. Notwithstanding the scope and se verity of the issue, there is a dearth of investigations examining gender differences in depressive symptoms in U.S. community-dwelling Chinese older adults. The objectiv es of this study are to: 1) ex amine the gender dif ferences in depressive symptoms in U.S. Chinese older adults ; and 2) explore the corr elates of depressive symptoms in U.S. Chinese older men and older women.

2.   Methods

2.1. Population and settings

The Population Study of Chines e Elderly in Chicago (PINE) is a community-engaged, population-based epidemiological study of U.S. Chinese older adults aged 60 and over conducted in the greater Chicago area. Briefly, the purpose of the PINE study is to collect community-level data of U.S. Chinese older adults to exam ine the key cu ltural determinants of health and well-being. The project was initiated by a syner gistic community-academic collaboration among the Rush Institute

for Healthy Aging, Northwestern University, and many community-based social services agencies and organizations throughout the greater Chicago area [22].

In order to ensure study relevance to the well-being of the Chinese community and increase community participation, the PINE study implemented extensive culturally and linguistically appropriate community recruitment strategies strictly guided by a community-based participatory research (CBPR) approach. The formation of this community-academic partnership allowed us to develop appropriate research methodology in accordance with the local Chinese cultural context, in which a community advisory board (CAB) plays a pivotal role in providing insights and strategies for conducting research. Board members were community stakeholders and residents enlisted through over twenty civic, health, social and advocacy groups, community centers and clinics in the city and suburbs of Chicago. The board works extensively with investigative team to develop and examine study instrument to ensure cultural sensitivity and appropriateness.

Over twenty social services agencies, community centers, health advocacy agencies, faith-based organizations, senior apartments and social clubs served as the basis of study recruitment sites. Community-dwelling older adults who aged 60 years and over and self-identified as Chinese were eligible to participant in the study. Out of 3,542 eligible older adults approached, 3,159 agreed to participate in the study, yielding a response rate of 91.9 %.

Our bilingual research team translated the scales into Chinese and back translated it into English. The translations were further scrutinized by investigators to ensure content and face validity. The Participant signed a consent form approved by the Institutional Review Board of the Rush University Medical Center prior to the interview. Trained multicultural and multilingual interviewers conducted face-to-face home interviews with participants in their preferred language and dialects, such as English, Cantonese, Taishanese, Mandarin, or Teochew dialect. Data were collected using state-of-science innovative web-based software which recorded simultaneously in English, Chinese traditional and simplified characters. This transformative technological platform minimized any information that may have been "lost in translation", thus providing deeper meaning to the data collected.

Based on the available census data drawn from U.S. Census 2010 and a random block census project conducted in the Chinese community in Chicago, the PINE study is representative of the Chinese aging population in the greater Chicago area with respect to key demographic attributes, including age, sex, income, education, number of children, and country of origin. The study was approved by the Institutional Review Board of the Rush University Medical Center.

2.2. Measurements

2.2.1. Socio-demographics

Basic demographic information included age (in years), sex (female and male), education (years of education completed), personal income (0–$4,999 per year; $5,000–$9,999 per year; $10,000–$14,999 per year; $15,000–$19,999 per year; or more than $20,000 per year), marital status (married, separated, divorced, or widowed), number of children, number of grandchildren and living arrangement (living alone, living with 1 person, living with 2–3 persons, or living with 4 or more persons). Number of years in the community and years in the U.S. were also assessed in all participants.

2.2.2.   Overall health status, quality of life and health changes over the last year

In general, how would you rate your health?" on a four-point scale (1 = poor, 2 = fair, 3 = good, 4 = very good). Quality of life was assessed by asking "In general, how would you rate you r quality of life?" also on a four-point scale ranging from 1 = poor to 4 = very good. Health changes over the last year was measured by "Compared to one year ago, how would you rate your health now?" on a three-point scale (1 = worsened, 2 = same, 3 = improved).

2.2.3.   Depressive symptoms

We used the Patient Health Questionnaire (P   HQ-9) to assess depressive sym ptoms among Chinese older adults. T he PHQ-9 consists of nine item s assessing e ach of the nine symptoms of depression from the Diagnostic and St atistical Manual of Mental Disorders (DSM-IV) [23] P articipants were asked if they had the following symptoms in the last two weeks: (1) changes in sleep; (2) changes in appetite; (3) fatigue; (4) feelings of sadness o r irritability; (5) loss of interest in activities; (6) inability to experience pleasur e, feelings of guilt or worthlessness; (7) inability to concentrate or make decisions; (8) feeling restless or slowed down; and (9) suicide thoughts. Respondents indicated answers to each question on a 4-point scale ranging from 0 = "not at all" to 3 = "nearly every day."

The total score could range from 0–27, with   a score of 1–4 indicating m inimal level of depressive symptoms, 5–9 indicating mild level of depressive symptoms, 10–14 indicating moderate level of depressive symptoms and 15 and more indicating severe level of depressive sym ptoms [24]. The PHQ-9 has been validated am ong Chinese Americans and has good inter–ra ter reliability [25]. The standardized Cronbach's alpha of the PHQ-9 in the PINE study was 0.82 [26].

2.3. Data analysis

Descriptive statistics were used to s ummarize demographic information of the older m en and women with any depressive sym ptoms. *Chi*-square statistics and Fisher 's exact test were us ed to compare the prevalence of dif ferent levels of depressive symptoms in each health status group. Pearson Correlation coef ficients and Spearman's rank correlation were calcu lated to exam ine the correlations of socio-demographic and health related factors depressive sym ptoms in older wome n and older men. Analyses were carried out using SAS, Version 9.2 (SAS Institute Inc., Cary, NC).

3.   Results

3.1. Socio-demographic and health related characteristics of older women and older men with any depressive symptoms

This study consisted of 1,831 olde r women and 1,328 older m en. More than half of the older women (59.2%) reported having depre ssive symptoms, as compared to 48.5% of the older m en. The characteristics of older women and older men with any depressive symptom are presented in Table 1. Compared to the group of older m en with any depressive symptoms, the group of older women with any depressive symptom had a higher proportion of older adults who had no education at all (10.2% *vs.* 1.1%, *P* < 0.001), had more than four children (32.5% *vs.* 24.9%, *P* < 0.01), had more than three grandchildren (71.4% *vs.* 59.2%,*P* < 0.001), were widowed (38.4% *vs.* 7.2%, *P* < 0.001), and lived alone (28.7% *vs.* 13.0%, *P* < 0.001).

Table 1. Characteristics of PINE study participants with any depressive symptom.

	Men 639 (48.5%)	Women 1,078 (59.2%)	χ^2	d.f	P-value
Age, N (%)					
60–64	131 (20.5)	218 (20.2)			
65–69	117 (18.3)	195 (18.1)			
70–74	120 (18.8)	210 (19.5)			
75–79	113 (17.7)	216 (20.0)			
80 and over	158 (24.7)	239 (22.2)	2.42	4	0.66
Education (yr), N(%)					
0	7 (1.1)	109 (10.2)			
1–6	205 (32.2)	431 (40.2)			
7–12	252 (39.6)	350 (32.7)			
13 –16	152 (23.9)	164 (15.3)			
17 and over	21 (3.3)	18 (1.7)	81.2	4	< 0.001
Income (USD), N (%)					
$0–$4,999	245 (38.5)	326 (30.5)			
$5,000–$9,999	319 (50.2)	608 (56.8)			
$10,000–$14,999	45 (7.1)	106 (9.9)			
$15,000–$19,999	18 (2.8)	15 (1.4)			
$20,000 and over	9 (1.4)	15 (1.4)	18.8	4	< 0.001
Marital status, N (%)					
Married	553 (87.0)	616 (57.6)			
Separated	15 (2.4)	22 (2.1)			
Divorced	22 (3.5)	21 (2.0)			
Widowed	46 (7.2)	410 (38.4)	1 98.4	3	< 0.001
Number of children, N (%)					
0	37 (5.8)	48 (4.5)			
1	87 (13.6)	111 (10.3)			
2–3	355 (55.6)	569 (52.7)			
4 and more	159 (24.9)	350 (32.5)	13.7	3	0. 003
Number of grandchildren, N (%)					
0	100 (15.8)	92 (8.6)			
1–2	159 (25.1)	214 (20.0)			
3 and more	375 (59.2)	765 (71.4)	32.0	2	< 0.001
Living arrangement, N (%)					
Living alone	83 (13.0)	309 (28.7)			
1	303 (47.6)	404 (37.5)			
2–3	103 (16.1)	145 (13.5)			
4 or more	149 (23.3)	220 (20.4)	56.7	3	< 0.001
Years in the U.S., N (%)					
0–10	191 (29.9)	275 (25.7)			
11–20	199 (31.1)	336 (31.4)			

21–30	141 (22.1)	262 (24.5)			
31 and more	108 (16.9)	198 (18.5)	4.15	3	0 .25
Years in the community, *N* (%)					
0–10	395 (62.0)	631(58.8)			
11–20	138 (21.7)	252 (23.5)			
21–30	69 (10.8)	113 (10.5)			
31 and more	35 (5.5)	77 (7.2)	3.02	3	0 .39
Overall health status, *N* (%)					
Very good	25 (3.9)	23 (2.1)			
Good	165 (25.8)	252 (23.4)			
Fair	279 (43.7)	482 (44.7)			
Poor	169 (26.6)	321 (29.8)	7.0	3	0 .07
Quality of life, *N* (%)					
Very good	39 (6.1)	64 (5.9)			
Good	219 (34.3)	432 (40.1)			
Fair	347 (54.3)	546 (50.6)			
Poor	34 (5.3)	36 (3.3)	8.53	3	0.04
Health changes over the last year, *N* (%)					
Improved	53 (8.3)	99 (9.2)			
Same	229 (35.8)	394 (36.6)			
Worsened	357 (55.9)	584 (54.2)	0.64	2	0 .72

3.2. Gender differences in the presentation of depressive symptoms

The prevalence of each depress ive symptom in older women and men is presented in T able 2. All symptoms assessed by the PHQ–9 were more prevalent am ong older wom en. In particular, compared with older men, a greater percentage of older women reported that they had little interest or pleasure in doing things (17.3% *vs.* 13.7%, $P < 0.01$); felt down, depressed, or hopeless (16.7% *vs.* 12.1%, $P < 0.001$); had sleeping disturbances (39.6% *vs.* 27.3%, $P < 0.001$); felt tired or had little energy (34.8% *vs.* 24.3%, $P < 0.001$); had poor appetite or over–ate (11.6% *vs.* 6.7%, $P < 0.001$); was unable to concentrate or make decisions (16.0% *vs.* 12.4%, $P < 0.05$); and had suic ide thoughts (4.7% *vs.* 2.0%, $P < 0.001$). No si gnificant gender differences were found for feel ings of guilt or worthlessness (10.4% *vs.* 8.7%, $P = 0.13$) and feeling restless or slowed down (16.3% *vs.* 14.4%, $P = 0.05$).

3.3. Gender differences in severity of depressive symptoms

The prevalence of depressive sym ptoms by different levels is presented in Table 3. Significant gender differences were found with respect to the severity of depressive symptoms. Among those who reported any depre ssive symptoms, 66.7% of older men had mini mal depressive symptoms, compared with 60.5% of olde r women. Among thos e who repor ted any de pressive symptoms, moderate to severe depressive symptoms were more prevalent in women (16.6%) than in men (12.0%).

Table 2. Presence of depressive symptoms by gender.

PHQ–9 Items	Not at all N (%)		Several days N (%)		More than half of days, N (%)		Nearly every day, N (%)		P
	Men	Women	Men	Women	Men	Women	Men	Women	
Little interest or pleasure in doing things	1,136 (86.4)	1,503 (82.8)	79 (6.0)	134 (7.4)	56 (4.3)	96 (5.3)	44 (3.4)	83 (4.6)	0.007
Feeling down, depressed, or hopeless	1,157 (87.9)	1,519 (83.4)	89 (6.8)	144 (7.9)	40 (3.0)	92 (5.1)	30 (2.3)	67 (3.7)	< 0.001
Trouble falling, staying asleep or too much	959 (72.7)	1,102 (60.4)	165 (12.5)	316 (17.3)	75 (5.8)	182 (10.0)	119 (9.0)	225 (12.3)	< 0.001
Feeling tired or having little energy	998 (75.7)	1,188 (65.2)	165 (12.5)	285 (15.6)	79 (6.0)	175 (9.6)	76 (5.8)	175 (9.6)	< 0.001
Poor appetite or overeating	1,230 (93.3)	1,610 (88.3)	45 (3.4)	90 (4.9)	27 (2.1)	64 (3.5)	17 (1.3)	59 (3.2)	< 0.001
Feeling bad about oneself — or that you are a failure or have let yourself	1,204 (91.4)	1,624 (89.6)	55 (4.2)	87 (4.8)	30 (2.3)	66 (3.6)	29 (2.2)	36 (2.0)	0.13
Trouble concentrating on things, such as reading the newspaper or watching TV	1,155 (87.7)	1,522 (84.0)	85 (6.5)	141 (7.8)	46 (3.5)	92 (5.1)	31 (2.4)	56 (3.1)	0.03
Moving or speaking so slowly that other people could have noticed	1,128 (85.7)	1,512 (83.6)	96 (7.3)	141 (7.8)	52 (4.0)	109 (6.0)	41 (3.1)	46 (2.5)	0.05
Thoughts you would be better off dead, or of hurting in some way	1,293 (98.1)	1,726 (95.3)	14 (1.1)	58 (3.2)	2 (0.2)	11 (0.6)	9 (0.7)	17 (0.9)	< 0.001

Table 3. Prevalence of different levels of depressive symptoms by gender.

	Men, N (%)	Women, N (%)	χ^2	d.f	P-value
Minimal (1–4)	426 (66.7)	652 (60.5)			
Mild (5–9)	136 (21.3)	247 (22.9)			
Moderate(10–14)	57 (8.9)	121 (11.2)			
Severe (15–27)	20 (3.1)	58 (5.4)	9.45	3	0.02

3.4. *Prevalence of depressive symptoms by health status*

The gender specific distribution of overall he alth status, quality of life and health changes in the past year is presented in Table 4. Having any depressive symptom was most prevalent among older adults with poor overall health status. In addition, compared to their male counterparts, a higher percentage of older wom en with poor health status had depressive sym ptoms (85.9% *vs.* 77.2%, $P < 0.01$), and in particular, severe depressive symptoms (12.1% *vs.* 5.9%, $P < 0.05$).

Table 4. Prevalence of depressive symptoms by health status.

Overall health status	Very good		P	Good		P	Fair		P	Poor		P
	Men N (%)	Women N (%)		Men N (%)	Women N (%)		Men N (%)	Women N (%)		Men N (%)	Women N (%)	
Any symptom	25(36.8)	23(32.4)	0.59	165(34.3)	252(41.2)	0.02	279 (50.8)	482(62.8)	< 0.001	169(77.2)	322(85.9)	0.005
Minimal (1–4)	21 (30.9)	18(46.2)	0.47	131(30.1)	184(27.2)	0.30	200(36.4)	333(43.4)	0.01	74 (33.5)	117(31.4)	0.59
Mild (5–9)	3(4.2)	3(4.4)	0.96	29 (6.0)	54 (8.8)	0.08	57 (10.4)	96 (12.5)	0.23	47 (21.3)	94 (25.2)	0.28
Moderate(10–14)	1(1.5)	2(2.8)	0.39	3 (0.6)	13 (2.1)	0.04	17(3.1)	41 (5.4)	0.05	36 (16.3	65 (17.4)	0.72
Severe (15–27)	0	0	1	2 (0.4)	1(0.2)	0.33	5 (0.9)	15 (1.6)	0.30	13(5.9)	45 (12.1)	0.01

Quality of Life	Very Good		P	Good		P	Fair		P	Poor		P
	Men N (%)	Women N (%)		Men N (%)	Women N (%)		Men N (%)	Women N (%)		Men N (%)	Women N (%)	
Any Symptom	39(44.3)	64(50.4)	0.38	219(41.2)	432(51.0)	< 0.001	347 (53.6)	545(68.1)	< 0.001	34 (65.4)	36 (76.6)	0.22
Minimal (1–4)	35(39.8)	39(30.7)	0.17	156(29.3)	290(34.2)	0.06	221(34.2)	313(39.1)	0.05	14 (26.9)	9 (19.2)	0.36
Mild (5–9)	3(3.4)	21(16.5)	0.00	40(7.5)	88(10.4)	0.07	83(12.8)	126(15.8)	0.11	10 (19.2)	12 (25.5)	0.45
Moderate(10–14)	1(1.1)	4(3.2)	0.34	18(3.4)	42(5.0)	0.16	32 (5.0)	69 (8.6)	0.006	6 (12.8)	6 (11.5)	0.85
Severe (15–27)	0	0	1	5(0.9)	12(1.4)	0.43	11 (1.7)	37 (4.6)	0.002	4 (7.7)	9 (19.2)	0.06

Table 4. Continue.

Health changes	Improved			Same			Worse		
	Men N(%)	Women N (%)	P	Men N (%)	Women N (%)	P	Men N (%)	Women N (%)	P
Any symptom	53 (47.8)	99 (60.7)	0.03	229 (34.5)	394 (45.4)	< 0.001	357 (65.5)	583 (73.8)	0.001
Minimal (1–4)	38 (34.2)	67 (41.1)	0.25	171 (25.8)	287 (33.1)	0.00	217 (39.8)	297 (37.6)	0.41
Mild (5–9)	10 (9.0)	23 (14.1)	0.20	43 (6.5)	77 (8.9)	0.08	83 (15.2)	147 (18.6)	0.11
Moderate(10–14)	4 (3.6)	6(3.7)	0.26	12 (1.8)	23 (2.7)	0.27	41 (7.5)	91 (11.5)	0.02
Severe (15–27)	1 (0.9)	3 (1.8)	0.34	3(0.5)	7 (0.8)	0.39	16 (2.9)	48 (6.1)	0.01

Note: Percentage represents prevalence of depressive symptoms within each of the health status group.

Likewise, the prevalence of any depressive sym ptoms was highest among female older adults with th e lowest level of quality of l ife. The proportion of older women with severe depre ssive symptoms in those with fair quality of life was significa ntly higher than that of older me n with fair quality of life (4.6% *vs.* 1.7%, $P < 0.01$), but no significant gender dif ference of severe symptoms were found am ong those who reported poor quality of life.

Older adults with worsened health status had the highest proportion of people reporting depressive symptom(s). The prevalence of moderate and severe depressive symptoms in older women with worsened health status was all significantly higher than that of older m en with worsened health status.

3.5. Correlation of depressive symptoms in older men and older women

The socio–demographic and health related correlates of any depressive symptom among older women is presented in Table 5. Older age ($r = 0.09, P < 0.001$), lower income ($r = 0.07, P < 0.01$), poorer health status ($r = 0.34, P < 0.001$), inferior quality of life ($r = 0.17, P < 0.001$) and worsening health changes over the past year ($r = 0.23, P < 0.001$) were positively correlated with any depressive symptom in older women.

Table 5. Correlations between any depressive symptom and socio-demographic variables in women.

	Age	Edu	Income	MS	Living	Children	Yrs in U.S.	Yrs in com	Origin	OHS	QOL	HC	ADS
Age	1.00												
Edu	-0.18***	1.00											
Income	-0.04	0.11***	1.00										
MS	-0.44***	0.20***	-0.03	1.00									
Living	-0.32***	-0.03	-0.10***	0.26***	1.00								
Children	0.32***	-0.40***	-0.07**	-0.14***	-0.03	1.00							
Yrs in U.S.	0.38***	-0.09***	0.30***	-0.24***	-0.29***	0.13***	1.00						
Yrs in com	0.26***	-0.09***	0.19***	-0.16***	-0.20***	0.08***	0.67***	1.00					
Origin	0.03	-0.08***	-0.20***	0.05*	0.06*	0.08***	-0.23***	0.15***	1.00				
OHS	-0.08***	0.05*	0.10***	0.04	-0.03	0.00	0.04	0.09***	0.07**	1.00			
QOL	0.03	0.10***	0.06**	-0.02	0.00	0.04	0.02	-0.01	0.07**	0.31***	1.00		
HC	-0.13***	0.03	0.05*	0.07**	0.00	-0.03	-0.02	0.06**	0.01	0.33***	0.14***	1.00	
ADS	0.09 ***	-0.01	-0.07**	-0.02	-0.03	-0.01	-0.01	-0.04	0.00	-0.34***	-0.17***	-0.23***	1.00

We also examined the correlates of any depressive symptom in older men. Older age ($r = 0.08$, $P < 0.001$), being unmarried ($r = 0.06$, $P < 0.05$), lower income ($r = 0.11$, $P < 0.01$), fewer years in the community ($r = 0.06$, $P < 0.05$), poorer health status ($r = 0.28$, $P < 0.001$), inferior quality of life ($r = 0.12$, $P < 0.001$) and worsening health changes over the past year ($r = 0.25$, $P < 0.001$) were positively correlated with any depressive symptom in older men.

4. Discussion

This study demonstrates that depressive symptoms are more prevalent in U.S. Chinese older women than in older men. The prevalence of all depressive symptoms of the PHQ-9, especially somatic symptoms, was higher in older women than in older men. In addition, older women were more likely to report moderate to severe depressive symptoms. Older age, lower income, poorer health status, inferior quality of life and worsening health status were positively correlated with any depressive symptom in both gender groups. However, being unmarried and fewer years in the community were positively correlated with any depressive symptoms in older men but not in older women.

This study represents the first large scale investigation on gender differences in depressive symptoms in U.S. Chinese community–dwelling older adults. It lays the groundwork for a more comprehensive understanding of how depressive symptoms in older adults may vary across gender and cultural groups. Our academic–community partnership and community engagement facilitated the design of culturally and linguistically appropriate research methods [27]. Due to our CBPR approach, participants may have been more comfortable conversing in their preferred dialects, more trusting of research assistants, and more willing to express emotions and acknowledge their feelings.

This study suggests that depressive symptoms are more prevalent in U.S. Chinese older women than in older men, consistent with the majority of studies of older adults in both community and clinical settings. Using the PHQ-9, a recent study of 1,659 community–dwelling older adults aged 60 to 85 years in German showed that 62.4% of older women had depressive symptoms, compared with 51.1% of older men [14]. In the U.S., a study of 2,732 older patients aged 60 years and over in the clinical setting reported that 17.8% of the older women had lifetime depression, compared with 9.4% of older men. The prevalence of current depression in the older women (10.6%) was also higher than in the older men (5.7%) when assessed using criteria from the Diagnostic and Statistical Manual of Mental Disorders, (DSM–III–R) [28].

Our finding is also consistent with studies among Chinese older adults, which generally suggest that older women are more likely to present depressive symptoms. In a study of 1,062 Chinese older adults aged 65 years and older in Singapore, the prevalence of depression in older women (6.1%) was slightly higher than that in older men (5.9%) [29]. In a community sample survey of older adults in southern Taiwan, older women also reported a higher prevalence of depression than older men (21.8% *vs.* 14.0%) [30]. Several reasons may account for gender disparities in the prevalence of depressive symptoms among Chinese older adults; one key factor is that older women tend to be exposed to more negative life events in later life than older men. For instance, the subordinate role of women in Chinese culture may make older women more vulnerable to elder abuse, especially domestic abuse. Prior studies have consistently demonstrated the association between depressive symptoms and elder abuse [20,31]. We suspect that violence against women may in part be driving the high prevalence of depressive symptoms in Chinese women. In addition, compared with older men, U.S. Chinese older women may encounter greater cultural, language and transportation barriers as well as financial hardship, increasing their risk for experiencing depressive symptoms.

In addition to gender differences in the prevalence of depressive symptoms, this study also suggests a tendency for older women to report moderate to severe depressive symptoms. Similar findings are reported by a study of 50 community-dwelling Chinese older immigrants in New York, in which older women reported having higher rates of moderate to severe depressive symptoms than older men (4.0% *vs.* 0%) [32]. Variations in stress coping strategies may contribute to the observed

gender differences in the severity of depressive symptoms. For example, men may be more likely to use problem–focused and rational coping strategies, while women tend to adopt emotion-focused and avoidance coping strategies [33]. Thus, older women's adaptation of rumination as the primary stress coping strategy m ay maintain or worsen symptom s of depression. We are aware that depressive symptoms are more severe in imm igrant women, particularly among those who are separated from their children or grandchildren due to imm igration. Obsessive wo rry about childre n in the home country and longing for fam ily reunification m ay exacerbate d epressive symptoms among U.S. Chinese older women.

This study also supports earlier studies that found that manifestations of depressive sym ptoms differed by gender. Somatic depressive sym ptoms such as sleeping disturbances or fatigue are m uch more prevalent in older wom en than in older m en. A study using data on m ajor depression from the National Comorbidity Survey found that women exhibited a higher prevalence of somatic depression than men [34]. One explanation may be that women are more likely to assume the primary caregiver role—a role that m ay require substantial physical and em otional demands. In addition to providing care to the spouse, in Chinese culture, older wom en often take on the task of raising grandchildren. Taking care of grandchildren may trigger positive emotional effects such as high levels of self–esteem, but may also exacerbate stress and b urden, resulting in sleep disturb ances or fatigue in older adults. There is also evidence to suggest th at somatic depression in women may be associated with anxiety disorders and chronic pain [35]. Futu re studies should explore the factors associated with somatic depressive symptoms in older adults, and among older women in particular.

In line with prior stud ies, this study suggests that overall health status m ay be an im portant indicator for depressive sym ptoms in older adults. In particular , moderate to severe depressive symptoms was more prevalent in older women with poorer overall health status. This m ay be explained by higher levels of perceived burdens omeness among older wom en who are ill. Due to cultural and language barriers, old er Chinese wom en with illnes s may have to depend on adult children for scheduling doctor 's appointments and taking them to the doctor 's clinic. Such intensive demands on support from adult children m ay result in older wom en's higher levels of perceived burdensomeness and depressive symptom s. The inve rse association between health and depression indicates that depressive sym ptoms may contribute to poorer health outcomes in older adults. The presence of depressive sym ptoms may inhibit older adults' ability to perform physical activities, giving rise to unhealthy beha viors such as poor diet and insuf ficient sleep that may affect the health status of older adults.

Interestingly, marital status is significantly correlated with any depressi ve symptom in men but not with that in wom en, which corresponds to previous studies on gender dif ferences in the association between m arital status and depre ssion. In a study of 3,056 comm unity–dwelling older Dutch individuals, the risk of depressive symptoms for men who were not or were no longer m arried ($OR = 2.51$, $CI = 1.69–3.91$) was higher than that for wom en ($OR = 1.57$, $CI = 1.07–2.29$) [15]. This is perhaps due to d ifferences in th e nature of social engagem ent among older men and wom en. Women are more likely to develop and maintain close confiding relationships with persons other than the spouse. In contrast, m en may have smaller social networks in later li fe and may depend largely on their spouse's emotional and instrument support, which makes it more difficult for them to adjust to life after spousal death [36]. Si milarly, we found that years in the co mmunity is negatively correlated with any depressive sym ptom in older m en but not with that in older wom en. We suspect that men may experience greater financial and social status losses due to relocation. As a consequence, residential transitions m ay have gr eater adverse psychological ef fects on older men than on older women.

The findings of the study should be interpreted with limitations in mind. First, reporting bias may be present in this study, and may vary by gender. It is possible that older women are more willing to openly express psychological distress, thereby resulting in higher rates of depressive symptoms. Second, this study did not examine gender differences in the link between intergenerational relationships and depressive symptoms. Given the role of family relationship in the well-being of Chinese older adults, it may be of considerable importance to take into account the contributions of intergenerational relationships when examining gender differences. Third, this study aimed to understand depressive symptoms and we did not delve into the complex issue of clinical depression. Future studies should continue to examine the optimal cut-off point for clinical depression among U.S. Chinese older adults and improve our understanding of the scope of clinical depression in this vulnerable population. Additionally, gender differences may also persist in patterns of health seeking behaviors among those with depressive symptoms. Understanding differences in health seeking behaviors may facilitate the diagnosis of depressive symptoms in U.S. Chinese older adults. Lastly, this study utilizes a cross-sectional design, so we could not postulate on potential temporal relationships. Future longitudinal studies are needed to explore risk factors and outcomes associated with depressive symptoms in U.S. Chinese older women and older men.

This study has important implications for researchers, mental health professionals, community service workers, and policy makers. First, community-based mental health services should be tailored to meet the specific needs of older women. In doing so, community organizations should: prioritize educational workshops that focus on the relevant knowledge regarding depressive symptoms among older women, address violence and abuse closely associated with depressive symptoms, and enhance stress management and coping skills among older adults, especially older women. Second, health care professionals should be educated on gender-specific depressive symptoms and the culturally effective approaches to tackle the symptoms. Specific attention should be given to those who are with older age, lower income, and poor health status and quality of life.

5. Conclusion

This study demonstrates that U.S. Chinese older women are more prone to depressive symptoms than older men. Moreover, significant gender differences in the prevalence, symptom manifestation, severity, and correlates of depressive symptoms exist among U.S. Chinese older adults. This study highlights the need to develop tailored interventions for depressive symptoms in this subgroup of U.S. Chinese older adults. Future longitudinal studies are needed to better understand gender differences in risk factors and outcomes associated with depressive symptoms in U.S. Chinese older adults.

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Conflict of interest

The authors declare that we have no conflict of interest.

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