Couple-based Study on the Association Between Chronic Diseases and Depressive Symptoms in China: a Cross-section Study

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Abstract

Background: We explored the association between several chronic diseases and depressive symptoms (DSs) at individual and couple levels.

Methods: Data were derived from the 2018 China Health and Retirement Longitudinal Study, including 5365 middle-aged and elderly couples. DSs were measured using the 10-item Center for Epidemiological Studies Depression Scale, and chronic diseases were determined by self-report and doctor diagnosis. Multivariate logistic regression models were used to estimate the association between chronic diseases and DSs.

Results: Couples' unilaterality with different numbers of chronic diseases had increased 16%–289% risk on their own DSs and 24%–39% risk on spousal DSs. Couples with different numbers of chronic diseases increased their co-depression by 183%–834%, which was mainly increased in wives' depressive symptoms (WDSs) by 51%–301%, more severe than husbands' depressive symptoms (HDSs). WDSs and HDSs increased by 13%–111% in couples with unilateral respiratory disease, dyslipidaemia, digestive disease, arthritis, kidney disease, stroke, memory-related disease and by 24%–244% in couples' co-morbidity of respiratory, metabolic, and digestive diseases, arthritis, heart problem, kidney disease, stroke. Further, co-depression increased by 34%–458% in couples with unilaterality/co-morbidity of these chronic diseases.

Conclusions: Couples' unilaterality/co-morbidity of most chronic diseases were associated with WDSs, HDSs, and co-depression. WDSs were more susceptible to chronic diseases than HDSs. Physical health of an individual could predict not only his/her own mental health but also his/her spouse's mental health.

Background

Depression has become a global public health problem, making a major contribution to the global burden of disease[1]. It affects approximately 322 million individuals, causing 7.5% of all years lived with disability and increasing the risk of mortality[2, 3]. Over the past decades, the incidence of depression has increased significantly worldwide[2, 4, 5]. The elderly are recognised as one of the most vulnerable groups that experience depression[5, 6]. China is currently experiencing an aging population, and depression is inevitable. Peking University conducted a prospective study termed the China Health and Retirement Longitudinal Study (CHARLS)[7]; Wang et al. analysed these data and found that the average prevalence of depressive symptoms (DSs) was over 30% between 2008 and 2015[3]. Moreover, Ren et al. used these data and identified that the incidence rate of DSs was 25.8% in 2018, with a 3-year follow-up period among the middle-aged and elderly individuals[8].

Many risk factors contributing to depression have been found in the past few decades, such as cognitions, stressors, dispositions[5, 9], heredity, family status[10], and physical health status[8, 11]. Chronic diseases, including hypertension, diabetes, chronic lung disease, arthritis, stroke, and asthma, which require ongoing self-management and medical support, are the independent risk factors for depression in middle-aged and elderly individuals[6, 12, 13]. Epidemiological studies have reported that the risk of depression increased by 115% in hypertension, 160% in diabetes, 223% in chronic lung disease, 182% in arthritis, 274% in stroke, and 373% in asthma among Chinese middle-aged and elderly individuals[14]. Moreover, there is some evidence suggesting that marriage acts as a protective factor, contributing to lower depression incidence and higher level of health status[10, 15, 16]. However, these studies have only considered marriage as an external factor and ignored the fact that marriage is essentially composed of two individuals (the wife and husband) that have a mutual influence.

Moreover, existing studies that consider marriage as an internal factor have mainly aimed to assess the concordance of co-morbidity of any chronic disease or depression among couples. A prospective cohort study[17] demonstrated that husbands whose wives had chronic diseases at baseline reported a higher incidence rate of chronic diseases than those whose wives did not have a chronic disease at baseline (25.81% vs. 21.47%). For depression, if one's spouse has depression, his/her risk of depression increases by three to five fold[15, 18]. Based on the results of previous studies on health concordance, we additionally defined the co-morbidity and co-depression within couples and aimed to explore the association between unilaterality or co-morbidity of different types of chronic diseases within couples and DSs, including wives' depressive symptoms (WDSs), husbands' depressive symptoms (HDSs), and co-depression.

Methods

Data source

Data were recruited from CHARLS, a nationally representative longitudinal cohort of Chinese residents aged 45 years and above. A stratified multistage probability sampling design was used, with selection made from sampling units based on geographical area, sex, and age groups using household registries. All participants were assessed by one-to-one interviews using a structured questionnaire. Participants were followed up every 2 years with a face-to-face interview[19]. All data in CHARLS are maintained at the National School of Development of Peking University and will be publicly accessible to researchers worldwide on the study website: <http://charls.pku.edu.cn/en>. We used data from 2018. The inclusion criteria were as follows: (1) participants who were married/cohabitating; (2) participants, both wives and husbands, who were involved in CHARLS; and (3) participants with complete information on various chronic diseases and DSs. Finally, couples sharing the same household ID were matched as primary sampling units, and 5365 couples were identified for study.

Depressive symptoms

DSs were measured using the 10-item Center for Epidemiological Studies Depression Scale (CESD-10)[20]. Participants were instructed to evaluate how often they experienced DSs in the past week, including eight positive and two negative questions. For eight negative questions, the items were recorded as 0

(rarely) to 3 (most of the time), and two positive questions were just the reverse. The total CESD-10 score ranged from 0 to 30, and we defined participants who scored 10 or more as depressive individuals. We observed three outcomes: WDSs, HDSs, and co-depression (spouses were both depressed).

Chronic diseases

Fourteen chronic diseases according to self-report and doctor diagnosis were present in CHARLS. We excluded one disease (emotional, nervous, or psychiatric problems), considered 13 chronic diseases, and divided them into the following 10 types: (1) respiratory diseases (chronic lung diseases and asthma), (2) metabolic diseases (hypertension, diabetes, or high blood sugar level), (3) dyslipidaemia (high or low free fatty acid level), (4) digestive diseases (stomach or other digestive diseases and liver disease), (5) arthritis or rheumatism, (6) heart problems, (7) kidney diseases, (8) cancer or malignant tumour, (9) stroke, and (10) memory-related disease. Each type of chronic disease was considered in three situations: neither sickness, unilateral sickness, and co-morbidity within couples. We also considered different numbers of chronic diseases and couples' unilaterality/co-morbidity of chronic diseases. Co-morbidity refers to spouses getting the same type of chronic diseases.

Covariates

Covariates mainly involved some demographic characteristics of the wives and husbands, including the couples' age at interview, level of education, job status, husbands' drinking status, and spousal DSs.

Statistical analyses

Continuous variables are shown as mean $\pm$ standard deviation, and categorical variables are shown as numbers (percentages). Standard *t*-test for continuous variables and χ^2 test for categorical variables were used to compare differences of demographic characteristics between the depressive and non-depressive groups. The association between chronic diseases and DSs was estimated using multivariate logistic regression analysis adjusted for confounders. The dependent variable considered WDSs, HDSs, and co-depression in different models. All data were analysed using Stata version 16, and an alpha value of 0.05 (two-sided) was considered statistically significant.

Results

Demographic characteristics of the study participants

Differences in demographic characteristics between the depressive and non-depressive groups among wives and husbands are reported in Table 1. Among the 5365 middle-aged and elderly couples, the prevalence of DSs was 40.69% (2183/5365) in the wives and 27.38% (1469/5365) in the husbands. The mean ages of wives and husbands with DSs were 59.10 ± 8.45 and 61.31 ± 8.71 years, respectively. Furthermore, depressed participants tended to be older, had a higher proportion of lower level of education, had a higher proportion of farming as a job, and had a lower proportion of on-work than non-depressed participants among both wives and husbands. Moreover, husbands who were depressed were more likely to be drinkers.

Table 1
Demographic characteristics of wives and husbands among 5365 middle-aged and elderly couples

	WDSs		t/χ^2	P	HDSs		t/χ^2	P
	No(n = 3182)	Yes(n = 2183)			No(n = 3896)	Yes(n = 1469)		
Age at interview (year, $\bar{x} \pm SD$)	58.30 $\pm$ 8.63	59.10 $\pm$ 8.45	3.34	0.001*	60.50 $\pm$ 8.92	61.31 $\pm$ 8.71	2.97	0.003*
Level of education, n(%)								
Elementary school and below	2031(63.83)	1711(78.38)	145.87	< 0.001*	1833(47.05)	890(59.22)	75.99	< 0.001*
Middle school or high school	994(31.24)	443(20.29)			1751(44.94)	543(36.96)		
Vocational school or Two-/three-year College	135(4.24)	24(1.10)			254(6.52)	50(3.40)		
Bachelor's degree and above	22(0.69)	5(0.23)			58(1.49)	6(0.41)		
Job status, n(%)								
On work	583(18.32)	325(14.89)	83.03	< 0.001*	1312(33.68)	348(23.69)	99.22	< 0.001*
Retired	345(10.84)	115(5.27)			468(12.01)	115(7.83)		
Farmer	1055(33.16)	915(41.91)			1025(26.31)	523(35.60)		
Unemployed	915(28.76)	630(28.86)			611(15.68)	304(20.69)		
Others	284(8.93)	198(9.07)			480(12.32)	178(12.19)		
Smoking status, n(%)								
No	3055(96.01)	2072(94.92)	3.65	0.056	1895(48.65)	675(45.95)	3.12	0.077
Yes	127(3.99)	111(5.08)			2000(51.35)	794(54.05)		
Drinking status, n(%)								
No	3037(95.44)	2090(95.74)	0.27	0.604	2203(56.56)	931(63.38)	20.41	< 0.001*
Yes	145(4.56)	93(4.26)			1692(43.44)	538(36.62)		
Note. WDSs, wives' depressive symptoms; HDSs, husbands' depressive symptoms.								
* $P < 0.05$.								

Association between the number of couple's chronic diseases and WDSs/HDSs at the individual level

For wives, compared with themselves who did not experience any chronic disease, the wives having one, two, and more than two chronic diseases increased their risk of DSs by 75%, 131%, and 289%, respectively. Compared with husbands having no chronic disease, husbands with two or more chronic diseases were at increased risk of WDSs (24% versus 39%). Compared with perfectly healthy couples (couples without any type of chronic diseases), the increased risk of WDSs were 51%, 99%, 141%, 204%, and 301% in one, two, three, four, and more than four chronic diseases among couples, respectively. Additionally, the risk of DSs for husbands with one, two, or more than two different chronic diseases increased by 16%, 74%, and 177%, respectively. Furthermore, wives with one chronic disease contrarily decreased the risk of HDSs by 20%. Moreover, compared with perfectly healthy couples, a higher risk of HDSs only occurred when couples had more than four diseases together, increased by 103% (Table 2).

Table 2
The association between the number of couple's chronic diseases and WDSs/HDSs

The Number of Chronic Diseases	n(%)	WDSs		OR (95% CI) ^a	P	n(%)	HDSs		OR (95% CI) ^b	P
		No(n = 3182)	Yes(n = 2183)				No(n = 3896)	Yes(n = 1469)		
For oneself										
0	1161(21.64)	878(78.62)	283(24.34)	1.00		1132(21.10)	934(82.51)	198(17.49)	1.00	
1	1234(23.00)	790(64.02)	444(35.98)	1.75(1.45–2.14)	< 0.001*	1335(24.88)	1061(79.48)	274(20.52)	1.16(0.94–1.43)	0.017*
2	1094(20.39)	642(58.68)	452(41.32)	2.31(1.92–2.80)	< 0.001*	1123(20.93)	807(71.86)	316(28.14)	1.74(1.41–2.14)	< 0.001*
> 2	1876(34.97)	872(46.48)	1004(53.52)	3.89(3.26–4.65)	< 0.001*	1775(33.08)	1094(61.63)	681(38.37)	2.77(2.29–3.36)	< 0.001*
For one's spouse										
0	1132(21.10)	743(65.64)	389(34.36)	1.00		1161(21.64)	870(74.94)	291(25.06)	1.00	
1	1335(24.88)	821(61.50)	514(38.50)	1.13(0.96–1.35)	0.149	1234(23.00)	929(75.28)	305(24.72)	0.80(0.66–0.97)	0.026*
2	1123(20.93)	652(58.06)	471(41.94)	1.24(1.04–1.49)	0.017*	1094(20.39)	801(73.22)	293(26.78)	0.89(0.73–1.08)	0.245
> 2	1775(33.08)	966(54.42)	809(45.69)	1.39(1.18–1.64)	< 0.001*	1876(34.97)	1296(69.08)	580(30.92)	0.95(0.79–1.14)	0.579
For couples'										
0	369(6.88)	295(79.95)	74(20.05)	1.00		369(6.88)	303(82.11)	66(17.89)	1.00	
1	566(10.55)	409(72.26)	157(27.74)	1.51(1.10–2.09)	0.012*	566(10.55)	466(82.33)	100(17.67)	0.89(0.62–1.26)	0.503
2	803(14.97)	530(66.00)	273(34.00)	1.99(1.47–2.69)	< 0.001*	803(14.97)	623(77.58)	180(22.42)	1.20(0.87–1.66)	0.267
3	821(15.30)	508(61.88)	313(38.12)	2.41(1.78–3.26)	< 0.001*	821(15.30)	633(77.10)	188(22.90)	1.20(0.87–1.66)	0.272
4	713(13.29)	405(56.80)	308(43.20)	3.04(2.24–4.13)	< 0.001*	713(13.29)	520(72.93)	193(27.07)	1.83(1.00–1.92)	0.052
> 4	2093(39.01)	1035(49.45)	1058(50.55)	4.01(3.02–5.33)	< 0.001*	2093(39.01)	1351(64.55)	742(35.45)	2.03(1.50–2.73)	< 0.001*
Note. WDSs, wives' depressive symptoms; HDSs, husbands' depressive symptoms.										
*P< 0.05.										
^a Adjusted for the wives' age at interview, level of education, job status, and HDSs.										
^b Adjusted for husbands' age at interview, level of education, job status, drinking status, and WDSs.										

Association between the number of couple's chronic disease and co-depression at the couple level

Considering only the wives' number of chronic diseases, having one, two, and more than two chronic diseases increased the risk of co-depression by 53%, 98%, and 279%, respectively. Similarly, for husbands' number of chronic diseases, having one, two, and more than two chronic diseases increased the risk of co-depression by 40%, 140%, and 288%, respectively. In addition, compared with perfectly healthy couples, having two, three, four, and more than four chronic diseases together increased the risk of co-depression by 183%, 242%, 422%, and 834%, respectively (Table 3).

Table 3
The association between the number of couple's chronic diseases and co-depression

The Number of Chronic Diseases	n(%)	Co-depression		OR (95% CI) ^a	P
		No(n = 2597)	Yes(n = 884)		
Wives'					
0	819(23.53)	703(85.84)	116(14.16)	1.00	
1	829(23.81)	657(79.25)	172(20.75)	1.53(1.17–1.99)	0.002*
2	681(19.56)	515(75.62)	166(24.38)	1.98(1.51–2.61)	< 0.001*
> 2	1152(33.09)	722(62.67)	430(37.33)	3.79(2.96–4.86)	< 0.001*
Husbands'					
0	757(21.75)	651(86.00)	106(14.00)	1.00	
1	873(25.08)	710(81.33)	163(18.67)	1.40(1.07–1.84)	0.016*
2	738(21.20)	537(72.76)	201(27.24)	2.40(1.83–3.14)	< 0.001*
> 2	1113(31.97)	699(62.80)	414(37.20)	3.88(3.02–4.97)	< 0.001*
Couples'					
0	267(7.67)	248(92.88)	19(7.12)	1.00	
1	405(11.63)	357(88.15)	48(11.85)	1.67(0.95–2.92)	0.075
2	542(15.57)	446(82.29)	96(17.71)	2.83(1.68–4.77)	< 0.001*
3	538(15.46)	429(79.74)	109(20.26)	3.42(2.03–5.76)	< 0.001*
4	450(12.93)	331(73.56)	119(26.44)	5.22(3.10–8.79)	< 0.001*
> 4	1279(36.74)	786(61.45)	493(38.55)	9.34(5.70-15.31)	< 0.001*
Note. *P< 0.05.					
^a Adjusted for the wives' age at interview, level of education, and job status.					
Co-depression: spouses were both depressed.					

Association between couples' unilaterality/co-morbidity of chronic diseases and WDSs/HDSs at the individual level

Compared with relatively healthy couples (couples neither having this type of chronic disease), the risk of WDSs and HDSs increased by 64% and 61% in unilateral respiratory disease, 20% and 17% in unilateral dyslipidaemia, 54% and 46% in unilateral digestive disease, 48% and 38% in unilateral arthritis or rheumatism, 41% and 58% in unilateral kidney disease, 52% and 13% in unilateral stroke, and 111% and 75% in unilateral memory-related disease. However, unilateral metabolic disease and heart problem only increased the wives' risk of depression by 18% and 39%, respectively.

Meanwhile, compared with relatively healthy couples, the risk of WDSs and HDSs increased by 151% and 92% in co-morbidity of respiratory disease, 29% and 24% in co-morbidity of metabolic disease, 129% and 77% in co-morbidity of digestive disease, 139% and 99% in co-morbidity of arthritis or rheumatism, 64% and 52% in co-morbidity of heart problem, 170% and 86% in co-morbidity of kidney disease, and 139% and 244% in co-morbidity of stroke. However, co-morbidity of memory-related disease only increased the risk of WDSs by 352%. Unfortunately, we did not determine any association between co-morbidity of dyslipidaemia and DSs and between unilaterality/co-morbidity of cancer or malignant tumour and DSs (Table 4).

Table 4
The association between couple's unilaterality/co-morbidity of chronic diseases and WDSs/HDSs

Chronic diseases of couples	n(%)	WDSs		OR (95% CI) ^a	P	HDSs		OR (95% CI) ^b	P
		No(n = 3182)	Yes(n = 2183)			No(n = 3896)	Yes(n = 1469)		
Respiratory disease									
Neither	3811(71.03)	2432(63.82)	1379(36.18)	1.00		2913(76.44)	898(23.56)	1.00	
Unilateral	1430(49.16)	703(49.16)	727(50.84)	1.64(1.44–1.86)	< 0.001*	914(63.92)	516(36.08)	1.61(1.40–1.85)	< 0.001*
Co-morbidity	124(2.31)	47(37.90)	77(62.10)	2.51(1.71–3.68)	< 0.001*	69(55.65)	55(44.35)	1.92(1.32–2.79)	0.001*
Metabolic disease: hypertension, diabetes or high blood sugar									
Neither	1946(36.27)	1215(62.44)	731(37.56)	1.00		1452(74.61)	494(25.39)	1.00	
Unilateral	2843(52.99)	1650(58.04)	1193(41.96)	1.18(1.04–1.33)	0.012*	2053(72.21)	790(27.79)	1.09(0.94–1.25)	0.246
Co-morbidity	576(10.74)	317(55.03)	259(44.97)	1.29(1.06–1.58)	0.012*	391(67.88)	185(32.12)	1.24(1.00-1.54)	0.048*
Dyslipidaemia: including high or low level									
Neither	3267(60.89)	1971(60.33)	1296(39.67)	1.00		2399(73.43)	868(25.57)	1.00	
Unilateral	1695(31.59)	977(57.64)	718(42.36)	1.20(1.08–1.38)	0.005*	1208(71.27)	487(28.73)	1.17(1.02–1.35)	0.023*
Co-morbidity	403(7.51)	234(58.06)	169(41.94)	1.25(1.00-1.56)	0.052	289(71.71)	114(28.29)	1.11(0.86–1.41)	0.425
Digestive disease									
Neither	2503(46.65)	1667(66.60)	836(33.40)	1.00		1956(78.15)	547(21.85)	1.00	
Unilateral	2387(44.49)	1307(54.75)	1080(45.25)	1.54(1.37–1.74)	< 0.001*	1642(68.79)	745(31.21)	1.46(1.28–1.67)	< 0.001*
Co-morbidity	475(8.85)	208(43.79)	267(56.21)	2.29(1.86–2.81)	< 0.001*	298(62.74)	177(37.26)	1.77(1.42–2.19)	< 0.001*
Arthritis or rheumatism									
Neither	2365(44.08)	1613(68.20)	752(31.80)	1.00		1873(79.20)	492(20.80)	1.00	
Unilateral	2055(28.30)	1167(56.79)	888(43.21)	1.48(1.30–1.68)	< 0.001*	1459(71.00)	596(29.00)	1.38(1.19–1.59)	< 0.001*
Co-morbidity	945(17.61)	402(42.54)	543(57.46)	2.39(2.03–2.82)	< 0.001*	564(59.68)	381(40.32)	1.99(1.68–2.38)	< 0.001*
Heart problem									
Neither	3575(66.64)	2223(62.18)	1352(37.82)	1.00		2653(74.21)	922(25.79)	1.00	
Unilateral	1464(27.29)	798(54.51)	666(45.49)	1.39(1.22–1.59)	< 0.001*	1037(70.83)	427(29.17)	1.08(0.94–1.25)	0.269
Co-morbidity	326(6.08)	161(49.39)	165(50.61)	1.64(1.29–2.09)	< 0.001*	206(63.19)	120(363.81)	1.52(1.18–1.95)	0.001*
Kidney disease									
Neither	4366(81.38)	2687(61.54)	1679(38.46)	1.00		3272(74.94)	1094(25.06)	1.00	
Unilateral	901(16.79)	460(51.05)	441(48.96)	1.41(1.21–1.63)	< 0.001*	567(62.93)	334(37.07)	1.58(1.35–1.85)	< 0.001*

Note. WDSs, wives' depressive symptoms; HDSs, husbands' depressive symptoms.

* $P < 0.05$.

^aAdjusted for the wives' age at interview, level of education, job status, and HDSs.

^bAdjusted for husbands' age at interview, level of education, job status, drinking status, and WDSs.

Neither spouse had this disease. Unilateral: either of the spouses had this disease. Co-morbidity: Both spouses had this disease.

Chronic diseases of couples	n(%)	WDSs		OR (95% CI) ^a	P	HDSs		OR (95% CI) ^b	P
		No(n = 3182)	Yes(n = 2183)			No(n = 3896)	Yes(n = 1469)		
Co-morbidity	98(1.83)	35(35.71)	63(46.29)	2.70(1.75–4.15)	< 0.001*	57(58.16)	41(41.84)	1.86(1.22–2.83)	0.004*
Cancer or malignant tumour									
Neither	5141(95.82)	3060(59.52)	2081(40.48)	1.00		3740(72.75)	1401(27.25)	1.00	
Unilateral	219(4.08)	121(55.25)	98(44.75)	1.22(0.92–1.63)	0.140	153(69.86)	66(30.14)	1.14(0.84–1.55)	0.414
Co-morbidity	5(0.09)	1(20.00)	4(80.00)	5.60(0.47–66.38)	0.172	3(60.00)	2(40.00)	1.17(0.19–7.14)	0.868
Stroke									
Neither	4749(88.52)	2883(60.71)	1866(39.29)	1.00		3503(73.76)	1246(26.24)	1.00	
Unilateral	582(10.85)	285(48.97)	297(50.03)	1.52(1.27–1.82)	< 0.001*	378(64.95)	204(35.05)	1.13(1.08–1.59)	0.006*
Co-morbidity	34(0.63)	14(41.18)	20(58.82)	2.39(1.15–4.97)	0.019*	15(44.12)	19(55.88)	3.44(1.68–7.03)	0.001*
Memory-related disease									
Neither	5075(94.59)	3067(60.43)	2008(39.57)	1.00		3067(60.43)	2008(39.57)	1.00	
Unilateral	267(4.98)	109(40.82)	158(59.18)	2.11(1.61–2.76)	< 0.001*	109(40.82)	158(59.18)	1.75(1.34–2.28)	< 0.001*
Co-morbidity	23(0.43)	6(26.09)	17(73.91)	4.52(1.73–11.78)	0.002*	6(26.09)	17(73.91)	1.20(0.51–2.80)	0.680
Note. WDSs, wives' depressive symptoms; HDSs, husbands' depressive symptoms.									
*P < 0.05.									
^a Adjusted for the wives' age at interview, level of education, job status, and HDSs.									
^b Adjusted for husbands' age at interview, level of education, job status, drinking status, and WDSs.									
Neither spouse had this disease. Unilateral: either of the spouses had this disease. Co-morbidity: Both spouses had this disease.									

Association between couples' unilaterality/co-morbidity of chronic diseases and co-depression at the couple level

At the couple level, compared with relatively healthy couples, the risk of co-depression increased by 134% and 190% in unilaterality and co-morbidity of respiratory diseases, increased by 34% and 64% in unilaterality and co-morbidity of metabolic disease, increased by 35% and 52% in unilaterality and co-morbidity of dyslipidaemia, increased by 113% and 256% in unilaterality and co-morbidity of digestive disease, increased by 103% and 357% in unilaterality and co-morbidity of arthritis or rheumatism, increased by 62% and 146% in unilaterality and co-morbidity of heart problem, increased by 112% and 342% in unilaterality and co-morbidity of kidney disease, increased by 100% and 458% in unilaterality and co-morbidity of stroke, and increased by 270% and 421% in unilaterality and co-morbidity of memory-related disease (Table 5).

Table 5
The association between couple's unilaterality/co-morbidity of chronic diseases and co-depression

Chronic diseases of couples	n(%)	Co-depression		OR (95% CI) ^a	P
		No(n = 2597)	Yes(n = 884)		
Respiratory disease					
Neither	2570(73.83)	2052(79.84)	518(20.16)	1.00	
Unilateral	837(24.04)	512(61.17)	325(38.83)	2.34(1.96–2.79)	< 0.001*
Co-morbidity	74(2.13)	33(44.59)	41(55.41)	2.90(2.81–7.40)	< 0.001*
Metabolic disease: hypertension, diabetes or high blood sugar					
Neither	1217(36.51)	996(78.36)	275(21.64)	1.00	
Unilateral	1838(52.80)	1349(73.39)	489(26.61)	1.34(1.12–1.60)	0.001*
Co-morbidity	372(10.69)	252(67.74)	120(32.26)	1.64(1.25–2.16)	< 0.001*
Dyslipidaemia: including high or low level					
Neither	2139(61.45)	1621(75.78)	518(24.22)	1.00	
Unilateral	1080(31.03)	785(72.69)	295(27.31)	1.35(1.13–1.60)	0.001*
Co-morbidity	262(7.53)	191(72.90)	71(27.10)	1.52(1.12–2.07)	0.008*
Digestive disease					
Neither	1710(49.12)	1415(82.75)	295(17.25)	1.00	
Unilateral	1494(42.92)	1028(68.81)	466(31.19)	2.13(1.80–2.53)	< 0.001*
Co-morbidity	277(7.96)	154(55.60)	123(44.40)	3.56(2.70–4.70)	< 0.001*
Arthritis or rheumatism					
Neither	1609(46.22)	1365(84.84)	244(15.16)	1.00	
Unilateral	1291(37.09)	931(72.11)	360(27.89)	2.03(1.68–2.45)	< 0.001*
Co-morbidity	581(16.69)	301(51.81)	280(18.19)	4.57(3.67–5.70)	< 0.001*
Heart problem					
Neither	2331(66.96)	1816(77.91)	515(22.09)	1.00	
Unilateral	945(27.15)	658(69.63)	287(30.37)	1.62(1.35–1.94)	< 0.001*
Co-morbidity	205(5.89)	123(60.00)	82(40.00)	2.46(1.80–3.36)	< 0.001*
Kidney disease					
Neither	2873(82.53)	2233(77.72)	640(22.28)	1.00	
Unilateral	548(15.74)	337(61.50)	211(38.50)	2.12(1.74–2.60)	< 0.001*
Co-morbidity	60(1.72)	27(45.00)	33(55.00)	4.42(2.59–7.57)	< 0.001*
Cancer or malignant tumour					
Neither	3339(95.92)	2499(74.84)	840(25.16)	1.00	
Unilateral	139(3.99)	97(69.78)	42(30.22)	1.40(0.95–2.06)	0.088
Co-morbidity	3(0.09)	1(33.33)	2(66.66)	4.44(0.40–49.50)	0.226
Stroke					
Neither	3097(88.97)	2367(76.43)	730(23.57)	1.00	
Unilateral	363(10.43)	222(61.16)	141(38.84)	2.00(1.58–2.53)	< 0.001*
Co-morbidity	21(0.60)	8(38.10)	13(61.90)	5.58(2.22–14.02)	< 0.001*

Note. *P< 0.05.

^aAdjusted for the wives' age at interview, level of education, and job status.

Co-depression: spouses were both depressed.

Chronic diseases of couples	n(%)	Co-depression		OR (95% CI) ^a	<i>P</i>
		No(n = 2597)	Yes(n = 884)		
Memory-related disease					
Neither	3301(94.83)	2512(96.73)	789(89.25)	1.00	
Unilateral	165(4.74)	79(3.04)	86(9.73)	3.70(2.65–5.18)	< 0.001*
Co-morbidity	15(0.43)	6(0.23)	9(1.02)	5.21(1.78–15.25)	0.003*
Note. * <i>P</i> < 0.05.					
^a Adjusted for the wives' age at interview, level of education, and job status.					
Co-depression: spouses were both depressed.					

Discussion

The prevalence of DSs varies greatly among countries. In our study, 34.04% of Chinese middle-aged and elderly individuals (aged ≥ 45 years) were depressed in 2018, which is close to the prevalence for previous study sampling CHARLS in 2008, 2011, 2012, 2013, and 2015, which were 33.61%, 37.31%, 34.95%, 31.52%, and 32.69%[3] respectively. Furthermore, the prevalence is higher than 27.70% in American adults aged ≥ 45 years [11] and 12.95% in Korean adults aged ≥ 40 years [21] and also higher than 9.3%, 12.6%, and 10.1% in the Netherlands' three birth cohorts of 55–64-year-olds in 1992, 2002, and 2012, respectively[22]. In addition to geographical differences, age may be a key factor. A lower prevalence of DSs (15.94%) was reported in Chinese older adults (aged ≥ 60 years) in 2016[5], whereas 23.4% of Chinese adults aged 16 years and above were depressed in 2016[23]. Moreover, differences in samples, depression measurement tools, and analysis methods may also explain certain differences in prevalence.

Our study found that one's own chronic diseases increased the risk of DSs by 16–177% among husbands and 75–289% among wives. Previous epidemiological studies have confirmed the association between chronic diseases and DSs[12, 24, 25]. Regardless of the type of disease, they are usually accompanied by physical discomfort, financial pressure, mental burden, and other threats[26–28], causing a high risk of depression. No studies have reported the effect of chronic diseases in one spouse on depression in other spouses. We found for the first time that a different number of husbands' chronic diseases increased the risk of HDSs by 24–39%. The poor health status of the husband may increase the family responsibilities of his wife, leading to physical and psychological stress[29, 30] and even depression. Interestingly, we found that wives with one chronic disease decreased the risk of HDSs by 20%, with more than one chronic disease not associated with HDSs. This suggests that men's mental health is not affected by their wives' chronic diseases, which requires further study. Furthermore, couples with different numbers of chronic diseases mainly increased WDSs by 51–301%. As the number increased, the risk increased accordingly, which could be explained by the phenomenon of multimorbidity. Multimorbidity is defined as experiencing two or more chronic diseases simultaneously[31], which has affected approximately half of adults aged 45–64 years and over 80% of adults aged 65 years and older[32]. Individuals with multimorbidity face more disease management and economic burden, causing several depression-related problems, such as a decline in health-related quality of life, functional limitations[33], higher mortality risk[34] and mental health threats[33, 35]. However, this phenomenon seems to have less of an effect on the male psychological status, because a higher risk of HDSs increased by 103% only when couples together had more than four diseases in our study. In contrast, at the couple level, we first found that the risk of couples' co-depression increased to 53–279% along with the increased number of wives' chronic diseases, 40–288% along with the increased number of husbands' chronic diseases, and 183–834% along with an increased number of couples' chronic diseases. This strong association between couples' co-depression and chronic diseases may be partially attributed to the indirect effect of the concordance of depression between couples[15, 18].

Our study is the first to report that couples' unilaterality and co-morbidity of any type of chronic diseases were positively associated with husbands'/wives' individual DSs and co-depression, except for cancer or malignant tumour. For example, couples' unilateral respiratory disease, digestive disease, arthritis or rheumatism, kidney disease, and stroke were positively associated with couples' individual DSs, with odds ratios (ORs) ranging from 1.13 to 1.64, and co-depression symptoms, with ORs ranging from 2.00 to 2.34. However, couples' co-morbidity of these chronic diseases was positively associated with couples' individual DSs, with ORs ranging from 1.77 to 3.44, and co-depression symptoms, with ORs ranging from 2.90 to 5.58. In general, couples' unilaterality and co-morbidity have a more negative effect on co-depression than individual DSs, and the negative influence on DSs of couples' co-morbidity was more serious than unilateral illness. Regarding co-morbidity, double burden and less spousal support contributed to the increased risk. Furthermore, couples' co-morbidity and co-depression may result from shared environment and lifestyle among couples[18].

In addition, our results indicated that WDSs were always slightly more susceptible to the influence of spousal unilaterality or co-morbidity of any type of chronic disease than husbands, which is consistent with the result of a previous study[36]. For example, we found that couples' unilateral/co-morbidity respiratory disease caused a higher risk of depression in wives (64% and 151%) than in husbands (61% and 92%), which is consistent with the finding that the reaction of women to the risk factors tends to be more sensitive, causing a higher possibility of major depression (21.3% for women vs. 12.7% for men) [9]. In addition to biological factors, the wife often plays the role of caregiver under the intimate marriage, and the illness of the husband could bring more stress to the wife.

Our study has some limitations. First, excluding the blood test data may cause underestimation of the prevalence of 13 types of chronic diseases, without considering the effect of severity of different chronic diseases on depression. Second, we lacked information on the marriage duration, which restricted our study on the influence of marriage duration or satisfaction with depression. Despite these limitations, our study is the first to consider the association

between unilaterality or co-morbidity of different numbers and different types of chronic diseases on depression, including WDSs, HDSs, and co-depression. In addition, 13 chronic diseases were included. Under the marriage relationship, co-morbidity is highly related to couples' depressive levels, including WDSs or HDSs and co-depression.

Abbreviations

CESD-10:10-item Center for Epidemiological Studies Depression Scale; CHARLS: China Health and Retirement Longitudinal Study; DSs: depressive symptoms; HDSs: husbands' depressive symptoms; WDSs: wives' depressive symptoms.

Declarations

Ethics approval and consent to participate

Ethical approval for all the CHARLS waves was granted from the Institutional Review Board at Peking University, this survey was conducted according to the guidelines of the Declaration of Helsinki. Each respondent who agreed to participate in the survey was asked to sign two copied of the informed consent during the fieldwork.

Consent for publication

Not applicable.

Availability of data and materials

All data in CHARLS are maintained at the National School of Development of Peking University and will be publicly accessible to researchers worldwide on the study website: <http://charls.pku.edu.cn/en>. Researchers need to apply for and obtain approval to access and use this survey data for research purpose from the CHARLS team at the Beijing University. However, the specific analysis process in the current study are available on a reasonable request to the corresponding author at jxiaoyz@163.com.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

YZ, WLR, JX and YJG conceived and designed the experiments. LWC, GDY, XHY, JC and LNC analysed the data. YZ, WLR, JX and YJG drafted the manuscript and approved the final version for submission. All authors read and approved the final manuscript.

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