



躯体疼痛与日常生活能力在农村中老年人慢性病 共病与抑郁间的链式中介作用*

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【摘要】目的 探讨躯体疼痛和日常生活能力在我国农村中老年人慢性病共病与抑郁间的中介效应,促进该群体的慢性病系统管理。**方法** 利用中国健康与养老追踪调查2011~2018年数据。运用截面logistic模型、面板随机效应模型探究慢性病共病、躯体疼痛、日常生活能力与抑郁的相关性与影响效应,采用结构方程模型结合Bootstrap法进行链式中介效应分析。**结果** 共纳入2949名中老年人作为研究对象。IADLs作为中介时,共病与抑郁之间的关联约48.44%可归因于躯体疼痛和IADLs的中介路径(0.051, 95% CI: 0.045~0.056);而当BADLs作为中介时,共病与抑郁的关联约47.91%可归因于躯体疼痛和BADLs的中介路径(0.050, 95% CI: 0.045~0.056)。躯体疼痛与日常生活能力构建的链式中介途径均有统计学意义(0.005, 95% CI: 0.004~0.006)。**结论** 慢性病共病直接影响中老年人的抑郁发生,还通过导致躯体疼痛以及降低日常生活能力单独或链式中介加剧抑郁风险。

【关键词】 抑郁 慢性病共病 躯体疼痛 日常生活能力

The Association Between Depressive Symptoms and Multimorbidity Among Middle-Aged and Older Adults in Rural China: Sequential Mediation Effects of Pain and Activities of Daily Living

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[Abstract] Objective To investigate the sequential mediation effects of pain and activities of daily living (ADLs) on the relationship between multimorbidity and depressive symptoms among middle-aged and older adults in rural China, providing evidence to optimize health management strategies. **Methods** Using four waves of data (2011–2018) from the China Health and Retirement Longitudinal Study (CHARLS), cross-sectional logistic models and panel random-effects models were used to examine the associations and effects of multimorbidity, pain, ADLs, and depression. Structural equation modeling (SEM) combined with the Bootstrap method was applied to analyze the mediation pathways. **Results** A total of 2949 middle-aged and older participants were included in the study. When instrumental activities of daily living (IADLs) were used as the mediator, approximately 48.44% of the association between comorbidity and depression was attributable to the mediating path of physical pain and IADLs (0.051, 95% CI: 0.045–0.056). When basic activities of daily living (BADLs) were used as the mediator, approximately 47.91% of the association between comorbidity and depression was attributable to the mediating path of physical pain and BADLs (0.050, 95% CI: 0.045–0.056). The chain mediating pathways involving physical pain and the development of daily living abilities were both statistically significant (0.005, 95% CI: 0.004–0.006). **Conclusion** Multimorbidity directly increases the risk of depression and also exacerbates this risk through pain and subsequent declines in ADLs, either independently or sequentially.

[Key words] Depression Multimorbidity Pain Activities of daily living

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我国农村中老年人面临慢性病与抑郁共病的双重健康威胁。与城镇中老年人相比,农村中老人在身心健康水平和社会支持资源方面处于相对弱势,整体健康风险更高^[1,2]。数据显示,30%~46%的农村老年人存在抑郁症状^[3],75%患有以上慢性病^[4],且两者显著相关^[5]。国家政策明确将老年心理健康纳入慢性病防控体系,现有研究提示,慢性病可能通过躯体疼痛和日常生活能力受限间接导致抑郁^[6-12],但缺乏对中介路径的时序分析。本研究基于CHARLS2011~2018年4期数据,采用结构方程模型,重点探讨“疼痛-功能受限”的链式中介效应,为制定针对性干预策略提供科学依据。

1 资料与方法

1.1 数据来源

本研究基于CHARLS中2011年、2013年、2015年和2018年的调查数据展开。CHARLS采用分层多阶段概率抽样法,覆盖全国28个省级行政区的150个县/区、450个社区(村),样本代表性良好^[13]。数据纳入标准:(1)基线(2011年)调查时年龄为45岁及以上,且后来未失访或死亡;(2)关键变量无缺失且符合逻辑;(3)剔除确认患有情感或精神障碍的个体。最终共纳入研究对象2949例。

1.2 研究内容及指标定义

采用抑郁自评量表(CESD-10)判定是否发生抑郁。CESD-10包含10个条目,总分范围0~30分,分数越高,心理状况越差,总分≥10分为具有抑郁症状^[14]。慢性病共病的判定基于CHARLS问卷中自我报告的13种慢性病,通过询问“是否经医生确诊患病”判定,每确诊1种计1分,总分范围0~13分,总分≥2分视为处于共病状态,赋值为1^[15]。躯体疼痛:通过问卷中16个身体部位(如头、肩、腕)的疼痛情况评估,每个部位计1分,总分范围0~16分,反映躯体疼痛部位数量。

本研究选取两个变量来测量中老年人日常生活能力:工具性日常活动能力(instrumental activities of daily living, IADLs):包括做家务、做饭、购物、服药、理财5个项目,总分为5~20分,分数越高,工具性日常活动能力越强;基础性日常活动能力(basic activities of daily living, BADLs):包括穿衣、洗澡、做饭、如厕、控制大小便、起床下床6部分,总分范围为6~24分,分数越高,基础性日常活动能力越好。本研究还纳入以下协变量:人口学特征(年龄、性别、教育程度、居住地、婚姻状态);健康行为因素(夜间睡眠时间、是否吸烟、是否饮酒;上月参与社交活动种类及频率;见表1)。

表 1 研究变量的赋值与类型

Table 1 Variable coding and types

Variable	Assignment	Type
Age/yr.	—	Continuous
Gender	Female = 0, male = 1	Categorical
Household registration	Rural = 1, urban = 1	Categorical
Marital status	Separation/divorce/widowhood/single = 0, married/cohabitation = 1	Categorical
Education level	Illiterate = 1, primary school = 2, junior middle school = 3, vocational /senior high school = 4, college and above = 5	Categorical
Smoking	No = 0, yes = 1	Categorical
Drinking	No = 0, yes = 1	Categorical
Nightly sleep duration/h	—	Continuous
Social participation/ types	—	Continuous
Social participation/ frequency	Almost daily = 30, almost weekly = 4, rarely = 1	Categorical
Depression	No = 0, yes = 1	Categorical
The number of chronic diseases	—	Continuous
Multimorbidity	No = 0, yes = 1	Categorical
Pain	—	Continuous
IADLs	—	Continuous
BADLs	—	Continuous

IADLs: instrumental activities of daily living; BADLs: basic activities of daily living.

1.3 统计学方法

使用R 4.4.0对CHARLS数据进行描述性分析。采用截面数据的logistic回归模型,对变量间的相关性进行初步检验。进一步利用面板数据构建随机效应模型如下:

$$\begin{aligned} \text{logit}(P_{Depression} = 1) = & \beta_0 + \beta_1 Multimorbidity_{ij} + \beta_2 Pain_{ij} + \\ & \beta_3 ADLs_{ij} + \beta_4 X_{ij} + u_i \end{aligned} \tag{1}$$

以系统分析时间*j*的个体*i*的慢性病共病Multimorbidity、躯体疼痛Pain、日常生活能力ADLs和

其他协变量 X 对其抑郁发生风险 P 的影响, 其中 u_i 是个体水平的随机效应。最后, 建立广义结构方程模型(GSEM), 设定如下:

$$Pain_i = a_1 + \gamma_1 Multimorbidity_i + C_1 X_i + \epsilon_{1i} \quad (2)$$

$$ADLs_i = a_2 + \gamma_2 Multimorbidity_i + \gamma_3 Pain_{ij} + C_2 X_i + \epsilon_{2i} \quad (3)$$

$$Depression_i = a_3 + \gamma_4 Multimorbidity_i + \gamma_5 Pain_i + \gamma_6 ADLs_i + C_3 X_i + \epsilon_{3i} \quad (4)$$

基于上述模型, 探讨躯体疼痛与日常生活能力在慢性病共病与抑郁关联中的链式中介作用及其路径机制。采用Bootstrap方法检验, 检验水准设定为 $\alpha = 0.05$ 。

2 结果

2.1 基本特征描述

本研究共纳入 2 949 名 45 岁及以上农村中老年人, 基线年龄为 (59.69 ± 8.27) 岁, 多为女性(63.75%)。人口学特

征显示, 农村居民占比高于城镇居住者, 已婚且同住者占 80% 以上, 具有初中及以上教育程度者占近 25%。健康行为方面: 基线夜间睡眠时长为 (6.11 ± 1.88) h, 吸烟 734 人(24.89%)、饮酒 761 人(25.81%); 社会参与方面, 基线时上月参与社交活动 (1.20 ± 0.51) 种, 频率为 (8.94 ± 15.91) 次。在基线时, 研究对象慢性病罹患数量为 (1.81 ± 1.42) 种, 其中 1 561 人处于共病状态(52.93%), 躯体疼痛部位为 (2.27 ± 3.37) 处; 基线 IADLs 得分为 (19.14 ± 1.98) 分, BADLs 为 (23.38 ± 1.53) 分, 均随年龄增长而下降。经量表评估, 2011 年发生抑郁人群为 1 493 人(50.63%), 到 2018 年为 1 465 人(49.68%), 随年龄变大呈现占比先降低后增加的趋势。见表 2。

2.2 截面logistic回归与面板随机效应模型结果

基于 2018 年截面数据, 构建 logistic 回归模型 1, 同时基于面板数据构建随机效应模型 2, 分析慢性病共病

表 2 研究人群的一般情况描述

Table 2 Descriptive statistics of the study population characteristics

Variable	Year 2011 (<i>n</i> = 2 949)	Year 2013 (<i>n</i> = 2 949)	Year 2015(<i>n</i> = 2 949)	Year 2018(<i>n</i> = 2 949)
Age/yr.	59.69 ± 8.27	61.69 ± 8.27	63.69 ± 8.27	66.69 ± 8.27
Gender/case (%)				
Female	1 880 (63.75)	1 880 (63.75)	1 880 (63.75)	1 880 (63.75)
Male	1 069 (36.25)	1 069 (36.25)	1 069 (36.25)	1 069 (36.25)
Household registration/case (%)				
Rural	2 369 (80.33)	2 369 (80.33)	2 358 (79.96)	2 372 (80.43)
Urban	580 (19.67)	580 (19.67)	591 (20.04)	577 (19.57)
Marital status/case (%)				
Separation/divorce/widowhood/single	344 (11.66)	395 (13.39)	454 (15.40)	576 (19.53)
Married/ cohabitation	2 605 (88.34)	2 554 (86.61)	2 495 (84.60)	2 373 (80.47)
Education level/case (%)				
Illiterate	892 (30.25)	890 (30.18)	889 (30.15)	881 (29.87)
Primary school	1 308 (44.35)	1 310 (44.42)	1 315 (44.59)	1 361 (46.15)
Junior middle school	511 (17.33)	511 (17.33)	507 (17.19)	486 (16.48)
Vocational /Senior high school	219 (7.43)	219 (7.43)	219 (7.43)	198 (6.71)
College and above	19 (0.64)	19 (0.64)	19 (0.64)	23 (0.78)
Smoking/case (%)				
No	2 215 (75.11)	2 238 (75.89)	2 296 (77.86)	2 335 (79.18)
Yes	734 (24.89)	711 (24.11)	653 (22.14)	614 (20.82)
Drinking/case (%)				
No	2 188 (74.19)	2 185 (74.09)	2 170 (73.58)	2 228 (75.55)
Yes	761 (25.81)	764 (25.91)	779 (26.42)	721 (24.45)
Nightly sleep duration/h	6.11 ± 1.88	5.96 ± 1.84	6.08 ± 2.02	5.91 ± 2.07
Social Participation/ types	1.20 ± 0.51	1.29 ± 0.66	1.30 ± 0.71	1.23 ± 0.61
Social Participation/ frequency	8.94 ± 15.91	11.38 ± 18.15	10.17 ± 17.65	9.21 ± 16.84
Depression/case (%)				
No	1 456 (49.37)	1 635 (55.44)	1 577 (53.48)	1 484 (50.32)
Yes	1 493 (50.63)	1 314 (44.56)	1 372 (46.52)	1 465 (49.68)
The number of chronic diseases	1.81 ± 1.42	2.12 ± 1.53	2.38 ± 1.64	3.06 ± 1.91
Multimorbidity	1 561 (52.93)	1 807 (61.28)	1 953 (66.23)	2 275 (77.14)
Pain	2.27 ± 3.37	1.44 ± 2.48	2.84 ± 4.12	4.27 ± 4.13
IADLs	19.14 ± 1.98	19.03 ± 2.21	18.76 ± 2.45	18.36 ± 2.91
BADLs	23.38 ± 1.53	23.36 ± 1.49	23.10 ± 1.80	23.02 ± 1.89

IADLs: instrumental activities of daily living; BADLs: basic activities of daily living.

状态、躯体疼痛、工具性日常活动能力和其余协变量对抑郁的影响。可见模型1的结果支持了研究变量之间的相关关系,模型2进一步表明,处于慢性病共病状态($\beta = 0.201$)、躯体疼痛增多($\beta = 0.119$)均与发生抑郁呈现正向关联,为危险因素,而工具性日常活动能力越强($\beta = -0.106$)、基础性日常活动能力越好($\beta = -0.086$)、睡眠时间越长($\beta = -0.165$)则为保护因素。此外,居住在城镇、受教育程度高、已婚且同居、累积社交活动频率高均是发生抑郁的保护因素。见表3。

表 3 2018年截面logistic回归模型1与面板随机效应模型2结果

Table 3 Results from the 2018 cross-sectional logistic regression and panel random effects models

Variable	Model 1 (n = 2 949)			Model 2 (n = 2 949)		
	β	OR(95% CI)	P	β	OR(95% CI)	P
Intercept	6.957	—	< 0.001	7.041	—	< 0.001
Multimorbidity	0.169	1.184(0.982,1.429)	0.077	0.201	1.223(1.124,1.330)	< 0.001
Pain	0.090	1.094(1.071,1.118)	< 0.001	0.119	1.126(1.113,1.140)	< 0.001
Nightly sleep duration	- 0.121	0.886(0.852,0.922)	< 0.001	- 0.165	0.848(0.830,0.866)	< 0.001
IADLs	- 0.057	0.945(0.912,0.979)	0.002	- 0.106	0.899(0.880,0.919)	< 0.001
BADLs	- 0.105	0.900(0.849,0.954)	< 0.001	- 0.086	0.918(0.888,0.949)	< 0.001
Age	- 0.037	0.964(0.954,0.974)	< 0.001	- 0.030	0.970(0.965,0.976)	< 0.001
Gender	- 0.034	0.967(0.785,1.190)	0.751	- 0.123	0.884(0.796,0.983)	0.024
Household registration	- 0.298	0.742(0.603,0.915)	0.005	- 0.348	0.706(0.635,0.785)	< 0.001
Education level	- 0.166	0.847(0.767,0.936)	0.001	- 0.146	0.864(0.823,0.908)	< 0.001
Marital status	- 0.376	0.687(0.556,0.848)	< 0.001	- 0.440	0.644(0.573,0.725)	< 0.001
Smoking	0.124	1.132(0.910,1.408)	0.263	0.137	1.147(1.028,1.280)	0.014
Drinking	- 0.182	0.833(0.684,1.015)	0.067	- 0.022	0.978(0.887,1.079)	0.665
Social participation types	- 0.034	0.967(0.822,1.137)	0.684	- 0.075	0.928(0.858,1.003)	0.060
Social participation frequency	- 0.004	0.996(0.990,1.002)	0.163	- 0.005	0.995(0.993,0.997)	< 0.001

β : partial regression coefficient; 95% CI: 95% confidence interval.

2.3 链式中介模型分析

为检验躯体疼痛及日常生活能力在慢性病共病状态对抑郁症状影响中的链式中介作用,分别构建纳入IADLs和BADLs的结构方程模型。结果显示,控制年龄、性别、居住地等协变量,慢性病共病状态能正向预测躯体疼痛($\beta = 1.425$)、是否抑郁($\beta = 0.054/0.055$),负向预测IADLs($\beta = -0.226$)和BADLs($\beta = -0.211$);而躯体疼痛正向预测IADLs($\beta = -0.121$)和BADLs($\beta = -0.104$);IADLs($\beta = -0.028$)和BADLs($\beta = -0.032$)均负向预测是否抑郁,见图1。

2.4 链式中介路径分析

使用Bootstrap法检验中介路径的稳健性,结果显示,IADLs作为中介时,慢性病共病状态与抑郁之间的关联有统计学意义(95% CI: 0.086 ~ 0.124),约48.44%可归因于躯体疼痛和IADLs的中介路径(95% CI: 0.045 ~ 0.056);而当BADLs作为中介时,慢性病共病状态与抑郁的关联亦有统计学意义(95% CI: 0.086 ~ 0.124),约47.91%可归因于躯体疼痛和BADLs的中介路径(95% CI: 0.045 ~ 0.056)。其中躯体疼痛的直接中介是最主要的中介途径,

而躯体疼痛与日常生活能力构建的链式中介途径均有统计学意义(95% CI: 0.004 ~ 0.006)。见表4。

2.5 敏感性分析

见表5。将是否处于共病状态替换为慢性病患者数量分析,中介路径结果依然稳健。进一步仅保留处于共病状态的个体分析,结果同样稳健,且可归因于躯体疼痛

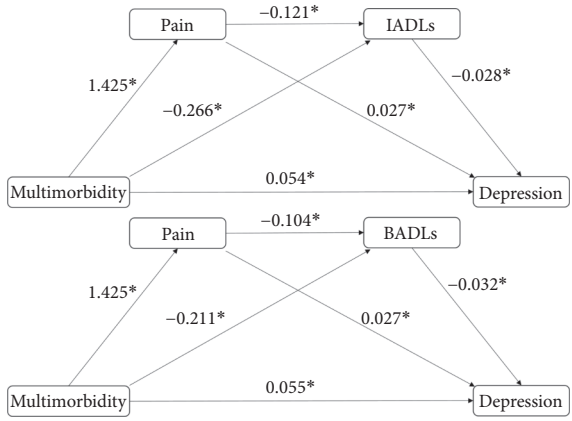


图 1 慢性病共病状态与抑郁的链式中介模型

Fig 1 Sequential mediation model of multimorbidity and depression

* P<0.001.

表 4 链式中介模型的Bootstrap法结果
Table 4 Bootstrapping results for sequential mediation models

Mediation Pathway	β	<i>P</i>	Bootstrap 95% <i>CI</i> [*]	Relative Effect/%
Ind_x : Multimorbidity ; M1: Pain; M2: IADLs; y: Depression				
Ind_x_M1_y	0.039	< 0.001	0.034-0.043	36.80
Ind_x_M2_y	0.007	< 0.001	0.005-0.010	7.06
Ind_x_M1_M2_y	0.005	< 0.001	0.004-0.006	4.58
Total indirect effect	0.051	< 0.001	0.045-0.056	48.44
Direct effect	0.054	< 0.001	0.036-0.072	51.57
Total effect	0.105	< 0.001	0.086-0.124	100.00
Ind_x : Multimorbidity ; M1: Pain; M2: BADLs; y: Depression				
Ind_x_M1_y	0.039	< 0.001	0.034-0.043	36.80
Ind_x_M2_y	0.007	< 0.001	0.005-0.010	6.53
Ind_x_M1_M2_y	0.005	< 0.001	0.004-0.006	4.59
Total indirect effect	0.050	< 0.001	0.045-0.056	47.91
Direct effect	0.055	< 0.001	0.036-0.073	52.09
Total effect	0.105	< 0.001	0.086-0.124	100.00

^{*} The number of bootstrap sampling was 10 000.

表 5 链式中介模型的敏感性分析(替换自变量)
Table 5 Bootstrapping results for sequential mediation models using different x

Mediation Pathway	Using the number of chronic diseases as Ind_x		Using the number of chronic diseases (all >1) as Ind_x	
	β	Relative effect/%	β	Relative effect/%
M1: Pain; M2: IADLs; y: Depression				
Ind_x_M1_y	0.015*	41.79	0.014*	48.23
Ind_x_M2_y	0.003*	8.50	0.003*	9.61
Ind_x_M1_M2_y	0.002*	4.93	0.002*	5.61
Total indirect effect	0.020*	55.21	0.019*	63.45
Direct effect	0.016*	44.79	0.011**	36.55
Total effect	0.037*	100.00	0.030*	100.00
M1: Pain; M2: BADLs; y: Depression				
Ind_x_M1_y	0.015*	41.33	0.015*	47.59
Ind_x_M2_y	0.003*	8.47	0.003*	8.57
Ind_x_M1_M2_y	0.002*	4.91	0.002*	5.00
Total indirect effect	0.020*	54.71	0.019*	61.16
Direct effect	0.017*	45.29	0.012**	38.84
Total effect	0.037*	100.00	0.031*	100.00

* *P* < 0.001, ** *P* < 0.05.

和日常生活能力的中介路径即总间接效应占比由55.21%和54.71%上升到63.45%和61.16%。

3 讨论

本研究基于2011~2018年CHARLS数据,探究了躯体

疼痛和日常生活能力在农村中老年人慢性病共病与抑郁之间的中介路径。研究发现,躯体疼痛、日常生活能力不仅独立介导共病对抑郁的影响,还形成了链式路径。这一发现为理解慢性病共病与抑郁间的机制路径提供了新的理论视角。

在截面回归和面板随机效应模型中, 本研究发现处于慢性病共病状态、躯体疼痛部位增加与日常生活能力变差均与中老年人抑郁的发生呈现正相关关系, 而睡眠时间延长则与抑郁的发生呈负相关关系, 与既往研究结果^[16-19]一致。躯体疼痛作为慢性病患者常见症状, 对日常生活能力会产生直接影响, 如类风湿关节炎会导致关节疼痛肿胀, 导致穿衣等日常活动难以进行^[15]。本研究进一步使用结构方程模型结合Bootstrap法, 证明了躯体疼痛与日常生活能力组成的中介通路的存在。由此表明, 处于慢性病共病状态通过躯体疼痛增加了中老年人日常生活的难度, 而生活能力的减退会影响中老年人的社会参与, 导致丧失社交、娱乐等活动, 可能造成其社会角色的变化^[20]。此外, 失能状态会降低自尊, 影响心理健康, 从而导致抑郁的发生或加重^[21]。本研究还发现, 共病状态下该中介通路的介导比例会进一步上升。这可能由于患有多种慢性疾病的中老年人躯体疼痛部位增多时, 带来的失能程度加剧会更明显, 会产生较大的挫败感和不满, 直接影响心理健康^[22]。

基于《“十四五”国民健康规划》及《中共中央 国务院关于深化养老服务改革发展的意见》的政策背景^[23-24], 结合慢性病共病对抑郁发生的影响机制, 本研究对我国农村中老年人慢性病管理提出以下建议: ①加强健康教育, 促进定期体检, 并建立基层主导的定期健康筛查制度, 将“三高共管”进一步扩大范围; ②针对共病群体躯体疼痛, 要突破单一疾病导向, 在乡镇设立疼痛综合干预门诊, 建立包含药物、中医理疗、康复训练的系统干预方案。同时在农村地区推广落实“家庭适老化改造”, 减少日常活动障碍; ③构建“家庭-社区-机构”三级支持网络, 发展农村互助养老, 并开展“家庭照护技能培训”。对于失能群体, 要强化其长期护理保障; ④建立心理危机预警机制, 将心理评估纳入基层慢性病管理流程, 加强基层心理援助热线建设, 并及时干预; ⑤在智能化背景下, 运用区域医疗大数据平台等数智技术, 突破单病种、碎片化服务困局, 促进优质医疗资源下沉, 探索区域整合式智慧慢病管理^[25]。

本研究仍存在局限。首先, 尽管采用面板数据并使用Bootstrap法, 但由于测量数据间隔长, 无法完全排除反向因果关系。其次, 睡眠时间等主要变量测量采用自报数据而非客观监测数据, 可能会影响评估的准确性。此外, 本研究未纳入营养状态等保护因素, 可能遗漏重要的调节变量。建议后续研究扩展相关分析。

综上所述, 研究表明, 农村中老年人慢性病共病与抑郁之间存在链式中介机制, 该群体躯体疼痛和日常生活能力的变化是值得关注的风险因素。因此, 在我国农

村中老年群体的慢性病管理中要突破单一症状管理模式, 从疼痛综合评估、加强社会支持等角度进行系统整合干预, 以避免抑郁的发生。

* * *

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