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The factors related to depressive symptoms in urban older adults in South Korea: a study based on the Seoul Aging Survey

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Abstract

Purpose This study aims to comprehensively examine the determinants of depression among urban older adults in Seoul, utilizing the social-ecological model to address multifaceted influences.

Methods A comprehensive analysis was conducted using data from the 2022 Seoul Aging Survey, which surveyed 2,914 individuals aged 65 and above. A multiple logistic regression analysis was performed to identify factors contributing to depressive symptoms, including socio-demographic characteristics, health behaviors and status, research accessibility, social support, and environmental influences.

Results This study revealed that poor subjective health (OR = 1.47) and the presence of multiple chronic diseases (OR = 1.59) significantly increased the risk of depressive symptoms among urban older adults. From a social support standpoint, living alone was associated with a higher risk of depression (OR = 1.66), low food security (OR = 2.56), and low digital competency (OR = 2.70) were all significant predictors of depressive symptoms. Additionally, a lack of engagement with cultural facilities (OR = 2.15) was identified as a critical environmental factor contributing to depression.

Conclusions The findings underscore the need for comprehensive policy and practical interventions aimed at preventing chronic disease, enhancing social support networks, improving digital literacy, ensuring food security, and expanding access to healthcare and cultural facilities. Such measures are crucial in mitigating depression among urban older adults, thereby enhancing their overall well-being and quality of life.

Keywords Depression, Urban older adults, Social-ecological model, Cultural facility, Health behaviors, Social support

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Introduction

By 2050, approximately one in two people over 60 will reside in urban areas [1]. In 2020, over 55% of the world's population was already living in urban areas; by 2050, 75% of the population is projected to live in these areas [2]. Since 2006, WHO has established the Global Network for Age-Friendly Cities and Communities (GNAFCC) to seek joint responses at the city level from this demographic trend. According to the GNAFCC, age-friendly cities need to be physically and socially barrier-free to guarantee active aging [3]. The social-ecological model also underscores the interconnectedness between individuals and their surrounding contexts, emphasizing the importance of creating environments conducive to healthy aging [4].

Then, how does living in an urban setting benefit the older adults? From the perspective of the social-ecological model, urban landscapes offer opportunities for older adults. The most strengthening point of cities is the accessibility to social and health-related services and higher health literacy, which are required for healthy and active aging [5, 6]. Cities provide convenient public transportation systems to accommodate the many people living in urban areas. Older adults in urban areas with convenient transportation systems have easy access to family, friends, and services [6]. Urban older adults also have better access to high-quality healthcare services than those in rural areas, given that medical facilities are typically located in urban centers. This access disparity can significantly impact the health outcomes of older adults living in rural areas [7].

However, the social-ecological model also sheds light on the challenges faced by older adults in urban environments. Issues such as limited access to green spaces, exposure to environmental stressors like air and noise pollution [8, 9], financial strains caused by high living costs [10], and social isolation [11, 12] are key factors negatively impacting mental health within the urban context. As a result of social distancing intended to prevent the spread of COVID-19, older adults have been less likely to participate in social activities in urban areas and have been more susceptible to depression-related symptoms [12]. In the aftermath of social distancing, older adults with weak social networks have been at greater risk of mental health and depression [13].

Traditional factors associated with depression among older adults include age, gender, marital status, level of education [14–18], chronic diseases [19], and low income [20]. Some studies demonstrated a significant correlation between food insecurity and depression among older adults [21, 22]. Recent studies have begun to examine the impact of digital competency variables as determinants of depressive symptoms in later life [23]. Research on the characteristics of older adults residing in urban areas

has focused on the green environment [6, 24, 25] and public transportation [23] as factors that contribute to depression among the population. However, studies that did not adopt a multilevel approach consistent with the social-ecological model may have overlooked the interconnected nature of influences across different levels. By failing to examine how individual behaviors interact with individual, interpersonal, and community factors, previous research might have missed valuable opportunities to uncover the complex mechanisms driving depressive symptoms among urban older adults.

In South Korea, the traditional social structure and rapid urbanization have created unique challenges in the mental health of older adults. The cultural emphasis on family and community provides a valuable context for understanding the impact of social support on mental health. However, changes in family structures and increasing urbanization are altering traditional support systems, potentially increasing the vulnerability of older adults to depression [5]. The depression rate among older adults in South Korea is the highest among OECD countries, and medical expenses due to depressive symptoms among those aged 65 and older have more than tripled from 25.9 billion KRW in 2004 to 105.1 billion KRW in 2019 [26]. Recently, Korean society has been focusing on lonely deaths among older adults resulting from depression and social isolation in urban areas. According to a 2022 survey on lonely deaths conducted by the Korean government, a total of 1,605 lonely deaths occurred among those aged 60 and older. Among these, 83.0% occurred in metropolitan areas, including Seoul and Gyeonggi Province [27]. In this situation, the social-ecological model underscores the importance of considering the complex interactions between individuals, their social networks, and the urban environment in addressing mental health disparities within this population.

Against this backdrop, this study seeks to identify the factors contributing to depressive symptoms among older adults in Seoul, integrating the social-ecological model's principles. Seoul, where approximately 10 million people live, shows the typical characteristics of a mega city [28]. The proportion of older adults over the age of 65 in Seoul is expected to increase from 15.4% in 2020 to 24.5% in 2030 [29]. Since becoming a member of the WHO GNAFCC in 2013, the Seoul Metropolitan Government has been consistently implementing policies at the macro level to promote the mental health of older adults [28]. With COVID-19 and social distancing, the government has also launched an intelligent healthcare project that leverages smartphones and mobile applications to deliver healthcare services to its citizens. There are plans to extend its priority from young citizens to older adults shortly. Additionally, to assist older adults with low health and digital literacy, the workers at the

Seoul Metropolitan Government will serve as coordinators [30]. By examining the intricate relationship between individual, interpersonal, and community characteristics among older adults in Seoul, this research aims to provide tailored interventions and urban policies that promote mental well-being and foster age-friendly urban environments for the population.

Methods

Data

This study used the original data of the 2022 Seoul Aging Survey conducted by the Seoul Welfare Foundation. The Seoul Aging Survey has been conducted every year by the Seoul Metropolitan Government in Korea since 2012. The purpose of the survey is to find out how the older adults in Seoul live and what they want based on Article 25 of the 'SEOUL METROPOLITAN GOVERNMENT FRAMEWORK ORDINANCE ON REALIZATION OF AGE-FRIENDLY CITY,' enacted in 2011. The survey covers diverse issues such as health conditions, family, work status, job history, finance, living environment, leisure, abuse, and demographic characteristics. According to the 2022 Korean Population Statistics (based on the Resident Registration), the survey was conducted using a stratified sampling method with proportional allocation based on gender, age, and 25 districts. The total number of respondents from the survey was 2,914 citizens aged 65 and above residing in Seoul, Korea [30].

The IRB was waived because this study used public data collected by the Seoul Welfare Foundation, one of the agencies under the Seoul Metropolitan Government. According to the Bioethics and Biosafety Act of Korea, surveys and research conducted by the relevant government ministry or agency for public interest are exempt from the IRB approval procedures [31]. Informed consent was obtained from the survey respondents according to the Seoul Welfare Foundation's bylaws.

Variables

In previous research studies of depression among older adults in urban settings, socioeconomic status, and social support were primarily studied. These aspects include living arrangements, social connections, educational achievement, financial difficulties [32–35], chronic diseases [36] and healthy lifestyles [37]. Given the increasing emphasis on creating a healthy urban milieu, researchers have underscored the significance of physical spaces, with a particular focus on neighborhoods and communities, including elements like the built environment, parks, and cultural and religious facilities [6, 38–41]. In addition, in the era of the 4th Industrial Revolution and the Coronavirus pandemic, research has proved that the digital capabilities of older adults in developed countries positively impact access to information and the

formation of social relationships [42, 43]. Therefore, this study aimed to explore the determinants of depression among urban older adults from the individual level to the community level based on the social-ecological model, focusing on domains such as socio-demographic factors, health behaviors and health status, social support, resource accessibility, and environmental factors.

Individual level: socio-demographic factors

The socio-demographic factors of the subjects were sex, age, education level, and income level. Sex was divided into male and female, age group was classified into 65–69 years old, 70–74 years old, 75–79 years old, and 80 years old or older. Education level was 'below the elementary school,' 'middle school,' 'high school,' 'University,' and the household income level was classified as less than 1 million won, '1 million to 1.99 million won,' '2 million to 2.99 million won,' '3 million to 3.99 million won,' and 'more than 4 million won' based on Korean currency (won).

Individual level: healthy behavior and health status

The health status of the subjects included subjective health status, chronic disease, and smoking. The subjective health status questionnaire is a single question: 'How do you think your usual health condition is?', 'Very poor,' 'Poor,' 'Fair,' 'Good,' 'Excellent.' In this study, the original data's 'Very poor' and 'poor' were classified as 'Bad,' and 'Fair,' 'Good,' and 'Very good' were classified as 'Good.' In the case of chronic diseases, the question was, "Do you have any chronic diseases that have been diagnosed by a doctor and have been suffering for more than three months?". Afterward, it was re-categorized into three categories and included in the analysis: 'no chronic disease,' 'having a chronic disease,' and 'having two or more chronic diseases.' Smoking was a dichotomous variable of current smoking or not. On the other hand, nutrition is a significant factor influencing the mental health of older adults. In this study, the following variable was included in the analysis [37].

Individual level: resource accessibility

The resource accessibility domain was composed of variables such as unmet healthcare needs due to financial barriers, food insecurity, and digital competency. Unmet needs for healthcare utilization due to economic barriers were defined as a person who answered 'yes' to the question, "Have you ever been unable to visit a hospital because of lack of money in the past year?" In the case of food insecurity, in response to "I skipped meals because I did not have money," 'yes' was reclassified as 'experience of food insecurity' and 'no' was reclassified as 'not experiencing food insecurity.' It has been reported that the use of digital devices and programs using digital devices

prevented or reduced depressive symptoms in older adults. Since 1990, South Korea has rapidly expanded innovative technology and infrastructure, and the older adults living in Seoul, the capital of Korea, the subjects of this study, are known to be the most capable of using smart devices in Korea [44]. Therefore, the digital competency of older adults was included as a significant variable in this study. The older adults who cannot use smartphones are rated as 'Bad,' those who can use smartphones are re-categorized as 'Fair,' and among those who use smartphones, those who use at least one among smart pads, laptops or kiosks are rated as 'Good [45]'.

Interpersonal level: social support

The socio-demographic factors of the subjects were composed of family types and relationships with friends and acquaintances. Family types were classified into the older adults living alone and the older adults living together with a family, including a spouse. In this research, the variable 'relationships with friends and acquaintances' denotes contentment with one's connections with friends, acquaintances, and family members. For analysis, the original data categories 'Very bad,' 'Bad,' and 'Fair' were amalgamated into a single 'Bad' category, while 'Good' and 'Very good' were merged into a 'Good' category.

Community level: environmental factors

It is known that the prevalence of depression among older adults living in urban areas varies depending on their living environment. Access to parks and cultural facilities and the use of religious facilities affect psychological stability and thus positively impact mental health [46, 47]. Among the currently used community places, open

spaces, cultural facilities, and religious facilities that are likely to affect depression were included in the analysis. Specifically, those who responded that they used outdoor spaces such as parks, playgrounds, waterside parks, or mountains were categorized as 'Open space users.' Those who responded that they visited art galleries, museums, or libraries were categorized as 'Cultural facility users.' In addition, 'religious facility user' was included in the analysis as a dichotomous variable based on whether or not a cathedral, church, or temple was used.

Depressive symptoms: SGDS-K (Korean version of the short form of Geriatric Depression Scale)

The Geriatric Depression Scale (GDS) was developed as a 30-item self-report depression scale [48]. Considering that the 30-item GDS was time-consuming and challenging to use, A 15-item Short Form of GDS (SGDS) was developed. [49]. Afterward, the 15-item SGDS was standardized in Korean and was developed based on the SGDS in Korea [50]. The same questions were used as a depression scale in this study. The validity and reliability of GDS-K (Korean Version of the Geriatric Depression Scale) were secured (Cronbach's $\alpha=0.88$), and 0 to 7 points meant 'not depressed' and 8 to 15 meant 'depressed' [51]. The conceptual framework of this study is presented in Fig. 1.

Statistics

This study analyzed the factors influencing the experience of depressive symptoms among urban older adults using an analytical framework based on the social-ecological model. First, the frequency, percentage, mean, and standard deviation were analyzed for socio-demographic factors, healthy behaviors and status, social support, and environmental factors.

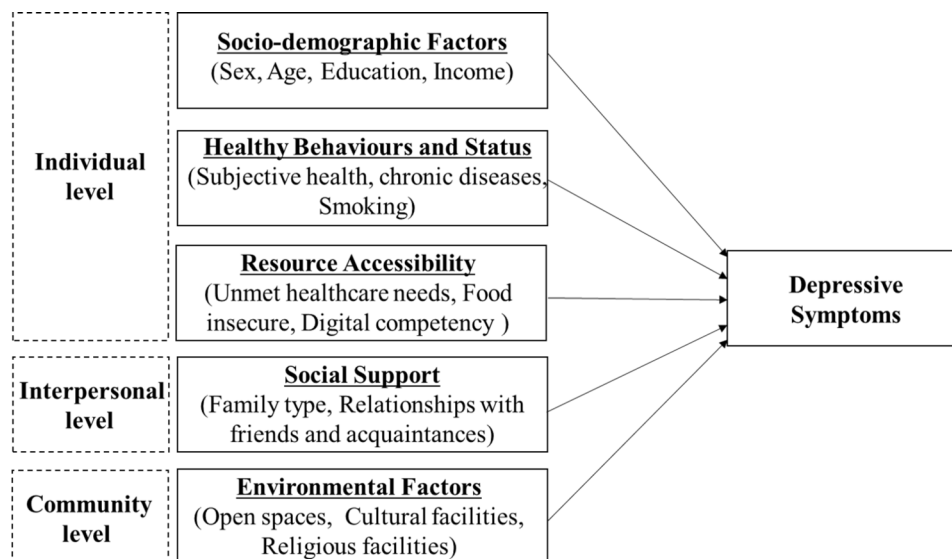


Fig. 1 Conceptual framework of risk factors for depressive symptoms among urban older adults

Table 1 General characteristics of the study participants (N=2,914)

Variables	Men		Women		Total		
	N	%	N	%	N	%	
Total	1,367	100.0	1,547	100.0	2,914	100.0	
Age							
	65–69	419	30.5	459	29.5	878	30.1
	70–74	362	26.4	375	24.1	737	25.3
	75–79	297	21.6	341	21.9	638	21.9
	Above 80	295	21.5	381	24.5	676	23.2
Education level							
	Under Elementary School	226	16.5	617	39.7	843	28.9
	Middle School	325	23.7	350	22.5	675	23.2
	High School	532	38.8	486	31.2	1,018	34.9
	University	290	21.1	103	6.6	393	13.5
Average monthly income							
	₩0 – ₩990 K	142	10.4	252	16.3	394	13.5
	₩1000 K – ₩1,990 K	313	22.9	376	24.3	689	23.6
	₩2000 K – ₩2,990 K	316	23.1	354	22.9	670	23.0
	₩3000 K – ₩3,990 K	266	19.5	241	15.6	507	17.4
	More than ₩4,000 K	330	24.1	324	20.9	654	22.4
Subjective health status							
	Good	716	52.4	656	42.4	1,372	47.1
	Fair	482	35.3	573	37.0	1,055	36.2
	Poor	169	12.4	318	20.6	487	16.7
Number of chronic diseases							
	Mean (S.D.)	1.73(1.35)		2.11(1.66)		1.93(1.53)	
Smoking							
	Yes	279	20.4	41	2.7	320	11.0
	No	1,088	79.6	1506	97.4	2,594	89.0
Unmet needs of healthcare utilization due to financial barriers							
	Yes	13	1.0	17	1.1	30	1.0
	No	1,354	99.1	1,530	98.9	2,884	99.0
Food insecure							
	Yes	25	1.8	35	2.3	60	2.1
	No	1,342	98.2	1,512	97.7	2,854	97.9
Digital competency							
	Good	304	22.2	165	10.7	469	16.1
	Fair	877	64.2	1067	69.0	1,944	66.7
	Bad	186	13.6	315	20.4	501	17.2
Family type							
	Alone	166	12.1	458	29.6	624	21.4
	Living with family	1,201	87.9	1,089	70.4	2,290	78.6
Relationships with friends and acquaintances							
	Good	801	58.6	953	61.6	1,754	60.2
	Fair	506	37.0	516	33.4	1,022	35.1
	Bad	60	4.4	78	5.0	138	4.7
Open space							
	Use	190	13.9	366	23.7	556	19.1
	Not use	1,177	86.1	1,181	76.3	2,358	80.9
Cultural facilities							
	Use	119	8.7	173	11.2	292	10.0
	Not use	1,248	91.3	1,374	88.8	2,622	90.0
Religious facilities							
	Use	337	24.7	700	45.3	1,037	35.6
	Not use	1,030	75.4	847	54.8	1,877	64.4

S.D.: standard deviation

resource accessibility, and environmental factors of urban older adults. Second, the differences in independent variables between older adults who experienced depressive symptoms and those who did not were analyzed using the chi-square test. Finally, multiple logistic regression analysis was conducted to identify the factors related to the experience of depression among urban older adults. The multiple logistic regression analysis was divided into four models based on the social-ecological model. Model 1 included variables constituting the domains of socio-demographic characteristics and healthy behaviors and status as independent variables. Model 2 added the social

support domain to Model (1) Model 3 further included the resource accessibility domain to Model (2) Model 4 added environmental factors to Model (3) Each model fit was presented based on the Akaike Information Criterion (AIC) and -2 Log Likelihood (-2 Log L). In addition, to verify multicollinearity among the independent variables, Variance Inflation Factors (VIF) were calculated, and it was confirmed that all variables had values below 10. All statistical analyses were performed using SAS ver. 9.4 software (SAS Institute Inc., Cary, NC, USA).

Results

Sample characteristic

Table 1 presents the general characteristics of the older adults who participated in the 2022 Seoul Survey of Older Adults. Regarding demographic characteristics, 1,367 (46.9%) of the participants were men and 1,547 (53.1%) were women. The socio-demographic factors are as follows: 30.1% of the older adults were aged 65–69, 25.3% were 70–74, 21.9% were 75–79, and 23.2% were over 80. In terms of education level, 48.4% had graduated from

high school or higher. Compared to 39.7% of women with an elementary school diploma or less and 16.5% of older men. In addition, only 6.6% of older women compared to 21.1% of men with a college degree or higher. Additionally, 13.5% had a monthly household income of less than 1 million won, while 22.4% had a revenue of more than 4 million won. In terms of social support, 21.4% of the older adults were living alone. While 29.6% of older women lived alone, only 12.1% of men lived alone. Approximately 60.2% regarded their relationships

Table 2 Differences in the experience of depressive Symptom according to general characteristic

Variables	No Depression		Depressive symptom		χ^2/ t	P-value	
	N	%	N	%			
Total	2,642	90.7	272	9.3	-	-	
Sex	Men	1,246	91.2	121	8.9	0.7091	0.399
	Women	1,396	90.2	151	9.8		
Age	65–69	823	94.0	53	6.1	17.893	0.001
	70–74	664	90.3	71	9.7		
	75–79	565	89.12	69	10.9		
	Above 80	590	88.2	79	11.8		
Education level	Under Elementary School	705	84.9	125	15.1	55.980	<0.0001
	Middle School	606	89.9	68	10.1		
	High School	963	94.6	55	5.4		
	University	368	93.9	24	6.1		
Average monthly income	₩0 – ₩990 K	336	85.3	58	14.7	24.144	<0.0001
	₩1000 K – ₩1,990 K	615	89.3	74	10.7		
	₩2000 K – ₩2,990 K	612	91.3	58	8.7		
	₩3000 K – ₩3,990 K	465	91.7	42	8.3		
	More than ₩4,000 K	614	93.9	40	6.1		
Subjective health status	Good	1,287	93.8	85	6.2	48.849	<0.0001
	Fair	950	90.1	105	9.9		
	Poor	405	83.2	82	16.8		
Number of chronic diseases	Mean (S.D.)	1.83(1.42)		2.80(2.15)		-10.03	<0.0001
Smoking	Yes	293	91.6	27	8.4	0.342	0.559
	No	2,349	90.6	245	9.4		
Unmet needs of healthcare utilization due to financial barriers	Yes	18	60.0	12	40.0	33.682	<0.0001
	No	2,624	91.0	260	9.0		
Food insecure	No	2,601	91.1	253	8.9	36.102	<0.0001
	Yes	41	68.3	19	31.7		
Digital competency	Bad	400	79.8	101	20.2	87.056	<0.0001
	Fair	1,796	92.4	148	7.6		
	Good	446	95.1	23	4.9		
Family type	Alone	533	85.4	91	14.6	25.851	<0.0001
	Living with family	2,109	92.1	181	7.9		
Relationships with friends and acquaintances	Good	1,619	92.3	135	7.7	25.092	<0.0001
	Fair	912	89.2	110	10.8		
	Bad	111	80.4	27	19.6		
Open space	Use	487	87.6	69	12.4	7.681	0.005
	Not use	2,155	91.4	203	8.6		
Cultural facilities	Use	283	96.9	9	3.1	14.989	<0.0001
	Not use	2,359	90.0	263	10.0		
Religious facilities	Use	955	92.1	82	7.9	3.873	0.049
	Not use	1,687	89.9	190	10.1		

with friends and acquaintances as good, 35.1% viewed them as fair, and a small fraction, 4.7%, considered them bad. Regarding health behaviors and status, 16.7% of the older adults reported their subjective health as poor, and the average number of chronic diseases among the older adults was 1.93. Older women had about 2.11 chronic diseases, and older men had 1.73 chronic diseases. Additionally, 11.0% of the older adults smoked. The smoking rate among older women was only 2.7%, and among older men it was 20.4%. Regarding resource accessibility, 1.0% of the older adults experienced unmet healthcare needs due to financial barriers, and 2.1% were food insecure. Digital competency was a strength for urban older adults, with 16.1% demonstrating high competency. While 22.2% of older men had good digital competency, only 10.7% of older women had good digital competency. Lastly, concerning environmental factors, 19.1% of the older adults used open spaces, 10.0% used cultural facilities, and 35.6% used religious facilities. Among older women, 23.7% used open spaces compared to 13.9% of older men. Additionally, only 24.7% of older men used religious facilities, whereas 45.3% of older women did.

Differences in the experience of depressive symptoms according to general characteristic

The following are the results of an analysis of differences in the experience of depression according to the main characteristics of urban older adults. Overall, 9.3% of the older adults experienced depression, and no statistical significance was found according to gender. The rate of experiencing depression increased with age and was higher among those with lower levels of education and income. Among different types of living arrangements, the rate of experiencing depression was about 14.6% in single-person households, roughly twice as high as in other types of households. Lower rates of depression were observed among those with good relationships with friends and acquaintances and among those with higher subjective health levels. In contrast, those with lower subjective health levels experienced a significant increase in depression rates, highlighting a substantial difference in depression according to differences in subjective health status. The average number of chronic diseases was about 1.8 for those without depression and about 2.8 for those with depression. No statistically significant difference in depression was found according to smoking status. Higher experiences of depression were observed among older adults with unmet medical needs, food insecurity, and low digital competency. Lastly, older adults who used open spaces, cultural facilities, and religious facilities experienced lower levels of depression.

Depressive symptoms factors of urban older adults

To investigate the factors related to depressive symptoms among urban older adults in Korea, a multiple logistic regression analysis was conducted based on the social-ecological model (Table 3). Model 1 analyzed the impact of socio-demographic characteristics, such as health behaviors and health status, on depressive symptoms. The results indicated that older adults with lower educational levels were less likely to experience depressive symptoms. At the same time, those with poor subjective health status and multiple chronic diseases were more likely to experience depressive symptoms. Model 2 incorporated resource accessibility domains alongside those in Model 1. The risk of depression decreased for those with a high school or university education compared to those with only an elementary school education or less. Those who reported good subjective health had a lower risk of depression, while urban elderly with multiple chronic diseases had a higher risk. Additionally, unmet healthcare needs due to financial barriers, food insecurity, and low digital competency were found to increase the risk of depression in the elderly. Model 3 is an extension of Model 2 with the addition of the social support domains. The research results showed that low education levels, poor subjective health status, multiple chronic diseases, unmet healthcare needs, food insecurity, and low digital competency all increased the risk of depressive symptoms in the same direction. Additionally, it was found that urban elderly living alone were at a higher risk of experiencing depressive symptoms.

Finally, Model 4 included environmental factors in addition to those in Model 3. The analysis indicated no statistically significant variables among the socio-demographic characteristics. Regarding health behaviors and status, urban older adults with poor subjective health had a 1.47 times higher risk of depression compared to those with good subjective health, and those with multiple chronic diseases had a 1.59 times higher risk of depression compared to those without chronic diseases. Those who experienced unmet healthcare due to financial barriers had a 3.73 times higher risk. Older adults with low food security had a 2.56 times higher risk of depression compared to those with adequate food security. Furthermore, those with low digital competency had a higher risk of depression compared to the others. Specifically, urban older adults who could not use a smartphone had a 2.7 times higher risk of depression compared to those using smart devices such as smartphones, tablets, and kiosks. In the social support domains, urban older adults living alone had a 1.66 times higher risk of experiencing depressive symptoms compared to those living with other family members. Among environmental factors, urban older adults who did not use cultural facilities had a 2.15 times higher risk of depressive symptoms

Table 3 Factors on depressive symptoms (SGDS-K) in urban older adults: results of multiple logistic regression

Parameter	Model 1					Model 2					Model 3					Model 4				
	O.R	S.E.	95% C.I	O.R	S.E.	95% C.I	O.R	S.E.	95% C.I	O.R	S.E.	95% C.I	O.R	S.E.	95% C.I	O.R	S.E.	95% C.I		
Sex (ref= men)	0.82	0.14	0.62	1.09	0.79	0.15	0.59	1.05	0.74	0.15	0.55	1.00	0.76	0.15	0.56	1.03				
Age (ref= 65–69)	1.22	0.2	0.83	1.8	1.13	0.20	0.76	1.68	1.16	0.20	0.78	1.71	1.17	0.20	0.79	1.74				
	1.21	0.2	0.81	1.8	1.04	0.21	0.69	1.57	1.06	0.21	0.70	1.61	1.08	0.21	0.72	1.64				
	1.09	0.21	0.73	1.64	0.75	0.22	0.48	1.16	0.73	0.22	0.47	1.14	0.74	0.22	0.48	1.15				
Education (ref= under Elementary School)	0.70*	0.17	0.5	0.99	0.79	0.18	0.56	1.13	0.81	0.18	0.57	1.14	0.81	0.18	0.57	1.14				
	0.41***	0.19	0.28	0.6	0.48***	0.20	0.33	0.72	0.49***	0.20	0.33	0.73	0.50***	0.20	0.34	0.74				
	0.45**	0.26	0.27	0.75	0.57*	0.28	0.33	0.99	0.58*	0.28	0.33	1.00	0.62	0.28	0.35	1.07				
Monthly income (ref= ₩0–₩990 K)	0.88	0.19	0.6	1.29	1.06	0.20	0.72	1.58	1.27	0.21	0.84	1.93	1.30	0.21	0.85	1.97				
	0.89	0.21	0.59	1.34	1.10	0.22	0.72	1.69	1.53	0.25	0.94	2.49	1.56	0.25	0.96	2.55				
	0.92	0.23	0.59	1.44	1.16	0.24	0.73	1.85	1.65	0.27	0.97	2.81	1.69	0.27	0.99	2.87				
	0.72	0.24	0.45	1.14	0.92	0.24	0.57	1.48	1.36	0.28	0.78	2.35	1.38	0.28	0.79	2.40				
Subjective health status (ref= Fair/Good)	1.67***	0.16	1.22	2.27	1.53**	0.16	1.11	2.10	1.49*	0.16	1.09	2.06	1.47*	0.16	1.07	2.03				
	1.13	0.25	0.69	1.83	1.11	0.25	0.68	1.82	1.10	0.25	0.67	1.80	1.09	0.25	0.67	1.79				
Number of chronic diseases (ref= No)	1.65**	0.22	1.07	2.53	1.63*	0.22	1.05	2.51	1.62*	0.22	1.05	2.50	1.59*	0.22	1.03	2.46				
	1.02	0.22	0.66	1.58	0.95	0.23	0.61	1.49	0.93	0.23	0.59	1.46	0.90	0.23	0.57	1.42				
Smoking (ref= No)																				
Unmet healthcare needs due to financial barriers (ref= No)					3.90**	0.44	1.64	9.28	3.85**	0.44	1.61	9.18	3.73**	0.44	1.57	8.91				
					2.59**	0.33	1.35	4.98	2.59**	0.33	1.35	4.98	2.56**	0.33	1.33	4.92				
Food insecure (ref= No)					1.21	0.26	0.74	2.01	1.23	0.26	0.74	2.03	1.12	0.26	0.67	1.86				
Digital competency (ref= Good)					3.11***	0.29	1.75	5.51	3.10***	0.29	1.75	5.51	2.70***	0.30	1.51	4.84				
Family type (ref= Living with family)									1.63**	0.18	1.14	2.33	1.66**	0.18	1.17	2.38				
Relationships with friends & acquaintances (ref= Fair/Good)									1.19	0.14	0.91	1.56	1.16	0.14	0.89	1.52				
Open space (ref= Use)													1.09	0.16	0.79	1.50				
Cultural facility (ref= Use)													2.15*	0.36	1.07	4.32				
Religious facility (ref= Use)													1.10	0.15	0.82	1.47				
Model fit																				

***p < .001, **p < .01, *p < .05

compared to those who did. The use of open spaces and religious facilities tended to reduce the risk of depressive symptoms, but these findings were not statistically significant. For the multiple logistic regression model, the goodness-of-fit was validated by identifying the model yielding the minimal AIC scores and $-2 \text{ Log } L$. Additionally, the Variance Inflation Factor (VIF) for all independent variables in the regression analysis ranged between 1.066 (VIF of open space user) and 1.625 (VIF of Education), confirming the absence of multicollinearity among the variables.

Discussion

This study delves into the intricate web of factors influencing depression among urban older adults in Seoul through the lens of the social-ecological model. A comprehensive analysis was conducted using data from the 2022 Seoul Aging Survey, encompassing 2,914 individuals aged 65 and above. The research employed multiple logistic regression analyses to discern the key contributors to depressive symptoms, including socio-demographics, health behaviors and status, resource accessibility, social support, and environmental influences. The main results of this study are urban older adults with poor health or chronic conditions faced increased risks of depression, especially if living alone and lacking social support. Those with unmet healthcare needs, financial constraints, food insecurity, or poor digital skills were also more susceptible to depressive symptoms. This result is consistent with the previous research examining negative effects on food insecurity and mental health in older adults [52, 53] and the positive contribution of the use of Internet devices in reducing depressive symptoms [21, 54]. This research also suggests that older adults who did not engage with cultural facilities showed higher vulnerability to the symptoms. Specifically, studies have found that urban older adults who use cultural facilities have lower levels of depression compared to their rural counterparts. These findings add to the existing evidence supporting the positive impact of cultural engagement on mental health in older age [55].

The results of this study highlight the importance of considering the social-ecological model as a guiding framework for understanding the complexities of depression in urban settings, emphasizing the need for comprehensive strategies that address the diverse determinants of mental health. From a social-ecological perspective, the results underscore the interconnectedness of individual health behaviors and resource accessibility, social interactions, and environmental influences in shaping mental well-being among urban older adults. By identifying factors such as poor subjective health, social isolation, financial constraints, and limited access to healthcare and cultural amenities as key contributors

to depressive symptoms, this study provides actionable insights for designing interventions that target multiple levels of influence to create supportive and inclusive environments for older adults in urban settings as the below.

Recent studies have focused on the association between digital competency and mental health among older adults [43, 56]. In this study, it was observed that urban older adults with low digital competency, as one of the individual characteristics, exhibited higher levels of depressive symptoms. Those older adults lacking digital competency faced challenges accessing information or social media, leading to feelings of isolation [57]. Social isolation at the interpersonal level could contribute to increased anxiety and uncertainty about maintaining a healthy lifestyle, negatively impacting the mental health of older adults [58]. The implementation of social distancing policies at the macro level may have exacerbated depressive symptoms among urban older adults, especially those with low digital competence, as they faced increased restrictions in their daily activities compared to rural older adults [32]. Enhancing the digital competence of urban older adults could prove effective in monitoring their health conditions and facilitating access to medical services.

Another significant determinant of depression among Seoulites aged 65 and above at the individual level is food security, despite their comparatively higher income levels than older adults in rural areas of Korea. Adequate and consistent access to nutritious food is crucial for maintaining a healthy later life [59]. This finding suggests that food insecurity disparities can manifest within urban areas despite the proximity to abundant resources. In this context, urban older adults facing challenges in affording food may not only experience malnutrition but also encounter stressful circumstances leading to relative deprivation and feelings of shame, potentially contributing to depressive symptoms.

In urban settings, the level of social networks tends to be lower compared to rural areas, making older adults in cities more susceptible to feelings of loneliness and depression [54]. Notably, in Seoul, the type of household structure emerged as a more influential factor than living alone concerning relationships with friends and acquaintances. Additionally, urban older adults are at a heightened risk of developing chronic diseases due to their Westernized lifestyles, with older Seoulites with multiple chronic diseases experiencing a significantly increased risk of depression. This highlights the importance of prioritizing health promotion and disease management strategies in urban environments. Despite the availability of abundant medical and food resources in cities, the risk of depression escalates for older adults who face barriers to accessing healthcare services or have limited food intake due to low income levels. Urban dwellers with restricted access to essential resources, despite their

availability, may exhibit poorer health outcomes than their rural counterparts [60]. Continuous efforts are necessary to enhance accessibility to medical care and ensure food security for low-income older adults in urban areas.

Interestingly, the utilization of cultural facilities emerged as the sole statistically significant environmental factor at the community level associated with depression among older urban adults. Engaging in cultural activities encourages social interaction, physical exercise, and cognitive stimulation, effectively serving as a preventive measure against depression in later life [55]. However, the findings concerning living environment factors deviate from previous research on the effects of religious activities [61] or outdoor pursuits [62]. A noteworthy comparison reveals a decline in the utilization of facilities by older Seoulites from 49.3% in 2018 to 35.7% in 2022, although there was an increase in outdoor facility utilization from 73.6% in 2018 to 79.8% in 2022 [52]. Further research is warranted to ascertain whether the temporary restrictions on indoor gatherings, as part of the social distancing protocol during the COVID-19 outbreak, influenced the impact of religious or outdoor activities on depression among urban older adults. Conversely, the marginal change in the proportion of older Seoulites utilizing cultural facilities – from 12.1% in 2018 and 10.1% in 2022 – underscores the unequal accessibility of cultural resources in Seoul, renowned for its rich cultural landscape in Korea [63], which negatively impacts the mental health of urban older adults. The results of this study also indicate that access to and engagement with cultural amenities in urban settings positively influence the mental well-being of city-dwelling older adults, highlighting the necessity of implementing policies to enhance the accessibility of cultural venues.

The strengths of this research lie in its utilization of Seoul, a metropolis with a population of approximately ten million, as a case study, enabling the analysis of social and physical environmental characteristics typical of large urban areas. While depression research concerning the aging population traditionally focuses on socio-demographic attributes [14–17, 20, 64] and social support networks [12, 34, 39, 42, 65–67], this study aligns with the social-ecological model's advocacy for systemic interventions addressing health across multiple levels. The research endeavors to inform tailored social policies and practices aimed at combating the high prevalence of depression among urban older adults by highlighting the specific attributes of Seoul's urban landscape and aging demographic. Through these insights, the study aims to guide the development of the social-ecological model, promoting holistic approaches to enhance mental well-being in urban settings.

While this study suggests the need for interventions at the city level to address depression among urban

older adults, it is essential to acknowledge its limitations. Firstly, the data in this study is representative of urban older adults without communication difficulties, as individuals with low cognitive or physical function were excluded from the Seoul Aging Survey. Secondly, the findings are derived solely from Seoul, Korea, warranting the need for comparative studies across various countries and regions to comprehensively assess factors contributing to depressive symptoms among urban older adults. Furthermore, the study lacks certain crucial variables that could offer a more comprehensive understanding of the research topic. For example, the dataset does not encompass variables related to significant life events in old age, such as the loss of a spouse or friend or the intricacies of social connections. More in-depth research is warranted to explore how specific indicators related to social relationships and digital competency, not addressed in this study, influence depressive symptoms among urban older adults.

Conclusion

The findings in this study illuminate the intricate interplay between individual, interpersonal, and environmental factors and their impact on depressive symptoms among urban older adults, aligning closely with the principles of the social-ecological model. Key determinants such as food security, access to medical care, digital literacy, and cultural engagement underscore the significance of considering multiple levels of influence on mental well-being within urban environments. Through the lens of the social-ecological model, interventions aimed at improving nutrition, enhancing digital competencies, fostering social connections, and ensuring access to cultural amenities emerge as crucial strategies for promoting health equity and reducing depression in urban older adults. The study highlights the interconnectedness of individual behaviors, social interactions, and environmental influences in shaping mental health outcomes, emphasizing the importance of holistic approaches rooted in the social-ecological model to enhance the overall quality of life for urban older adults.

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Author contributions

The research project was conceptualized and designed by CS and JK, who were responsible for the development and planning of the study. The methodology was designed and performed under the responsibility of CS, while data consolidation was carried out by JK. CS and JK contributed to reviewing and editing of the study. All authors read and approved the final manuscript to be published.

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Data availability

The data that support the findings of this study are available from the Department of Policy Research of the Seoul Welfare Foundation but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available (Contact: 82-2-1670-5755, <https://welfare.seoul.kr/web/contents/foundinfo1-1.do>). However, data is available from the corresponding author (Junghyun Kim) upon reasonable request and with the permission of the Seoul Welfare Foundation.

Declarations

Ethics approval and consent to participate

This study was exempted from the IRB according to the national legislation, the Bioethics and Biosafety Act of Korea, since the dataset analyzed for this study was collected by a relevant government agency, the Seoul Welfare Foundation. All methods were carried out in accordance with relevant guidelines and regulations of the Seoul Welfare Foundation.

Consent for publication

The dataset analyzed for this study does not disclose any personally identifiable information. Therefore, consent to publication was not required.

Competing interests

The authors declare no competing interests.

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References

1. Artmann M, Chen X, Iojă C, Hof A, Onose D, Poniży L, et al. The role of urban green spaces in care facilities for elderly people across European cities. *Urban Urban Green*. 2017;27:203–13.
2. Tadors W, Wellenstein SN, Das A. Demographic trends and Urbanization. World Bank Group; 2021.
3. The Global Network for Age-Friendly Cities and Communities. Looking back over the last decade, looking forward to the next. 2018.
4. Golden SD, McLeroy KR, Green LW, Earp JAL, Lieberman LD. Upending the Social-ecological model to Guide Health Promotion efforts toward policy and environmental change. *Health Educ Behav*. 2015;42:8–14.
5. Park K, Park Y-R, Son D. The relationship between Social Connectedness and Depressive Symptom: a comparison between the Rural and Urban Elderly. *J Korea Contents Association*. 2020;20:667–77.
6. Carpentieri G, Guida C, Fevola O, Sgambati S. The Covid-19 pandemic from the elderly perspective in urban areas: an evaluation of urban green areas in ten European capitals. *J Land Use Mobil Environ*. 2020;3:389–408.
7. Du M, Cheng L, Li X, Yang J. Factors affecting the travel mode choice of the urban elderly in healthcare activity: comparison between core area and suburban area. *Sustain Cities Soc*. 2020;52 March 2019:101868.
8. Jang Somang, Bae J-S, Lee K-E. Meal and Food Provision Services for Community-Dwelling Vulnerable Older Adults Perceived by Health & Welfare Service Providers in Seoul. *J Korean Diet Assoc*. 2019;25:295–309.
9. Reklaitiene R, Virviciute D, Tamosiunas A, Baceviciene M, Luksiene D, Sapranaviciute Zabazlajeva L, et al. The relationship of green space, depressive symptoms and perceived general health in urban population. *Scand J Public Health*. 2014;42:669–76.
10. Bilkis MS, Islam M, Zaman F, Zinia SN, Rahman M. Lifestyle and depression in Urban Elderly of selected District of Bangladesh. *Mymensingh Med J*. 2020;29:177–82.
11. Ejiri M, Kawai H, Fujiwara Y, Ihara K, Watanabe Y, Hirano H, et al. Social participation reduces isolation among Japanese older people in urban area: a 3-year longitudinal study. *PLoS ONE*. 2019;14:1–11.
12. Copeland M, Nowak GR, Liu H. Social participation and self-reported depression during the COVID-19 pandemic among older adults. *Aging Ment Health*. 2022. <https://doi.org/10.1080/13607863.2022.2126821>.
13. Figueroa CA, Aguilera A. The need for a Mental Health Technology Revolution in the COVID-19 pandemic. *Front Psychiatry*. 2020;11:1–5.
14. Curran E, Rosato M, Ferry F, Leavey G. Prevalence and factors associated with anxiety and depression in older adults: gender differences in psychosocial indicators. *J Affect Disord*. 2020;267:114–22.
15. Hubbard G, Daas C, Johnston M, Dixon D. Sociodemographic and psychological risk factors for anxiety and depression: findings from the Covid-19 health and adherence research in Scotland on mental health (CHARIS-MN) cross-sectional survey. *Int J Behav Med*. 2021;28:788–800.
16. Lotfaliany M, Hoare E, Jacka FN, Kowal P, Berk M, Mohebbi M. Variation in the prevalence of depression and patterns of association, socio-demographic and lifestyle factors in community-dwelling older adults in six low- and middle-income countries. *J Affect Disord*. 2019;251:218–26.
17. Richardson RA, Keyes KM, MSc JM, Calvo E. Socio-demographic inequalities in depression among older adults: cross-sectional evidence from 18 countries. *Lancet Psychiatry*. 2020;7:648–9.
18. Bandayrel K, Wong S. Systematic Literature Review of Randomized Control Trials Assessing the Effectiveness of Nutrition Interventions in Community-Dwelling older adults. *J Nutr Educ Behav*. 2011;43:251–62.
19. Turana Y, Tengawan J, Chia YC, Shin J, Chen CH, Park S, et al. Mental health problems and hypertension in the elderly: review from the HOPE Asia Network. *J Clin Hypertens*. 2021;23:504–12.
20. Anbesaw T, Fekadu B. Depression and associated factors among older adults in Bahir Dar City administration, Northwest Ethiopia, 2020: cross-sectional study. *PLoS ONE*. 2022;17(8 August):1–14.
21. Kuerbis A, Mulliken A, Muench F, Moore AA, Gardner D. Older adults and mobile technology: factors that enhance and inhibit utilization in the context of behavioral health. *Ment Health Addict Res*. 2017;2.
22. Li N, Pang L, Chen G, Song X, Zhang J, Zheng X. Risk factors for depression in older adults in Beijing. *Can J Psychiatry*. 2011;56:466–73.
23. Matsuda N, Murata S, Torizawa K, Isa T, Ebina A, Kondo Y, et al. Association between Public Transportation Use and Loneliness among Urban Elderly people who stop driving. *Gerontol Geriatr Med*. 2019;5:1–5.
24. van Hoof J, Marston HR, Kazak JK, Buffel T. Ten questions concerning age-friendly cities and communities and the built environment. *Build Environ*. 2021;199:107922.
25. Jennings V, Bamkole O. The relationship between social cohesion and urban green space: an avenue for health promotion. *Int J Environ Res Public Health*. 2019;16:452.
26. Kim SY, Kim JH. The relationship between old-age oral health and depression levels. *Health Social Welf Rev*. 2021;41:62–71.
27. Ko S, Ahn Y, Hwang N, Lee A, Choi H. Study on the stuats of lonely death prevention in 2022. *Sejong*; 2023.
28. Kim J, Nam H. 2022 Seoul Aging Survey. 2022.
29. KOSIS. Population projections.
30. Kim J, Nam H. Life for Community-Dwelling Older seoulites before and after the COVID-19 outbreak. *Korean J Res Gerontol*. 2022;31:221–31.
31. Lee WB, Kee K. Interpretation of the IRB Review exemption under the Bioethics and Biosafety Act & proposal for improvement in Pra. *Bioethics*. 2019;20:63–82.
32. Carpiniello B, Carta MG, Rudas N. Depression among elderly people: a psychosocial study of urban and rural populations. *Acta Psychiatr Scand*. 1989;80:445–50.
33. Abe Y, Fujise N, Fukunaga R, Nakagawa Y, Ikeda M. Comparisons of the prevalence of and risk factors for elderly depression between urban and rural populations in Japan. *Int Psychogeriatr*. 2012;24:1235–41.
34. Cao W, Li L, Zhou X, Zhou C. Social capital and depression: evidence from urban elderly in China. *Aging Ment Health*. 2015;19:418–29.
35. Misawa J, Kondo K. Social factors relating to depression among older people in Japan: analysis of longitudinal panel data from the AGES project. *Aging Ment Health*. 2019;23:1423–32.
36. Mandolilar RY, Naik P, Akram MS, Nirgude AS. Depression among the elderly: a cross-sectional study in an urban community. *Int J Med Sci Public Health*. 2017;6:318–23.
37. Hua Y, Wang B, Wallen GR, Shao P, Ni C, Hua Q. Health-promoting lifestyles and depression in urban elderly Chinese. *PLoS ONE*. 2015;10:1–11.
38. O'Brien B, Shrestha S, Pargament MAS, Pargament IK, Cummings J, Kunik ME, et al. Positive and negative religious coping as predictors of distress among minority older adults. *Int J Geriatr Psychiatry*. 2018;34:54–99.
39. Roh HW, Hong CH, Lee Y, Oh BH, Lee KS, Chang KJ, et al. Participation in physical, social, and religious activity and risk of depression in the elderly: a community-based three-year longitudinal study in Korea. *PLoS ONE*. 2015;10:1–13.
40. Hu M, Roberts JD, Azevedo GP, Milner D. The role of built and social environmental factors in Covid-19 transmission: a look at America's capital city. *Sustain Cities Soc*. 2021;65 August 2020:102580.

41. Guida C, Carpentieri G. Quality of life in the urban environment and primary health services for the elderly during the Covid-19 pandemic: an application to the city of Milan (Italy). *Cities*. 2021;110 October 2020:103038.
42. Hofer M, Hargittai E. Online social engagement, depression, and anxiety among older adults. *New Media Soc*. 2021. <https://doi.org/10.1177/14614448211054377>.
43. Lee MA, Ferraro KF, Kim G. Digital technology use and depressive symptoms among older adults in Korea: beneficial for those who have fewer social interactions? *Aging Ment Health*. 2021;25:1839–47.
44. Yang Y-M, Wang H-H, Debra A. Immigration Distress and Associated factors among Vietnamese women in transnational marriages in Taiwan. *Kaohsiung J Med Sci*. 2010;26:647–57.
45. Cotten SR, Ford G, Ford S, Hale TM. Internet use and depression among retired older adults in the United States: a longitudinal analysis. *Journals Gerontol Ser B: Psychol Sci Social Sci*. 2014;69:763–71.
46. Dao ATM, Nguyen VT, Nguyen HV, Nguyen LTK. Factors Associated with depression among the elderly living in Urban Vietnam. *Biomed Res Int*. 2018;1–10.
47. Shon C. The Effect of walking practice on Depression of the Urban Elderly. *Alcohol Health Behav Res*. 2021;22:47–55.
48. Yesavage JA, Sheikh JI. Geriatric depression scale (GDS) recent evidence and development of a shorter version. *Clin Gerontol*. 1986;5:165–73.
49. Sheikh JI, Yesavage JA. Geriatric Depression Scale (GDS): recent evidence and development of a shorter version. *Clin Gerontologist: J Aging Mental Health*. 1986;5:165–73.
50. Bae JN, Cho MJ. Development of the Korean version of the geriatric Depression Scale and its short form among elderly psychiatric patients. *J Psychosom Res*. 2004;57:297–305.
51. Lee D-Y, Nam A. The effect of laughter therapy on geriatric Depression, Quality of Life and Physiologic Change of Depressive Elderly women. *J Korean Soc Wellness*. 2014;163–74.
52. Mesbah SF, Sulaiman N, Shariff ZM, Ibrahim Z. Does food insecurity contribute towards depression? A cross-sectional study among the urban elderly in Malaysia. *Int J Environ Res Public Health*. 2020;17:1–9.
53. Muhammad T, Sulaiman KM, Drishti D, Srivastava S. Food insecurity and associated depression among older adults in India: evidence from a population-based study. *BMJ Open*. 2022;12:1–14.
54. Li L, Jin G, Guo Y, Zhang Y, Jing R. Internet access, support, usage divides, and depressive symptoms among older adults in China: a nationally representative cross-sectional study. *J Affect Disord*. 2023;323:514–23. December 2022.
55. Fancourt D, Tymoszuk U. Cultural engagement and incident depression in older adults: evidence from the English Longitudinal Study of Ageing. *Br J Psychiatry*. 2018;214:225–9.
56. Wang G, Duan J, Kan Q, Zhou Y, Cheng Z, Tang S. The correlation analysis of WeChat usage and depression among the middle-aged and elderly in China: the mediating role of social participation. *BMC Public Health*. 2023;23:1–17.
57. Jung H, Kim M, Lee Y, Won CW. Prevalence of physical frailty and its multidimensional risk factors in Korean community-dwelling older adults: findings from Korean frailty and aging cohort study. *Int J Environ Res Public Health*. 2020;17:1–20.
58. Blazer D. Social isolation and loneliness in older adults—a mental health/public health challenge. *JAMA Psychiatry*. 2020;77:990–1.
59. Kim J, Chon Y, Chang H. A study on the Food Security for low-income older adults: a Case Study on meals on Wheels Project in Seoul. *Korea Gerontological Soc*. 2020;40:617–38.
60. Agarwall S, Satyavada A, Kaushik S, Kumar R, Urbanization. *Urban Poverty and Health of the Urban Poor: Status, challenges and the Way Forward*. Demogr India. 2007;121–34.
61. Lerman S, Jung M, Jianwen Cai Elva M, Arredondo JMB, Castañeda SF, Daviglius ML, Espinoza RA, et al. Religiosity prevalence and its association with depression and anxiety symptoms among Hispanic/Latino adults. *PLoS ONE*. 2018. <https://doi.org/10.1371/journal.pone.0185661>.
62. Polku H, Mikkola TM, Portegijs E, Rantakokko M, Kokko K, Kauppinen M, et al. Life-space mobility and dimensions of depressive symptoms among community-dwelling older adults. *Aging Ment Health*. 2014;19:781–9.
63. Lee J-Y, Choi S-D. Spatial Distribution Characteristics Analysis of Cultural Infrastructure in Seoul: a focus on distribution of Population and Density of Use. *J Tourism Stud*. 2018;30:61–80.
64. Wong CKM, Liang J, Chan ML, Chan YH, Chan L, Wan KY, et al. Prevalence and psychosocial correlates of depressive symptoms in urban Chinese women during midlife. *PLoS ONE*. 2014;9:1–7.
65. Chatters LM, Taylor RJ, Woodwar AT, Nicklett EJ. Social support from church and family members and depressive symptoms among older African americans. *Am J Geriatric Psychiatry*. 2015;23:559–67.
66. Bourassa KJ, Memel M, Woolverton C, Sbarra DA. Social participation predicts cognitive functioning in aging adults over time: comparisons with physical health, depression, and physical activity. *Aging Ment Health*. 2017;21:133–46.
67. Sun Q, Lu N. Social capital and mental health among older adults living in urban China in the context of COVID-19 pandemic. *Int J Environ Res Public Health*. 2020;17:1–11.

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