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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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THE ASSOCIATION BETWEEN LABOR PARTICIPATION AND THE MENTAL HEALTH OF OLDER ADULTS IN THE CONTEXT OF THE SILVER ECONOMY

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Abstract.

Research Objective: This research aims to examine the association between labor participation and mental health of older adults, particularly depressive symptoms, and to investigate the extent to which this relationship varies across gender and socioeconomic backgrounds. Based on data from the China Longitudinal Aging Social Survey (CLASS), the research examined the mechanisms through which labor participation influenced the mental health of older adults and provided theoretical support and practical guidance for policymakers.

Materials and Methods: This research utilized data from the 2023 China Longitudinal Aging Social Survey (CLASS), involving 10,366 older adults aged 60 and above. Employing a cross-sectional design, the research assessed depressive symptoms using the Center for Epidemiologic Studies Depression Scale (CES-D). Labor participation was measured through the questionnaire item, "whether engaged in paid work." Descriptive statistics, univariable analysis, and multiple linear regression analysis explored the relationship between labor participation and mental health of older adults. Gender-stratified analyses were conducted to examine potential heterogeneity, and further heterogeneity analysis based on job types was performed to examine employment quality.

Results: Labor participation showed a significant association with depressive symptoms among older adults, with those engaged in labor exhibiting lower levels of depressive symptoms than their non-working counterparts. Gender analysis revealed that labor participation exerted a significantly greater association with depressive symptom among women than men. Heterogeneity analysis further revealed that a significant negative association with depressive symptoms was strongest only for work characterized by high autonomy and low physical demands. Additionally, factors such as educational attainment, health status, and marital status significantly influenced depressive symptoms. Labor participation interacted with these factors, jointly influencing the mental health of older adults.

Conclusion: A significant association was found between labor participation and reduced depressive symptoms, particularly among women. Furthermore, this relationship varied by job type, showing the strongest association in high-autonomy, low-physical-demand positions. Policy interventions should not only encourage labor participation—particularly among women—but also prioritize job quality by creating positions with greater autonomy and manageable physical demands. Enhancing these job characteristics can strengthen social participation and self-efficacy, thereby maximizing the mental health benefits of working in later life.

Key words. Mental health, depression, older adults, labor participation.

Introduction.

As the global aging process accelerates, mental health of older adults have garnered increasing attention from various sectors of society. In China, older adults population continues to grow year on year. This trend not only has profound implications for socioeconomic development but also posed new challenges to the mental well-being of older adults. As a crucial stage of life, the quality of mental health in old age directly affects an individual's quality of life, social adaptation, and family relationships [1]. Therefore, in-depth research into the factors influencing the mental health of older adults, particularly the role of labor participation, holds significant theoretical and practical importance [2-4].

In recent years, with the emergence of the concept of the "silver economy", labor participation has become one of the key factors affecting the quality of life for older adults [5,6]. Labor participation is both a means for older adults to maintain economic independence and a key pathway for social engagement, emotional connection, and fulfillment of self-worth [7,8]. However, the relationship between labor participation and mental health of older adults remains underexplored. Existing research indicates that labor participation significantly impacts mental health, alleviating negative emotions such as depression and anxiety while enhancing self-identity and perceived social support [9,10]. However, treating labor participation as a homogeneous entity may obscure important internal variations. According to models of work stress and the Conservation of Resources theory, job characteristics such as autonomy, physical demands, and psychological demands are critical factors influencing individual mental health. Within the context of the 'silver economy,' the types of work undertaken by older adults are increasingly diverse, ranging from high-skilled consultancy to low-skilled service or agricultural labor, with potentially vast differences in job quality.

This research aims to explore the association between labor participation and the mental health of older adults using data from the China Longitudinal Aging Social Survey (CLASS). It examines the associations between labor participation, gender, age, education level, marital status, and health status on mental

health by analyzing changes in depressive symptoms among older adults. After examining the basic association between labor participation and mental health, this research delve deeper to explore the heterogeneous effects of different job qualities (measured by autonomy and physical demands), aiming to provide more precise policy implications. Additionally, it investigates whether the association between labor participation and the mental health of older adults differs across genders and socioeconomic characteristics, providing effective intervention measures and policy recommendations for governments and society.

Methods.

Research design: This research employed a cross-sectional design to examine the association between labor participation and the mental health of older adults (particularly depressive symptoms), using data from the China Longitudinal Aging Social Survey(CLASS). The analysis utilized the latest 2023 data, performing regression analyses on depressive symptoms, labor participation, and relevant demographic characteristics to assess the role of these variables in the mental health of older adults.

Data Collection Process:

The data used in this research come from the China Longitudinal Aging Social Survey(CLASS), which focuses on individuals aged 60 and above. The CLASS project started from 2014 and has conducted five rounds of nationwide longitudinal surveys in 2014, 2016, 2018, 2020, and 2023. The survey sample covered 28 provinces (autonomous regions and municipalities) across China, employing a stratified multistage probability sampling method to ensure representativeness. The sample used in this research comprised data from 2023, involving 11,671 participants. During data cleaning, samples with severe missing data were removed to ensure data validity and analytical accuracy. Finally, 10,366 valid cases remained, resulting in a sample retention rate of 88.81%.

Data Collection Tools:

Dependent variable: Mental health of older adults. The Center for Epidemiologic Studies Depression Scale (CES-D) was primarily used to assess mental health status of older adults. Originally developed by the National Institute of Mental Health in 1977, the CES-D was designed for screening depressive symptoms in the general population, particularly for evaluating depressive mood in non-depressed individuals. The 9-item scale uses a 3-point scoring system, with total scores ranging from 0 to 18. Higher scores indicated greater depression levels and poorer mental health of older adults. The scale demonstrated good internal consistency, with a Cronbach's α coefficient of 0.722.

Independent variable: Labor participation. Labor participation, treated as an independent variable, was derived from the CLASS questionnaire item: "What is your current status regarding income-generating work/activities?" Respondents working in paid work were assigned a value of 1 for labor participation, while those not working were assigned a value of 0. To deeply analyze the heterogeneous effects of employment quality, this study further classified respondents engaged in paid work into three categories based on the survey item 'C3. What is your current primary job?': (1) High-Autonomy/Low-Physical Jobs: including 'leaders in government, enterprises, or institutions,' 'professionals,' and 'self-employed individuals, freelancers, and private business owners'; (2) Low-Autonomy/Low-Physical Jobs: referring to 'general office staff'; (3) Low-Autonomy/High-Physical Jobs: including 'general employees in commerce/services/manufacturing' and 'farmers, foresters, fishermen.' This classification is primarily based on the typical characteristics of occupations, aiming to capture the two core dimensions of 'job autonomy' and 'physical demands.' Respondents not engaged in paid work served as the reference group in the analysis.

Control variables: Demographic and socioeconomic characteristics. The demographic characteristics included age, gender, marital status, disability status and self-rated health status. Age variable was categorized into five groups: 60–64 years, 65–69 years, 70–74 years, 75–79 years, and 80 years and above. Gender variable was coded as 'Male' = 1 and 'Female' = 0. Marital status was categorized into two groups: 'Separated, widowed, etc.' = 0 and 'Married (spouse alive and cohabiting)' = 1. Disability status was coded as 'Yes' = 1 and 'No' = 0. Self-rated health status Variables were categorized as follows: 'Very good health,' 'Fairly good health,' and 'Fair health' were combined into 'Healthy' and coded as 1; 'Fairly poor health,' 'Very poor health,' and 'Unhealthy' were combined into 'Unhealthy' and coded as 0.

The Socioeconomic characteristics included educational attainment, income level and retirement status. Educational attainment variable was categorized into four groups: "primary school and below, junior high school, senior high school, tertiary education or above". The income level variable was log-transformed. The retirement status variable was categorized into two groups: 'Retired' = 1 and 'Not Retired' = 0.

Results.

Descriptive Statistics:

Among the 10,366 older adults aged 60 and above in this research, the prevalence of depressive symptoms was 36.3%, with a mean score of 8.37 ± 1.33. As shown in Table 1, depressive symptom scores and prevalence initially increased, then declined with advancing age. The lowest mean depression score (8.23 ± 1.35) was observed in the 60–64 age group, whereas the lowest prevalence (33.4%) occurred in the 80+ age group. Conversely, the 70–74 age group showed the highest mean depression score (8.60 ± 1.40) and prevalence (38.8%). Among males, the highest depression symptom level (8.10 ± 1.23) was found in the 75–79 age group, while the highest prevalence (31.5%) was observed in the 70–74 age group. Among females, the highest depression symptom level (9.36 ± 1.52) and prevalence (49.6%) were recorded in the 70–74 age group.

Univariable Analysis:

In univariable analysis, statistically significant differences in depressive symptom levels were observed across gender, marital status, educational attainment, health status, disability, income, retirement status, and labor participation ($P < 0.05$). No such differences were found for age. Specifically, Women showed

Table 1. *Descriptive Statistics of Depressive Symptoms in Older Adults.*

Age Group	Overall Depression Score	Overall Prevalence	Male Depression Score	Male Prevalence	Female Depression Score	Female Prevalence
60-64	8.23 ± 1.35	33.4%	8.01 ± 1.22	29.7%	8.28 ± 1.52	37.4%
65-69	8.35 ± 1.38	35.5%	8.05 ± 1.24	30.3%	8.59 ± 1.33	39.2%
70-74	8.60 ± 1.40	38.8%	8.06 ± 1.23	31.5%	9.36 ± 1.52	49.6%
75-79	8.29 ± 1.34	36.1%	8.10 ± 1.23	30.1%	8.78 ± 1.41	41.3%
≥80	8.43 ± 1.36	34.7%	8.03 ± 1.21	28.6%	8.65 ± 1.39	39.7%
Overall	8.37 ± 1.33	36.3%	8.04 ± 1.26	30.5%	8.71 ± 1.38	42.0%

Table 2. *Association with Labor Participation and Depressive Symptoms in older adults.*

Variable		Model 1	Model 2	Model 3
		Demographic	Socio-economic	Labor Participation
Gender (Reference: Female)		-0.171***	-0.082***	-0.169***
Marital Status (Reference: Separated, Widowed, etc.)		-0.067***	-0.206***	-0.052***
Age (Reference: 80 and Above)	60-64	0.037	-0.054	0.018
	65-69	0.046**	-0.090	0.064**
	70-74	0.096***	0.006	0.085***
	75-79	0.057***	-0.086	0.033
Self-rated Health Status (Reference: Unhealthy)		-0.364***	-0.253***	-0.363***
Disability (Reference: Non-disabled)		0.118***	0.057	
Income			-0.159	
Retired (Reference: No)			0.018***	-0.145***
Education (Reference: Primary School and Below)	Junior high school		-0.055***	-0.037
	Senior high school		-0.072***	-0.025
	Tertiary education or above		-0.018***	-0.007
Engaged in Paid Work (Reference: No)				-0.221***

*The values in the table are standardized coefficients. * indicates P < 0.05, ** indicates P < 0.01, and *** indicates P < 0.001.*

higher depressive symptoms than men. Separated or widowed individuals showed higher depressive symptoms than married individuals. The highest levels of depressive symptoms were observed among older adults with primary school education or below (9.23 ± 1.43) with a prevalence rate of 48.1%, while those with tertiary education or above had the lowest symptom levels (6.98 ± 0.95) and a prevalence rate of only 16.8%. Additionally, unhealthy individuals showed higher depression symptom levels than healthy individuals. Depression levels were higher among disabled elderly individuals than non-disabled individuals. Those with incomes below ¥5,000 had the highest depression levels and prevalence, while those earning over ¥30,000 had the lowest. Non-retired elderly showed higher depression levels than retired individuals. Labor-engaged elderly showed lower depression levels than non-engaged peers.

Multivariable Analysis:

Factors associated with depressive symptoms in multivariable analysis: Overall depressive symptom levels among older adults were used as the dependent variable, labor participation as the independent variable, and demographic and socioeconomic characteristics as control variables. This section examined the association between various factors and depressive symptoms, particularly the influence and role of labor participation. As shown in Table 2, in Model 1, the 60–64 age group was not statistically significant (P > 0.05), while other demographic factors were statistically significant. In Model 2, after incorporating socioeconomic characteristics, the associations of age groups, disability status, and income with depressive symptoms were not statistically significant (P > 0.05), but gender, marital status, self-rated health status, retirement status, and educational attainment remained statistically significant. In Model 3, after excluding disability and income, the 65–69 age group showed statistical significance, while other age groups and educational attainment did not. Model 3 presents our final parsimonious model. We excluded 'disability' and 'income' due to their statistical non-significance in Model 2, theoretical overlap with self-rated health (for disability), and concerns over measurement precision (for income). This approach enhances model stability and clarity for interpreting the results related to labor participation. All variance inflation factors (VIFs) were below 3, indicating no severe multicollinearity. Labor participation, gender, the 70–74 age group, marital status, self-rated health status, and retirement status were all significantly associated with depressive symptoms among older adults.

As shown in Table 2, the relationship between each factor and depressive symptoms is as follows:

Demographic characteristics.

The association between demographic characteristics and depressive symptoms was primarily manifested in: First, gender influenced depression symptom levels. In Model 3, the standardized coefficient for gender was -0.169, indicating that women exhibit higher levels of depressive symptoms than men. Under the influence of traditional social roles and stereotypes, women in this age group bear greater societal expectations, engaging in multiple social activities such as labor participation, household chores, and family caregiving (for parents and

grandchildren). As they juggled multiple social roles and experienced role overlap, they struggled to balance time and energy, leading to significant stress and increased risk of depressive symptoms. This conflict is particularly pronounced for older women approaching retirement age who have not yet retired. Second, marital status influenced depression symptom levels, with Model 3 showing a standardized coefficient of -0.052. This indicated that older adults in states such as separation or widowhood exhibited significantly higher levels of depressive symptoms than those who are married or cohabiting. Third, self-rated health status influences depression symptom levels, with Model 3 showing a standardized coefficient of -0.363. Evidently, the higher the self-rated health status among older adults, the lower their depression symptom levels.

Furthermore, our results reveal a non-linear relationship between age and depressive symptoms, with the peak observed in the 70-74 age group. This pattern may be explained by several concurrent challenges specific to this life stage. Firstly, this period often coincides with a notable acceleration in the decline of physical health and the onset of chronic illnesses, which is directly associated with mental well-being. Secondly, individuals in this cohort are likely to experience a concentrated loss of structured social roles and identities, such as full-time employment and intensive parenting, potentially leading to a sense of purposelessness. Finally, they may still actively compare themselves to younger, working cohorts, fostering feelings of obsolescence, whereas the oldest-old (80+) may have undergone psychological adaptation to aging, frailty, and lowered expectations, a phenomenon supported by theories of psychological adaptation. This nuanced age pattern underscores the importance of targeted mental health support for adults transitioning into their eighth decade.

Socioeconomic characteristics. The influence of socioeconomic characteristics on depression symptom levels of older adults primarily manifested through educational attainment and retirement status, while disability and income showed no statistical significance. First, as shown in Model 2 of Table 2, educational attainment was negatively associated with depressive symptoms, and this association was statistically significant. Compared to lower educational levels such as primary school and below, higher educational attainment was associated with reduced depression symptom levels. Second, as shown in Model 3, older adults in retirement exhibit relatively lower depressive symptoms compared to those not retired, with a standardized coefficient of -0.145. Evidently, retirement alleviated the pressures of older adults workforce, thereby reducing depression symptom levels.

Labor Participation.

Labor participation exerted a statistically significant negative influence on depression symptom levels. Among older adults, those who engaged in paid work exhibited relatively lower depression symptom levels, with a standardized coefficient of -0.221. This indicated that labor participation reduced depression symptom levels and alleviated depressive symptoms of older adults.

Gender Differences Analysis: We employed multiple linear regression analysis to examine the association between labor participation and depressive symptoms among older adults of different genders. Using a gender-stratified approach, depressive symptoms were set as the dependent variable, labor participation as the independent variable, and demographic and socioeconomic characteristics as control variables. As shown in Table 3, gender differences existed in the association between labor participation and depressive symptoms, with all factors showing a stronger association for women than for men. First, the association of marital status with depressive symptoms was more pronounced in women than in men. Compared to separated or widowed statuses, being married with a living spouse alleviated depressive symptoms more effectively for women than for men. In the model examining the association between labor participation and depressive symptoms, the standardized coefficient for women was −0.091 and for men was −0.067, both statistically significant. Second, a statistically significant inverse association was observed between self-rated health and depressive symptoms, which was stronger in women than in men. Third, regarding educational attainment, tertiary education or above showed a statistically significant association with depressive symptoms for men, but not for women. Conversely, the association of junior high school and senior high school education levels with reduced depressive symptoms was more pronounced in women than in men, which is also related to women generally having lower educational attainment than men. Fourth, the association between retirement status and depressive symptoms was statistically significantly stronger for women than for men, with a standardized coefficient of −0.095 for women and −0.088 for men. Fifth, the association between labor participation and depressive symptoms was statistically significant for both genders, but stronger for women. As shown in Table 3, the standardized coefficient for engaged in paid work was -0.055 ($p < 0.001$) for women and -0.049 ($p < 0.01$) for men,

Table 3. *Gender Differences in the Association Between Labor Participation and Depressive Symptoms in Older Adults.*

Independent Variable		**Labor Participation**	
		Male	**Female**
Marital Status (Reference: Separated, Widowed, etc.)		-0.067**	-0.091**
Self-rated Health Status (Reference: Unhealthy)		-0.367**	-0.389**
Education Level (Reference: Primary School and Below)	Junior high school	-0.065**	-0.092**
	Senior high school	-0.061**	-0.094**
	Tertiary education or above	-0.066**	-0.029
Retired (Reference: No)		-0.088**	-0.095***
Engaged in Paid Work		-0.049**	-0.055***

*The values in the table are standardized coefficients. * indicates P < 0.05, ** indicates P < 0.01, and *** indicates P < 0.001.*

Table 4. *The Association between Job Quality and Depressive Symptoms among Older Adults.*

Variable		Model 1	Model 2	Model 3
		Controls Only	**Labor Participation (Binary)**	**Job Quality (Heterogeneity)**
Engaged in Paid Work(Reference: No)			-0.221***	
Job Quality (Ref: No Work)	High-Autonomy /Low-Physical Job			-0.298***
	Low-Autonomy /Low-Physical Job			-0.174***
	Low-Autonomy /High-Physical Job			-0.061
Gender (Reference: Female)		-0.182***	-0.169***	-0.157***
Marital Status (Reference: Separated, Widowed, etc.)		-0.070***	-0.052***	-0.048***
Age (Reference: 80 and Above)	60-64	0.025	0.018	0.016
	65-69	0.062**	0.064**	0.072**
	70-74	0.092***	0.085***	0.077***
	75-79	0.042	0.033	0.029
Self-rated Health Status (Reference: Unhealthy)		-0.361***	-0.363***	-0.353***
Disability (Reference: Non-disabled)		-0.148***	-0.145***	-0.141***
Education (Reference: Primary School and Below)	Junior high school	-0.035	-0.037	-0.029
	Senior high school	-0.022	-0.025	-0.018
	Tertiary education or above	-0.005	-0.007	-0.005

*The values in the table are standardized coefficients. * indicates P < 0.05, ** indicates P < 0.01, and *** indicates P < 0.001.*

indicating that the beneficial association was more pronounced among female older adults.

Heterogeneity Analysis by Job Quality: To address the potential limitation of oversimplifying labor participation as a binary measure and to delve deeper into the context of the silver economy, we conducted a heterogeneity analysis based on job quality. In the multiple linear regression models, we replaced the binary labor participation variable with the multi-category job quality variable described above to examine the differences in the strength of association with depressive symptoms across different job qualities. Building upon the primary independent variable of labor participation, we further classified working older adults into three distinct categories according to the autonomy and physical demands of their occupations: (1) High-Autonomy/Low-Physical Jobs (including leaders, professionals, and self-employed individuals); (2) Low-Autonomy/Low-Physical Jobs (comprising general office staff); and (3) Low-Autonomy/High-Physical Jobs (including general commercial/service/manufacturing employees, and farmers). Older adults not engaged in paid work served as the reference group.

The results of this analysis are presented in Table 4.

Model 1 included only the control variables. Model 2 reintroduced the binary labor participation variable, replicating the primary finding that engagement in any paid work was significantly associated with lower depressive symptoms ($\beta = -0.221$, $P < 0.001$). Model 3, the core model for this analysis, replaced the binary variable with the job quality categories.

The findings from Model 3 revealed substantial heterogeneity in the association between labor participation and depressive symptoms across different job qualities. Specifically, engagement in High-Autonomy/Low-Physical Jobs demonstrated the strongest negative association with depressive symptoms ($\beta = -0.298$, $P < 0.001$). The association for Low-Autonomy/Low-Physical Jobs was also statistically significant but notably weaker ($\beta = -0.174$, $P < 0.001$). In contrast, engagement in Low-Autonomy/High-Physical Jobs was not statistically significantly associated with depressive symptoms ($\beta = -0.061$, $P > 0.05$).

These results indicate that the mental health benefits of labor participation in later life are not uniform. The protective association appears to be primarily driven by high-quality jobs characterized by greater autonomy and lower physical strain. Conversely, low-quality jobs offering little autonomy and requiring substantial physical effort show a negligible association with mental health outcomes. This nuanced pattern underscores the critical importance of considering job quality, beyond mere participation, when examining the well-being of older adults in the labor force within the silver economy.

Discussion.

Interpretation of Main Findings:

This research examined the association between labor participation and the mental health of older adults, specifically focusing on its relationship with depressive symptoms. Results indicated that labor participation was significantly associated with reduced depressive symptoms among older adults, with those engaged in labor exhibiting lower levels of depression than their non-working peers. This finding aligned with prior research, suggesting that labor not only enhanced economic independence but also strengthened social engagement and self-efficacy, thereby effectively alleviating psychological stress and negative emotions.

A significant advancement of this research lies in revealing substantial heterogeneity in the association between labor participation and older adults' mental health based on job quality. Our findings indicate that not all work is equally beneficial; only jobs characterized by 'high autonomy and low physical demands,' such as leadership positions, professional technical roles, and self-employment, demonstrated the strongest association with

a significant reduction in depressive symptoms. This finding aligns well with the Conservation of Resources theory and the Job Demand-Control model. High-autonomy jobs provide older adults with a greater sense of control and self-efficacy, which are key protective factors for mental health. Conversely, low physical demand reduces physical fatigue and depletion, allowing them to better enjoy the social and psychological benefits of work. In contrast, 'low-autonomy/high-physical' jobs showed no significant mental health benefit, potentially because they combine high physical depletion with low psychological rewards, possibly even acting as a chronic stressor.

The research further revealed significant gender heterogeneity, with a stronger association between labor participation and lower depressive symptom levels in women compared to men. This result underscored the critical role of gender in mental health, suggesting that older women may face greater societal expectations and family burdens, leading to more pronounced improvements in mental health following labor participation.

Comparison with Previous Research:

This research supports previous findings of a positive relationship between labor participation and mental health in older adults. Existing research have shown that labor participation can alleviate negative emotions such as depression and anxiety among older adults. However, the uniqueness of this research lay in its pioneering integration of data from China's older adult population with variables like gender and socioeconomic factors, illuminating the multifaceted relationship between labor participation and mental health as situated within these key contexts. Analysis of gender differences indicated that a more pronounced relationship between labor participation and depressive symptoms was observed in women. This offered a new perspective for future research, particularly regarding how labor participation may yield different mental health outcomes for older adults under the influence of sociocultural contexts and gender roles.

This research found that factors such as educational attainment, marital status, and health condition significantly influenced depressive symptoms among older adults, aligning with previous research. For instance, older adults with higher education levels showed milder depressive symptoms, suggesting that education not only enhanced social engagement but also alleviated psychological stress by improving cognitive and emotional regulation abilities.

Policy Implications.

The findings of this research have significant implications for public health and social policy. First, the observed protective association between labor participation and mental health in older adults suggests that governments and society should consider promoting greater social engagement and labor participation among older adults, particularly older women. However, this result strongly suggests that within the 'silver economy,' merely encouraging any form of labor participation is insufficient; public policy and corporate practices should strive to create and promote 'high-quality' employment opportunities for older adults that offer autonomy, respect, and a sustainable pace. Policymakers should consider implementing more flexible retirement systems to encourage continued participation in appropriate labor and social activities. Concurrently, enhancing labor participation opportunities for older adults through education and training can improve their mental health. Second, mental health of older adults is influenced not only by individual factors but also by social environments and policy support. Therefore, governments should increase investments in social welfare and health promotion for older adults, offering more mental health support and intervention services to help older adults better adapt to the challenges of an aging society.

Research Limitations.

Although this research provides robust evidence on the relationship between labor participation and mental health of older adults, certain limitations exist. First, the core independent variable 'labor participation' was operationalized only as a binary variable and lacked key information such as working hours, which remains a limitation of this study. Although we have partially mitigated this shortcoming by introducing a heterogeneity analysis based on job quality, which yielded valuable insights, future research employing more nuanced, multi-dimensional measures of job quality will provide a more comprehensive picture. Second, the cross-sectional nature of the data prevented establishing causality and revealed only the correlation between labor participation and depressive symptoms. Future longitudinal studies are needed to examine the long-term impact of labor participation on mental health of older adults. Finally, the sample data primarily comes from the China Longitudinal Aging Social Survey (CLASS). While the sample exhibits high representativeness, regional variations and cultural contexts may limit the external validity of the findings. Future research should replicate these results across additional regions and diverse cultural settings.

Conclusion.

This research, from the perspective of active aging, uses data from the China Longitudinal Aging Social Survey (CLASS) to examine the association between labor participation and depressive symptoms among older adults in the context of the Silver Economy. The analysis controls for the influence of demographic and socioeconomic factors and performs sub-sample regressions based on gender. The results of the research are as follows:

1. The association between labor participation and mental health in older adults varied significantly by gender, marital status, self-rated health, educational attainment, and retirement status.

2. Labor participation was positively associated with the mental health of older adults, with elderly individuals engaged in labor demonstrating significantly lower levels of depressive symptoms compared to those not participating in labor.

3. The association of labor participation with mental health was significantly more pronounced in older women compared to older men.

4. The association between labor participation and mental health varies by job quality. The protective association is strongest for high-autonomy, low-physical jobs, while the association for low-autonomy, high-physical jobs is not significant.

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Conflict of interest statement.

No potential conflicts of interest relevant to this article were reported.

Ethics approval and informed consent statement.

This Research was approved by the institutional review board at our institute, and all participants provided written informed consent.

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