Perceived stress levels in older adults with financial strain are diminished after theater practice [version 1; peer review: awaiting peer review]

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Abstract

**Background:** Participating in theater has been shown to be useful for reducing cognitive decline in older adults. This study focused on the social inclusion aspect of the performing arts and aimed to examine whether participation in the theater could help prevent dementia in older adults who are vulnerable to social exclusion.

**Methods:** Our participants were 371 community-dwelling older adults who belonged to the Gold Arts Club organized by the Saitama Arts Theatre. The change in perceived stress levels after a month and a half of theater practice were compared between older adults with and without financial strain.

**Results:** It was revealed that older adults with financial strain had a significantly greater reduction in perceived stress levels than those without financial strain after a month and a half of theater practice.

**Conclusions:** Since stress is one of the risk factors for cognitive decline, the results of this study suggest that participation in theater may be an effective way of reducing cognitive decline associated with dementia in the older people who feel strained financially.

**Keywords**

theater, financial strain, perceived stress, dementia, social inclusion
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Author roles: Matsudaira I: Conceptualization, Data Curation, Formal Analysis, Investigation, Visualization, Writing – Original Draft Preparation; Taki Y: Funding Acquisition, Project Administration, Supervision, Writing – Original Draft Preparation

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Introduction
Acting involves generating emotions and behaviors to characterize a person or thing other than themselves. Higher cognitive functions, such as emotion regulation, memory, verbal skills, empathy, and mentalization, are necessary skills for acting (McDonald et al., 2020). It has been suggested that participation in theater may improve cognitive function in older adults (Banducci et al., 2017; Chung et al., 2018; Noice et al., 2004). In the recent field of preventive medicine, personalized prevention has gained support as an effective strategy for preventing dementia (Sommerlad & Mukadam, 2020). Thus, it is meaningful to detect the population that participating in theater is a more valid choice to maintain cognitive health.

Social inclusion may be the key concept linking the theater with personalized prevention of dementia. Social inclusion is defined as the process of ensuring that people at risk of being left behind in society have the opportunities and resources they need to participate fully in economic, social, political, and cultural life, and to enjoy a level of well-being that is considered normal in the society in which they live (European Commission, 2004). The World Bank Group has argued the importance of performing arts for the maturation of society in terms of their social inclusion function (Kabanda, 2014). Older adults are likely to be targets of social exclusion (Walsh et al., 2017). Community-engaged art programs for older adults have been reported to promote well-being (Phinney et al., 2014; Poulos et al., 2019) and a sense of connectedness with the community (Moody & Phinney, 2012). However, the effect that participating in the arts has on older people, particularly those at high risk of social exclusion, is unclear.

One of the significant risk factors for social exclusion is financial strain, which refers to the perception that paying for both daily necessities (e.g., food, clothing, housing, and medical care) and other things, such as furniture, automobiles, and recreation (Pearlin et al., 1981), is difficult. A validation study of the social exclusion index for older adults found a significant positive association between self-perceived poverty and a sense of social exclusion (Chou, 2018). Recent findings have also suggested that financial strain increases the risk of developing dementia (Samuel et al., 2020). A putative mechanism underlying the relationship between financial strain and dementia may be an impairment in the stress response system because a significant association between financial strain and physiological markers of stress has been reported (Grossi et al., 2001; Palti et al., 2015; Steptoe et al., 2020). Also, it has been confirmed that psychological stress is associated with the increased risk of dementia (Franks et al., 2021).

This study, therefore, aimed to determine whether participating in the theater could be an effective way of preventing dementia in older adults with financial strain. To achieve this goal, we adopted a cohort design to investigate the effect of participating in the theater on perceived stress levels in older adults according to the presence or absence of financial strain.

Methods
Participants
Our participants were community-dwelling older adults who belonged to the Gold Arts Club organized by the Saitama Arts Theatre (https://www.saf.or.jp/arthall/). The Gold Arts Club is a large theatre company with almost 1,600 members and features large crowd plays with hundreds of performers. Members of the Gold Arts Club were recruited in 2016 through an open call for applications, provided that they were ≥ 60 years old at the time. The members include both experienced and inexperienced theatre performers, but no professional actors. The Gold Arts Club performed one play each year between 2016 and 2018 after a month or two of rehearsals. Each member had participated in at least one performance at the time of this study. Our survey was distributed in November 2019, when the Gold Arts Club was preparing for its fourth performance. The eligibility criteria was males and females aged 65 over, because in Japan, the definition of an elderly is being 65 years and older (Cabinet Office Japan, 2018). The pre-survey was carried out on the day of orientation before the start of rehearsals, and the post-survey was carried out during the final rehearsal about a month and a half later. Participants took part in up to six rehearsals of approximately two and a half hours each between the pre-and post-surveys. A total of 786 people participated in this production, of which 639 took part in the pre-survey. Of these, 456 also completed the post-survey. After excluding 62 participants with missing answers and 23 participants who were under 64 years, 371 participants were included in the final analysis. The purpose of this study was explained to the participants during the pre-survey. Written informed consent was obtained from each participant. This study was approved by the Institutional Review Board of Tohoku University.

Financial strain
Participants chose one of the following options to describe their financial situation: 1 = difficult, 2 = slightly difficult, 3 = somewhat secure, and 4 = secure. Those who chose 1 or 2 were categorized into the group with financial strain, while those who chose 3 or 4 were categorized into the group without financial strain. This question was asked only during the pre-survey.
Table 1. Participants’ characteristics.

<table>
<thead>
<tr>
<th></th>
<th>Total (N = 394)</th>
<th>With financial strain (N = 60)</th>
<th>Without financial strain (N = 334)</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Median</td>
<td>Max</td>
<td>Min</td>
</tr>
<tr>
<td>Age (years)</td>
<td>65</td>
<td>70</td>
<td>88</td>
<td>65</td>
</tr>
<tr>
<td>Number of productions(^a)</td>
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<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Stress_pre(^b)</td>
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<td>20</td>
<td>46</td>
<td>17</td>
</tr>
<tr>
<td>Stress_post(^c)</td>
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<td>54</td>
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<tr>
<td>Sex</td>
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<tr>
<td>Male</td>
<td>85</td>
<td>286</td>
<td>10</td>
<td>47</td>
</tr>
</tbody>
</table>

\(^a\)The number of productions at the Gold Arts Club the participant had participated in before the survey.
\(^b\)Score of perceived stress levels at the pre-survey.
\(^c\)Score of perceived stress levels at the post-survey. As all continuous variables in this data did not distribute normally, the differences between groups were analyzed using Mann-Whitney's U test.
Perceived stress levels
The perceived stress levels were assessed using the Comprehensive Stress Response Inventory for the elderly (http://labowakashima.c.ooco.jp/CSI_elder.pdf), a scale that assesses stress levels through the extent of psychological stress response experienced in the preceding month (Asai et al., 2013). The answers to the 17 questions were summed to calculate a perceived stress score. A Likert scale ranging from 1 to 4 (1 = “never” to 4 = “very often”) was used. These questions were asked both in the pre- and post-surveys. We subtracted the pre-survey score from the post-survey score to measure the change in perceived stress levels before and after participating in the theater practice.

Statistical analysis
Mann-Whitney’s U test was conducted to compare the extent of the change in perceived stress levels between the groups with and without financial strain. The significance level was set at P < 0.05. This analysis was performed using R studio (Version 1.2.5042).

Results
The participants’ characteristics are presented in Table 1. No significant differences in age, sex, the number of previous performances, and the perceived stress levels at the post-survey were found between the groups. The perceived stress levels on the pre-survey were significantly higher in those with financial strain than in those without financial strain (Table 1).

As shown in Figure 1 and Table 2, participants with financial strain showed a significantly greater decrease in perceived stress levels after participating in the theater practice than those without financial strain.

Discussion
Our results are consistent with the idea that economically disadvantaged older adults are likely to experience depressive symptoms (Mojtabai & Olfson, 2004). The findings of neuroimaging studies may explain why the perceived stress levels declined before and after theatre practice. Recent pioneering work about neural substrates of acting revealed that when actors respond to several questions as fictional characters, the ventromedial prefrontal cortex (vmPFC) is deactivated compared to when they responded as themselves (Brown et al., 2019). The vmPFC activation has been associated with stress resilience and recovery (Sinha et al., 2016; Meine et al., 2021; Yang et al., 2018). Consequently, although the

![Figure 1. Group difference in the changes in perceived stress levels before and after theater practice.](image_url)

**Table 2. Group differences in the changes in perceived stress levels.**

<table>
<thead>
<tr>
<th></th>
<th>With financial strain</th>
<th>Without financial strain</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Median</td>
<td>Max</td>
</tr>
<tr>
<td>StressΔ</td>
<td>16</td>
<td>25</td>
<td>8</td>
</tr>
</tbody>
</table>

*Subtracted value of perceived stress levels at the pre-survey from the post-survey.*
subjects of these previous neuroimaging studies were younger than our participants, it is speculated that the reduction in perceived stress levels may have been due to the flexibility of vmPFC activation through repeated experiences of leaving from one’s own perspective through theater practice.

This study has limitations. First, due to that we have no control group, it should be noted that this study is preliminary to examine the effect of theatre participation on the reduction in perceived stress levels among economically disadvantaged older people. Further study designed with the randomized controlled trial is necessary. Second, the participants in this study were not complete beginners in theater. This may have reduced the impact of theater practice on their perceived stress levels in this study. Third, since this study only involved participants in theater practice, it is not possible to make any definite claims about whether the present results are specific to the theater. Further studies designed to compare theater and other artistic activities are needed.

To the best of our knowledge, this is the first study to reveal that participating in the theater improves mental health particularly in older people with financial strain. Since higher psychological stress increases the risk of dementia, participation in theater may be an effective way to prevent dementia in older adults who are experiencing financial difficulties.

Consent
Written informed consent for publication of their answers for questionnaire was obtained from the participants.

Data availability
Figshare. Perceived_stress_levels_in_older_adults_with_financial_strain_are_diminished_after_theater_practice.xlsx.
DOI: https://doi.org/10.6084/m9.figshare.19657143.v3

This project contains the following underlying data:
- Our participants were community-dwelling older adults who belonged to the Gold Arts Club organized by the Saitama Arts Theatre (https://www.saf.or.jp/artheall/). The Gold Arts Club performed one play each year between 2016 and 2018 after a month or two of rehearsals. Each member had participated in at least one performance at the time of this study.
- **Financial Strain:** Participants chose one of the following options to describe their financial situation: 1 = difficult, 2 = slightly difficult, 3 = somewhat secure, and 4 = secure. Those who chose 1 or 2 were categorized into the group with financial strain, while those who chose 3 or 4 were categorized into the group without financial strain. This question was asked only during the pre-survey.
- **Stress Levels:** The stress levels were assessed using the Comprehensive Stress Response Inventory for the elderly (http://labo-wakashima.c.ooco.jp/CSI_elder.pdf), a scale that assesses stress levels through the extent of psychological stress response experienced in the preceding month. The answers to the 17 questions were summed to calculate a perceived stress score. A Likert scale ranging from 1 to 4 (1 = “never” to 4 = “very often”) was used. These questions were asked both in the pre-and post-surveys. We subtracted the pre-survey score from the post-survey score to measure the change in stress levels before and after participating in the theater practice.

Data are available under the terms of the Creative Commons Attribution 4.0 International license (CC-BY 4.0).

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symptoms.

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