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Original Article

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Nationwide Survey on the Awareness of Mild Cognitive Impairment

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ABSTRACT

Background and Purpose: Mild cognitive impairment (MCI), particularly due to Alzheimer's disease (AD), is an important stage for early intervention. We aim to assess awareness among the general population of MCI and AD, and evaluate their willingness to pay for treatment that delays the progression to dementia.
Methods: A nationwide cross-sectional telephone survey was conducted from August 29 to 31, 2022, targeting adults aged ≥18 years in the Republic of Korea. *In toto*, 1,006 respondents were randomly selected via a proportional allocation based on age, sex, and region. The survey consisted of 11 questions covering demographic information, awareness of MCI and AD, understanding of diagnostic procedures, such as amyloid positron emission tomography (PET), and willingness to pay for disease-modifying treatment.
Results: Among the respondents, 41.3% had heard of MCI, but only 12.0% were well informed. Some 77.0% stated that if they experienced cognitive decline, they would visit a hospital. Only 12.4% of respondents knew the important role of amyloid PET in diagnosing MCI due to AD. Regarding the treatment costs of disease-modifying drugs, 42.1% were willing to pay <600,000 KRW (approximately 420 USD) per month, while 18.4% were unwilling to pay. Older age and lower socioeconomic status were significantly associated with decreased willingness to pay (p<0.001).
Conclusions: Public awareness of MCI is limited, and willingness to pay decreases with older age and lower socioeconomic status. Targeted education and strategies are therefore required to increase awareness and reduce disparities.

Keywords: Mild Cognitive Impairment; Alzheimer's Disease; Survey

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The authors have no financial conflicts of interest.

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INTRODUCTION

As the population ages, Alzheimer's disease (AD)—the leading cause of dementia—poses a significant global health challenge.[1,2] AD is defined by the presence of neuropathological changes that include the deposition of amyloid–beta (Aβ) and pathological tau.[3] These changes develop without obvious symptoms in the affected individuals, and progressively lead to neurodegeneration, ultimately resulting in cognitive decline and memory dysfunction, a process known as the AD continuum.[1,3] This continuum encompasses three broad phases: cognitively unimpaired (pre-clinical AD), mild cognitive impairment (MCI) due to AD, and AD dementia (dementia due to AD).[1,3] A Korean Nationwide Survey showed that among individuals aged ≥65 years, the estimated prevalence of AD dementia was approximately 7.1%, while that of MCI was approximately 22.3%.[4] As the population ages, the burden of dementia and MCI will present a growing challenge.

Patients with MCI are at high risk of developing dementia, particularly those with MCI due to AD. A previous study including cohort from Korean memory clinics found that 53.8% of patients with MCI due to AD developed dementia within 3 years, whereas, 8.1% of patients with MCI without Aβ pathology developed dementia within the same period.[5]

The development of anti-amyloid therapies, including lecanemab and donanemab,[6,7] highlights the need to detect AD in individuals with MCI. However, many people are not aware of MCI caused by AD, and furthermore, may not even be informed regarding MCI. Also, amyloid positron emission tomography (PET) is normally required to detect the deposition of Aβ, and low awareness of this test may be prevalent. Important factors are to determine the level of understanding among the public regarding MCI, the tests required for diagnosis, the prognosis, and furthermore, how much they are willing to pay for disease-modifying drugs. Therefore, this study was based on a survey exploring respondents' awareness and knowledge of MCI and AD, and the cost that respondents were willing to pay for medication to delay or prevent the progression from MCI due to AD, to dementia.

This survey was conducted under the leadership of the Strategy and Planning Committee of the Korean Dementia Association to accurately assess public awareness and knowledge of MCI, which is regarded as a primary target for disease-modifying therapy (DMT). Through this survey, we aimed to establish the appropriate direction for nationwide public awareness campaigns and education to improve the public perception of MCI.

METHODS

Subject

A telephone survey was conducted from August 29 to 31, 2022, with participants aged ≥18 years. *In toto*, 1,006 respondents were randomly selected from the general population across 17 districts (cities: Seoul, Busan, Daegu, Gwangju, Daejeon, Ulsan, and Sejong; provinces: Gyeonggi-do, Gangwon-do, Chungcheongbuk-do, Chungcheongnam-do, Jeollabuk-do, Jeollanam-do, Gyeongsangbuk-do, and Gyeongsangnsam-do) in the Republic of Korea. The survey was commissioned by Gallup (Seoul, Korea), and conducted using a proportional allocation based on age, sex, and region.

Contents of survey

After reviewing the literature on perceptions toward MCI and based on the opinions of a multidisciplinary team of experts,[8,9] the survey was organized to comprise three key sections: 1) demographic information, 2) questions on awareness of the definition, diagnosis, and prognosis of MCI, and 3) willingness to visit the hospital and undergo testing, including amyloid PET, and the cost-willingness of respondents to pay for DMT. Given that the median income for a two-person household at the time of the study was 3 million Korean won (KRW), the average monthly pension received by a single beneficiary was 0.6 million KRW, and the expected cost of DMT (ranging, 1.2–4.5) million KRW), the authors determined the ranges of monthly willingness to pay through consultation with the Strategy and Planning Committee of the Korean Dementia Association. Demographic information included the age, sex, education, residence, and socioeconomic status of the respondents. Socioeconomic status was determined based on the respondents' self-perceived inclusion within a quintile. The socioeconomic status of the population was divided into five levels, and respondents were asked to indicate which level they believed they belonged to. A multidisciplinary team led by neurologists created the initial survey contents, which were reviewed over multiple iterations by the directors and members of the Korea Dementia Association. The final version had 11 questions (**Supplementary Tables 1** and **2**), including 'awareness of the term MCI,' 'how much do you know about MCI,' awareness of the fact that 'MCI is a precursor to dementia,' knew that 'MCI is a critical period to prevent dementia,' 'will you visit a hospital to diagnose the MCI when you or your family experience a perceived memory decline,' heard of 'MCI due to AD,' knew that 'most of MCI due to AD progresses to dementia,' and were aware that 'amyloid PET is required to diagnose MCI due to AD.'

Data analysis

Descriptive statistics for the study population and survey responses are presented. Pearson's χ^2 test was performed to examine differences between categorical variables (i.e., age group, sex, and socioeconomic status). Bonferroni adjusted χ^2 test was performed for *post hoc* analysis. Logistic regression analysis was conducted to identify factors associated with awareness of the term MCI, and unwillingness to pay for a drug to delay the progression from MCI due to AD to dementia. The multivariate model was adjusted for age, sex, education, and socioeconomic status. Statistical analyses were performed using IBM SPSS Statistics for Windows, version 27.0 (IBM Corp., Armonk, NY, USA). Significance was defined as a two-sided $p<0.05$.

RESULTS

Survey respondents

Altogether, 1,006 individuals (503 males and 503 females) responded to the survey (response rate, 17%). The margin of error for all respondents at a 95% confidence level was ±3.1%p. **Table 1** presents the demographic characteristics of the respondents. The mean age of respondents was (50.5±17.5) years (minimum 18 and maximum 94 years). Approximately 7.9% had <6 years of education, while approximately 57.7% had >12 years of education. Only 25 (2.5%) respondents were in the highest quintile, whereas 181 (18.0%) were in the lowest quintile.

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Table 1. Characteristics of respondents

Characteristics	Values (n=1,006)
Age groups (yr)	
18–19	23 (2.3)
20–29	149 (14.8)
30–39	146 (14.5)
40–49	163 (16.2)
50–59	200 (19.9)
60–69	191 (19.0)
≥70	157 (15.6)
Sex (female)	503 (50.0)
Education (grouped by yr)	
≤6	79 (7.9)
6–9	55 (5.5)
9–12	266 (26.4)
13–17	496 (49.3)
≥18	85 (8.4)
No response	25 (2.5)
Socioeconomic status	
1 (Highest)	25 (2.5)
2	116 (11.5)
3	417 (41.5)
4	229 (22.8)
5 (Lowest)	181 (18.0)
No response	38 (3.8)

Data are presented as the number of patients (%).

Awareness of MCI

Among all respondents (n=1,006), 415 (41.3%) reported having heard of MCI; of them, only 50 (12.0%) mentioned that they were well informed regarding MCI, and 148 (35.7%) answered that they had only heard of it (**Fig. 1**). Significantly more male respondents had 'never heard of MCI' compared to female respondents (68.2% vs. 47.7%, p<0.001), and females aged 50–59 years had the lowest proportion of responders who answered 'had never heard of MCI' (**Fig. 1A**). As well, male respondents were significantly more likely to report that they had only heard of the term without knowing it well (45.6% vs. 29.6%, p=0.004; **Fig. 1B**), and males aged 50–59 years had the highest proportion of responders who had 'only heard the term' without knowing it well (61.5%).

Concerning MCI (**Table 2**), the most common thought in respondents' mind was cognitive decline (23.3%), followed by dementia (20.4%), disability (10.8%), reduced intellectual function (4.6%), memory decline (4.4%), psychiatric disability (3.1%), and physical disability (3.1%).

In the survey on knowledge regarding MCI (**Fig. 2**), 332 (33.0%) respondents reported having heard that 'MCI is a precursor to dementia' (**Fig. 2A**), 262 (26.0%) knew 'MCI is a critical period to prevent dementia' (**Fig. 2B**), 349 (34.7%) had heard of 'MCI due to AD' (**Fig. 2D**), 351 (34.9%) knew that 'most of the MCI cases due to AD progress to AD' (**Fig. 2E**), and 125 (12.4%) were aware that 'amyloid PET is required to diagnose MCI due to AD' (**Fig. 2F**). Most respondents (n=775, 77.0%) stated that when they experienced perceived memory decline, they would visit a hospital to diagnose MCI (**Fig. 2C**). **Table 3** shows the number and proportion of respondents who were aware of these specific facts regarding MCI, according to age and sex. For questions on knowledge of MCI, a significantly higher proportion of females answered 'had heard of it,' than males. Considering the age group, those aged 50–59 and 60–69 years had the highest proportion of responders who answered 'had heard of it.' Similarly, for the questions regarding awareness of the statements 'MCI is a precursor to

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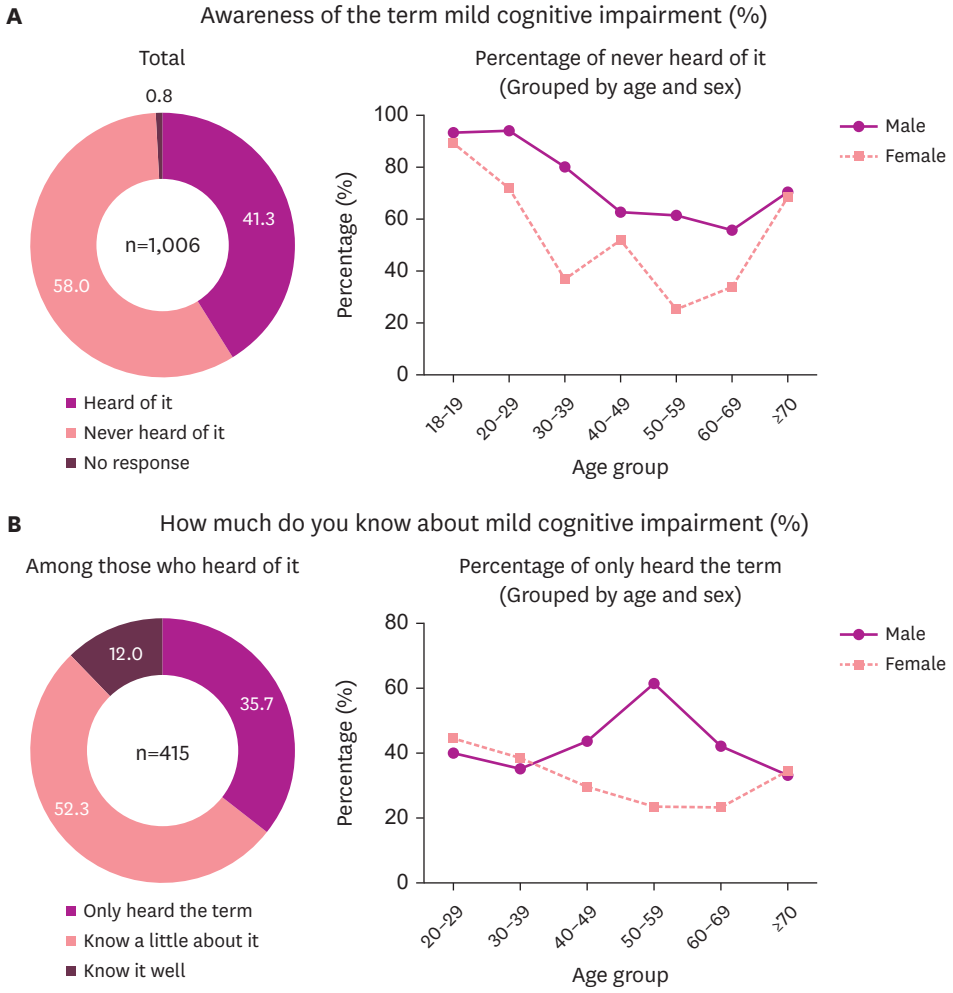

Fig. 1. Level of awareness regarding the term 'mild cognitive impairment.'

Table 2. What comes to mind when you think of mild cognitive impairment?

	Values (n=675)*
Cognitive decline	157 (23.3)
Dementia	138 (20.4)
Disability	73 (10.8)
Intellectual dysfunction	31 (4.6)
Memory decline	30 (4.4)
Mental disability	21 (3.1)
Physical disability	21 (3.1)
Mild disability	20 (3.0)
Difficulty in recognizing objects	15 (2.2)
Brain dysfunction	12 (1.8)
Speech disability	8 (1.2)
Uncomfortable	8 (1.2)
Aging	7 (1.0)
Autism	7 (1.0)

Data are presented as the number of patients (%).
Only responses with a response rate of 1% or more have been included.
*Total number except no response.

dementia,' 'MCI is a critical period to prevent dementia,' 'MCI due to AD,' and 'Most MCI cases due to AD progress to dementia,' individuals aged 50–59 and 60–69 years reported a

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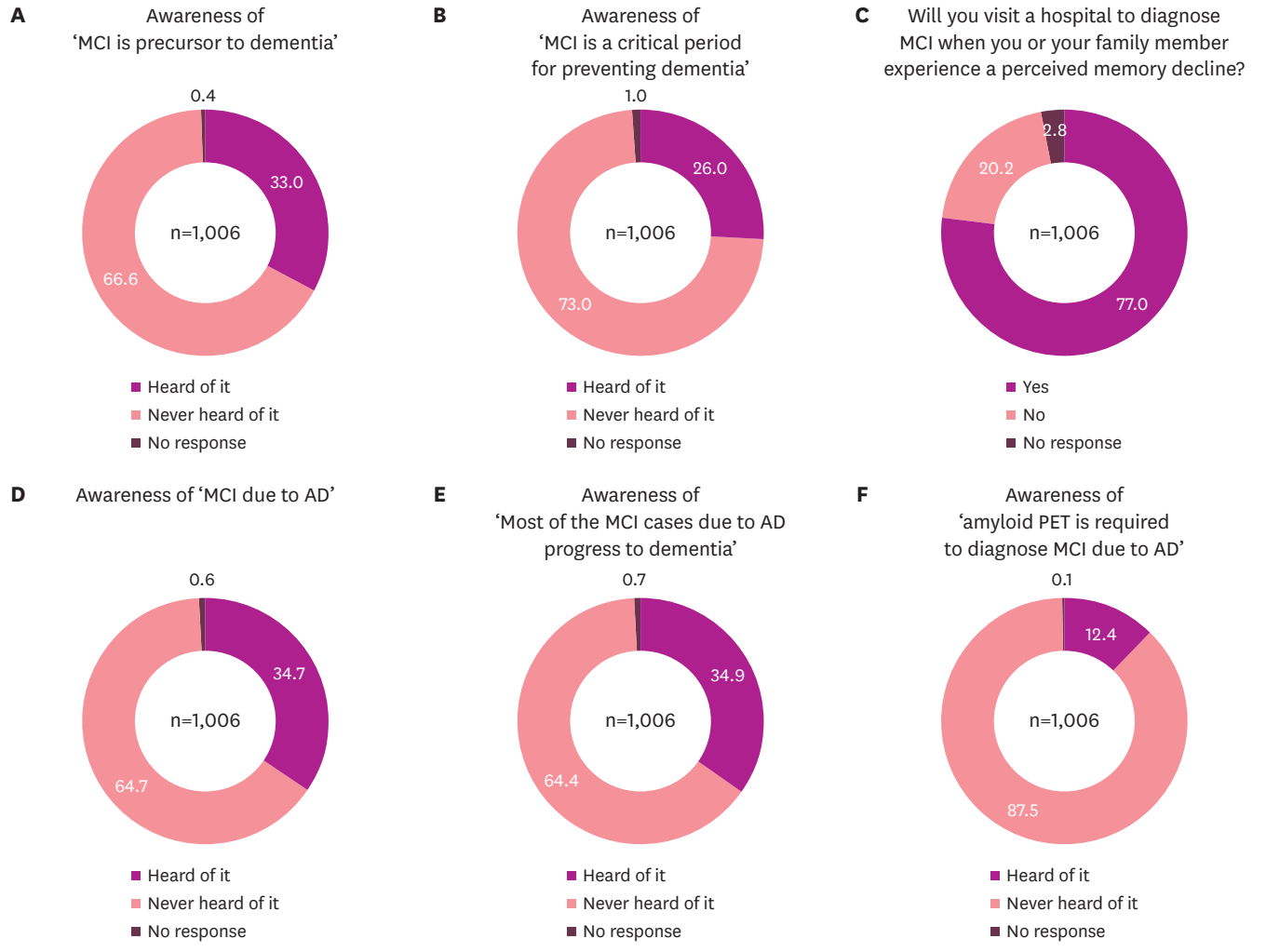

Fig. 2. Survey on knowledge of mild cognitive impairment, and willingness to visit a hospital.
MCI: mild cognitive impairment, AD: Alzheimer's disease, PET: positron emission tomography.

higher level of awareness than those in the other age groups. For all questions, a significantly higher proportion of females than males reported having heard of the question's subject. **Supplementary Table 3** shows the response rates according to age subgroup for each sex. The results for the total participants were similar. Multivariable logistic regression analysis adjusting for age, sex, education, and self-reported socioeconomic status showed that age (odds ratio [OR], 1.039; 95% confidence interval [CI], 1.028–1.049; $p<0.001$), female sex (OR, 3.092; 95% CI, 2.315–4.130; $p<0.001$), higher education level, and higher self-reported socioeconomic status were independently associated with the awareness of the term 'MCI' (**Supplementary Table 4**).

For the question 'willing to undergo an amyloid PET to evaluate MCI due to AD,' 608 (60.4%) respondents stated they would undergo amyloid PET scan (**Fig. 3A**). **Fig. 3B** shows the monthly cost that respondents could pay for medication to delay or prevent the progression from MCI due to AD to dementia. Among the respondents, 424 (42.1%) answered that they would pay <600,000 KRW per month, 185 (18.4%) stated that they had no willingness to pay, while 291 respondents were willing to pay >1.2 million KRW per month. Of the respondents, 18 (1.7%) answered that they would pay <4.5 million KRW, and 70 (7.0%) answered that they

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Table 3. Awareness of the information regarding MCI by age and sex subgroups

	MCI is a precursor to dementia	MCI is a critical period to prevent dementia	MCI due to AD	Most MCI cases due to AD progress to dementia	Amyloid PET is required to diagnose MCI due to AD
Age (yr)					
18–29 (n=149)	19 (12.8)[a]	16 (10.7)[a]	36 (24.2)[a]	36 (24.2)[a]	14 (9.4)
30–39 (n=146)	33 (22.6)[a]	25 (17.1)[a]	39 (26.7)[a]	42 (28.8)[a]	17 (11.6)
40–49 (n=163)	51 (31.3)[ab]	42 (25.8)[ab]	52 (31.9)[ab]	51 (31.3)[a]	16 (9.8)
50–59 (n=200)	99 (49.5)[b]	79 (39.5)[c]	98 (49.0)[c]	94 (47.0)[b]	31 (15.5)
60–69 (n=191)	88 (46.1)[b]	67 (35.1)[bc]	78 (40.8)[bc]	79 (41.4)[b]	33 (17.3)
≥70 (n=157)	42 (26.8)[a]	33 (21.0)[ab]	46 (29.3)[ab]	49 (31.2)[ab]	14 (8.9)
p-value	<0.001	<0.001	<0.001	<0.001	0.109
Sex					
Male (n=503)	132 (26.2)	94 (18.7)	151 (39.4)	135 (26.8)	46 (9.1)
Female (n=503)	200 (39.8)	168 (33.4)	198 (39.4)	216 (42.9)	79 (15.7)
p-value	<0.001	<0.001	0.008	<0.001	0.004

Data are presented as the number of respondents who had specific knowledge (%).
The *p*-values indicate for the difference between each age group or sex.
Alphabetical letters indicate a < b < c, Bonferroni adjusted χ^2 test was performed for *post hoc* analysis.
MCI: mild cognitive impairment, AD: Alzheimer's disease, PET: positron emission tomography.

Fig. 3. Willingness to undergo an amyloid PET and the monthly cost that can be paid for a drug to delay or prevent the progression from MCI due to AD, to dementia.
PET: positron emission tomography, MCI: mild cognitive impairment, AD: Alzheimer's disease.

would pay regardless of the cost. The older the respondents (p<0.001) and the lower their reported socioeconomic status (p<0.001), the less they were willing to pay monthly (**Table 4**). Multivariable logistic regression analysis adjusted for age, sex, education, and self-reported socioeconomic status showed that male, lowest education level, and lowest self-reported socioeconomic status were independently associated with the unwillingness to pay for a drug to delay the progression from MCI due to AD to dementia (**Supplementary Table 5**).

DISCUSSION

This survey with 1,006 participants (mean age of 50.5 years) found that only 41.3% of them had heard of MCI; and of those who had, 12.0% responded that they were well informed. Males were more likely to be unaware of MCI, compared to females. When considering MCI, respondents most commonly linked it to cognitive decline (23.3%), dementia (20.4%), and disability (10.8%). In terms of specific knowledge, 33.0% had heard that MCI is a precursor

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Table 4. The monthly cost that can be paid for a drug to delay or prevent the progression from mild cognitive impairment due to Alzheimer's disease to dementia, according to sex, age, and socioeconomic status

	No limit	≤ ₩4.5M	≤ ₩3.0M	≤ ₩1.2M	≤ ₩0.6M	Will not pay	No response/don't know
Total (n=1,006)	70 (7.0)	18 (1.8)	53 (5.3)	150 (14.9)	424 (42.1)	185 (18.4)	106 (10.5)
Age* (yr)							
20–29 (n=126)	10 (7.9)	3 (2.4)	14 (11.1)	32 (25.4)	38 (30.2)	22 (17.5)	7 (5.6)
30–39 (n=146)	15 (10.3)	3 (2.1)	13 (8.9)	29 (19.9)	67 (45.9)	13 (8.9)	6 (4.1)
40–49 (n=163)	14 (8.6)	6 (3.7)	9 (5.5)	29 (17.8)	71 (43.6)	21 (12.9)	13 (8.0)
50–59 (n=200)	10 (5.0)	3 (1.5)	8 (4.0)	25 (12.5)	109 (54.5)	27 (13.5)	18 (9.0)
60–69 (n=191)	12 (6.3)	1 (0.5)	3 (1.6)	22 (11.5)	94 (49.2)	36 (18.8)	23 (12.0)
≥70 (n=157)	4 (2.5)	0 (0.0)	2 (1.3)	8 (5.1)	38 (24.2)	66 (42.0)	39 (24.8)
Sex†							
Male (n=503)	49 (9.7)	13 (2.6)	28 (5.6)	80 (15.9)	196 (39.0)	96 (19.1)	41 (8.2)
Female (n=503)	21 (4.2)	5 (1.0)	25 (5.0)	70 (13.9)	228 (45.3)	89 (17.7)	65 (12.9)
Socioeconomic status*							
1 (Highest, n=25)	4 (16.0)	1 (4.0)	0 (0.0)	7 (28.0)	7 (28.0)	5 (20.5)	1 (4.0)
2 (n=116)	10 (8.6)	5 (4.3)	11 (9.5)	21 (18.1)	46 (39.7)	11 (9.5)	12 (10.3)
3 (n=417)	40 (9.6)	10 (2.4)	32 (7.7)	73 (17.5)	170 (40.8)	55 (13.2)	37 (8.9)
4 (n=229)	8 (3.5)	1 (0.4)	10 (4.4)	37 (16.2)	126 (55.0)	34 (14.8)	13 (5.7)
5 (Lowest, n=181)	7 (3.9)	1 (0.6)	0 (0.0)	12 (6.6)	69 (38.1)	67 (37.0)	25 (13.8)
No response (n=38)	1 (2.6)	0 (0.0)	0 (0.0)	0 (0.0)	6 (15.8)	13 (34.2)	18 (47.4)

Data are presented as number of respondents (%).
₩: won, M: million.
*p<0.001, †p=0.001.

to dementia, while 34.9% knew that most cases of MCI due to AD progressed to dementia. Notably, 77.0% stated that if they experienced memory decline, they would visit a hospital. Regarding the willingness to pay for medication to delay MCI progression, 42.1% were willing to pay <600,000 won per month, whereas 18.4% were unwilling to pay. Older age and lower socioeconomic status were associated with decreased willingness to pay (p<0.001).

Studies investigating public awareness of MCI are limited. A previous study conducted in the UK with 417 participants reported a higher awareness of dementia (82.3%, n=343) than cognitive impairment (61.4%, n=256),[8] which is notably higher than the 41.3% awareness of MCI observed in our study in South Korea. Notably, in the UK study, 184 participants (44.1%) were health-care professionals or dementia specialists, a group very likely to have greater medical knowledge than the general population. This suggests that the reported awareness levels may have been overestimated. In contrast, our study surveyed a randomly selected sample of the general public, making it more suitable to assess public awareness of MCI, compared to previous studies. A study conducted in Shanghai, China, with individuals aged ≥65 years (n=925) and their associates, also showed low awareness of MCI.[10] The awareness rate of MCI symptoms was 25.5%, and that of MCI prevention was 15.5%; 32% of older individuals with MCI were taken to a doctor, which contrasted with the rate in our study of 77.0%.

The question regarding awareness of the necessity of amyloid PET to diagnose AD had the lowest response rate for 'had heard of it' (12.4%; **Fig. 2F**). This may be attributed to the previously limited indications for amyloid PET scans, which were usually performed under the following conditions: 1) cognitive complaints with objective evidence of impairment; 2) when AD was considered a potential diagnosis, but could not be confirmed after a comprehensive assessment by a dementia specialist; and 3) when knowledge of Aβ pathology was anticipated to improve diagnostic accuracy and guide treatment decisions.[11] Access to amyloid PET is relatively easier in Korea, compared to other countries. However, until recently, no anti-amyloid therapies were available, while amyloid PET is not covered by national insurance,[12] leading to its limited use. Therefore, general awareness remains

low. However, with the advent of anti-amyloid therapies, confirming amyloid pathology has become increasingly important.[13] With its development and approval, anti-amyloid therapies are now available for use in clinical practice, and MCI represents a critical window for therapy. However, 66.6% of respondents stated that they had never heard that 'MCI is a precursor to dementia' (**Fig. 2A**), and 73.0% were unaware that 'MCI is a critical period to prevent dementia' (**Fig. 2B**). Given these findings, it is essential to increase the diagnostic rate of MCI through public awareness and education. Future efforts should focus on education and raising awareness regarding amyloid PET. In this study, 87.5% of respondents stated that they were unaware that 'amyloid PET is required to diagnose MCI due to AD' (**Fig. 2F**). However, when asked whether if they or their family members noticed a decline in memory, they would undergo amyloid PET to evaluate for MCI due to AD, 60.4% expressed their willingness to do so (**Fig. 3A**). These findings highlight the need for public awareness campaigns and education to improve the understanding of MCI and the requirement of amyloid PET for diagnosis. Notably, males aged ≥40 years demonstrated particularly low awareness levels (6.1%–8.9%; **Table 2**), highlighting the need for targeted educational initiatives in this group. Although the present study cannot determine the underlying causes, factors such as the level of interest in dementia, life expectancy, and sociocultural or health literacy are likely to have played a role. In Korea, through the national dementia plans, 256 Local Dementia Centres (LDCs) have been established nationwide, providing education programs regarding awareness and the prevention of dementia.[14] Based on the findings of this survey, incorporating an additional educational program focusing on MCI, AD, and amyloid PET into the existing educational framework of the LDCs is expected to enhance the effectiveness of public awareness initiatives.

Individuals with higher income levels and younger age groups demonstrated greater willingness to pay for treatment (**Fig. 3** and **Table 4**). Among the 348 respondents aged ≥60 years, 234 (67.2%) stated that they were willing to pay <600,000 KRW (approximately 400 USD) per month, or had no willingness to pay for a drug to delay or prevent the progression from MCI to dementia. Notably, 37.0% of those who identified themselves as having the lowest socioeconomic status reported being unwilling to pay for the drug. The introduction of high-cost anti-amyloid treatments may lead to inequality and polarization in patients with cognitive decline, necessitating careful consideration and proactive measures to address this issue.

This study has some limitations. First, it was performed only in the Republic of Korea, and the findings may not be generalizable to other countries. Second, although the survey used a proportional allocation based on age, sex, and region, the sample may not fully represent the diversity of the general population, particularly considering the reliance on self-selection for participation in telephonic surveys. Finally, this study relied on self-reported knowledge, awareness, and socioeconomic status, which can be subject to recall bias, social desirability bias, and inaccuracies in self-assessment. In addition, as information on the actual income, healthcare costs, or insurance coverage of respondents was not available, we were unable to determine the financial burden that each amount would impose on individuals.

In conclusion, this study revealed limited public awareness of MCI, with significant age and sex disparities, and highlighted that willingness to pay for disease-modifying treatments decreases with older age and lower socioeconomic status. These findings emphasize the need in future care strategies for dementia for targeted education and the consideration of cost-related barriers.

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SUPPLEMENTARY MATERIALS

Supplementary Table 1
Questionnaire items and response options of the survey (English version)

Supplementary Table 2
Questionnaire items and response options of the survey (Korean version)

Supplementary Table 3
Survey of knowledge about mild cognitive impairment by age groups for male and females

Supplementary Table 4
Multivariate logistic regression analysis for the awareness of the term mild cognitive impairment

Supplementary Table 5
Multivariate logistic regression analysis for unwillingness to pay for a drug to delay the progression from mild cognitive impairment due to Alzheimer's disease to dementia

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