A Comparison of the Knowledge of Alzheimer's Disease among Community Pharmacists Based on Regional Practice Setting Using the Alzheimer's Disease Knowledge Scale (ADKS)

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Abstract
Alzheimer's Disease (AD) is the most prevalent type of dementia and has a high prevalence in the aging population. Due to the requirements for care, it is valuable for members of the healthcare system to be knowledgeable about AD and its treatment. Community pharmacists are particularly valuable in assisting in AD care because of their accessibility to the general public and they are a source for dispensing AD medications. The purpose of this study is to assess the level of knowledge of AD among Ohio community pharmacists based on regional practice settings using the Alzheimer's Disease Knowledge Scale (ADKS). A standardized, 30-question assessment tool known as the Alzheimer's Disease Knowledge Scale exists to measure the level of knowledge of AD among a given population. Studies on AD knowledge have been conducted using this tool, and the use of this scale identifies major misconceptions about AD that could be addressed in education initiatives for both the general public and for health care professionals. This study implemented this tool to compare the knowledge of community pharmacists that serve rural areas to those that serve urban areas. The Ohio Board of Pharmacy provided a list of emails of community pharmacists to send an anonymous survey including both demographic questions and the ADKS. Statistical analyses including independent t-tests and descriptive statistics were conducted using SPSS to determine the significance of the data. This study found no statistically significant difference between urban versus rural community pharmacists. However, in the future we hope to identify specific questions that correlate to areas of AD where continuing education may be helpful in improving patient outcomes by enabling caregivers and healthcare providers with a more accurate understanding of AD.

Keywords: Alzheimer's disease, Knowledge, Community pharmacists, Patients, Rural, Urban

Introduction
Alzheimer's disease (AD) is the most common form of dementia, composing up to 80 percent of all dementias recognized today and impacting close to 44 million people worldwide.[1,3-4] It is a progressive neurological disorder ultimately ending in death.[1,2] AD affects mostly memory and cognition due to neuronal loss and brain atrophy in the hippocampus and prefrontal cortex.[1]
Loss of perceptual ability and the interpretation of events or words are part of the natural progression of the disease.[1]

The Alzheimer's Disease Knowledge Scale (ADKS) is a standardized tool used to measure knowledge of AD. It is a 30 question assessment tool covering seven primary categories: risk factors, assessment and diagnosis, symptoms, course, life impact, caregiving, and treatment and management.[5] Studies on AD knowledge have been conducted using this tool on Norwegian psychologists, Australian aging and dementia care professionals, as well as other Australian health professional groups, and college students from University of Northern

Iowa.[6-9] The use of this scale can be used to identify major misconceptions about AD that could potentially be addressed in education initiatives for both the general public and for health care professionals.[10] Misconceptions include how AD develops, best caregiving practices, public health impact of AD, and that AD is a normal part of aging.[10]

Despite the existence of the ADKS since 2009, a 2015 literature review of articles pertaining to knowledge of AD found that there was little consistency in the measurement of Alzheimer's knowledge.[11] Many researchers developed their own scale to evaluate how much people know about AD, which leads us to believe it would be helpful for a standardized tool to be used in evaluating AD knowledge.[11] Recently, a study was done in Malta using the ADKS (given in English language) that evaluated the knowledge of managing community pharmacists. The average ADKS score was 21.46 out of 30.[12] They found this to be greater than the knowledge scores of Maltese nurses, but less than those reported in studies on US college students and Norwegian psychologists.[12] The researchers found that younger pharmacists with less experience actually performed better on the ADKS than their older counterparts.[12]

The high prevalence of AD leads us to believe that it would be valuable for other members of the American healthcare system to be knowledgeable about AD and its treatment. Community pharmacists could be particularly valuable in assisting in AD care because they are widely accessible to the general public and they dispense AD medications.

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We evaluated trends observed in pharmacists from Malta applied to our data to identify a statistically significant difference in the level of knowledge of AD between study groups. This would indicate that current education for pharmacists better equips them for interacting with AD patients. Therefore, our purpose is to see if there is a difference in the level of knowledge of AD between urban or rural community pharmacists. This will allow us to target areas of knowledge that are lacking and identify misconceptions both in the general public and health professionals that could be addressed with future education initiatives. Our end goal of such an education initiative would be to improve patient outcomes by enabling caregivers and healthcare providers with a more accurate understanding of AD.

Methods

Sample Selection
This cross sectional analysis evaluates a survey that was sent to 4,405 community pharmacists in Ohio to test their AD knowledge. The Ohio Board of Pharmacy was contacted to obtain the emails and zip codes of urban and rural community pharmacists in the state of Ohio. An email was sent with a survey that maintained the anonymity of the participants and included both the Alzheimer's Disease Knowledge Scale (ADKS) as well as specific demographic questions. To classify pharmacists as "urban" or "rural," the United States Department of Agriculture (USDA) and Economic Research Service Rural-Urban Commuting Areas (RUCA) has a classification system utilizing a coded numbering system where numbers 1-3 refer to "urban" and 4-10 refer to "rural."[13] Using the latest classification system provided by the USDA and RUCA in 2013, the 88 counties in Ohio were broken down into urban versus rural.[14] These classifications were used when analyzing data after survey answers were collected.

In order to have a 95% confidence interval with a 5% margin of error, there was a required sample of at least 354 survey respondents.

Inclusion criteria referred to community pharmacists in the state of Ohio - both registered pharmacists (RPh) and doctors of pharmacy (PharmD) working full or part time. Exclusion criteria referred to pharmacists in Ohio that do not practice in a community setting and pharmacists working outside of Ohio. Non-probability purposive sampling was used to obtain the sample of pharmacists in Ohio.

Instrumentation and Implementation
The data was obtained through surveys emailed by an anonymous link to the pharmacists through Qualtrics. The survey included questions from the ADKS as well as demographic information, including age, gender, certification, degree, practice setting, length of time in practice, level of interest in AD, family members with AD, and frequency of dispensing AD medications. The knowledge level of pharmacists was based upon the ADKS.[15] The survey consisted of 30 true or false questions that each pharmacist completed. The pharmacist's level of knowledge was based on how many items the pharmacist answered correctly. Previous evaluation found that each of the thirty questions have maintained their validity when compared to current literature.[16-61]

Once the survey was completed, the Cedarville University Institutional Review Board (IRB) approved this study. After IRB approval, the survey was sent to the pharmacists' emails provided by the Board of Pharmacy. The survey was sent out every 2 weeks for four rounds for a total of 8 weeks starting in October of 2017.

Once the survey was officially closed, statistical analysis was conducted through SPSS to determine the level of knowledge of AD amongst community pharmacists. We explored the relationship between urban and rural practice settings as well as age distribution to the knowledge of AD using t-tests.

Results

Demographics
In order to have a 95% confidence interval with a 5% margin of error, there was a required sample of at least 354 survey respondents. After our 8 week study timeframe, we had 215 survey responses. Of the 215 responses, only 187 were completed and an additional 13 surveys were excluded due to regional practice setting which left a total of 174 respondents. Our 174 respondents averaged 44 years of age which is demonstrated in Figure 1. In total, 61.5% were female, 37.4% were male, and 1.1% indicated other. Nine pharmacists indicated that they were residency trained and 6 reported board certifications. There were 59.2% of respondents that practiced in a rural setting and 40.8% in an urban setting. Additionally, 69.5% worked at chain pharmacies with 30.5% working in independent pharmacies. In regards to personal connection to AD, 65.3% of the pharmacists reported no personal connection to AD, 27.2% had a family member with AD, and 7.5% had a friend with AD. The overall mean score was 25.6 points, which correlates to marking 85.3% of questions correct.

Statistical Analysis
Primary endpoints for the overall test scores on the ADKS assessment were not statistically significant between rural or urban groups. Rural community pharmacists scored a mean of 25.94 points while urban community pharmacists scored a mean of 25.11 points which correlates with a p value of 0.057 [Figure 3]. There was a slight trend towards rural pharmacists having more knowledge with a difference in average score of 0.83 points. Additionally, no statistical significance was found between length of practice. However, there was a significant difference (p=0.046) between those who indicated 31-35 years of experience versus those who indicated 15-20 years of experience. [Figure 2]

Secondary endpoints included looking at individual questions to find any gaps in knowledge between rural and urban pharmacists. There was a significant difference favoring rural pharmacists (p=0.017) on scale item 19 which assessed the pharmacist's knowledge about tremors in AD. No other individual test items met significance criteria between the rural and urban groups.

Additional analyses indicated no statistical significance in average test scores between independent and chain pharmacists (p=0.181). Unfortunately, there were not enough respondents with residency training or board certifications to calculate if these qualifications correlated to an effect on test scores. There was no significant difference between scores of those who reported having a bachelor's degree compared to those who reported having a doctorate degree (p=0.614). There was no significant difference in test score based on level of interest in AD care (p=0.052) [Figure 4]. However, on average those who stated they were interested scored 1-2 points higher on the assessment than those who indicated they were neutral.

Discussion

The primary goals of this study were to see if there was a difference in AD knowledge among Ohio pharmacists in rural versus urban settings. When looking at the results, we found there was a slight increase in knowledge of pharmacists who work in a rural setting compared to pharmacists working in an urban setting. Although there was not a statistically significant difference (p=0.057), it was surprising to learn that rural pharmacists seemed to have slightly increased knowledge. However, when looking back on demographic information, there were about 20% more pharmacists from the rural setting that completed the survey, which may contribute to skewed data. In the future, obtaining normally distributed data and a larger sample size would provide a better indication as to whether or not there is a statistically significant difference.

Originally, it was hypothesized that there would be an increased knowledge amongst younger pharmacists who had just graduated from school. This theory came from a study conducted in Malta where younger pharmacists scored higher than their more experienced counterparts.[12.] The data in this study compared to Malta found that pharmacists who have been practicing 31-35 years actually have more knowledge about Alzheimer's disease than those who have been practicing 15-20 years (p=0.046). However, there were no other significant conclusions relating to practice length. These findings could be contributed to more experience handling AD medications.

In this study, it was shown that Ohio community pharmacists scored an overall mean of 25.6 points on the ADKS survey, while the community pharmacists in Malta had an average score of 21.46 points on the same survey.[12] The results of the Malta study are comparable to this study and allude to a possible difference in how each country teaches their students about AD

in pharmacy school. In another survey determining the level of knowledge of AD in health care staff, participants in the urban setting scored an overall mean of 23.56 points compared with our urban average of 25.11 points; rural health care staff scored the same overall mean of 23.56 points compared with our rural average of 25.94.[8] This study was not pharmacy specific and included health care workers in all divisions of the care team (nursing, medicine, allied health, and support), so extrapolation to this study is difficult.

Strengths and Limitations
The most prominent strength of this study included being able to use the previously validated ADKS because it accurately represents knowledge of AD and can be compared with previous literature that employs this scale. The Ohio Board of Pharmacy provided a large amount of data which aided in survey distribution. Qualtrics enabled the sending of multiple survey rounds and filtered out duplicate responses.

The sample size of this study was limited due to the nature of survey research. Many people did not complete the survey and therefore, the sample size was not met. Additionally, there was not a way to control survey response and the data was not evenly distributed.

Future Direction and Clinical Practice
Pharmacists continue to play a very important role in the management of AD and the hope of this study as it applies to future research is to expand this survey nationwide. With the small survey response, expanding the survey distribution nationwide would allow for more analysis and hopefully statistically significant results. Additionally, a comparison of the knowledge of community pharmacists as compared to other health care professionals could be valuable to determine the distribution of AD knowledge in the healthcare system. The analysis of commonly missed ADKS items from this study could help identify misconceptions that may be addressed to equip community pharmacists with the information to better counsel AD patients, provide support to caregivers and families and have a better baseline knowledge on managing patients with AD. A continuing education (CE) course or partnership with pharmacy organizations would be beneficial to disseminate information on current standards in AD knowledge and care.

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Tables and Figures

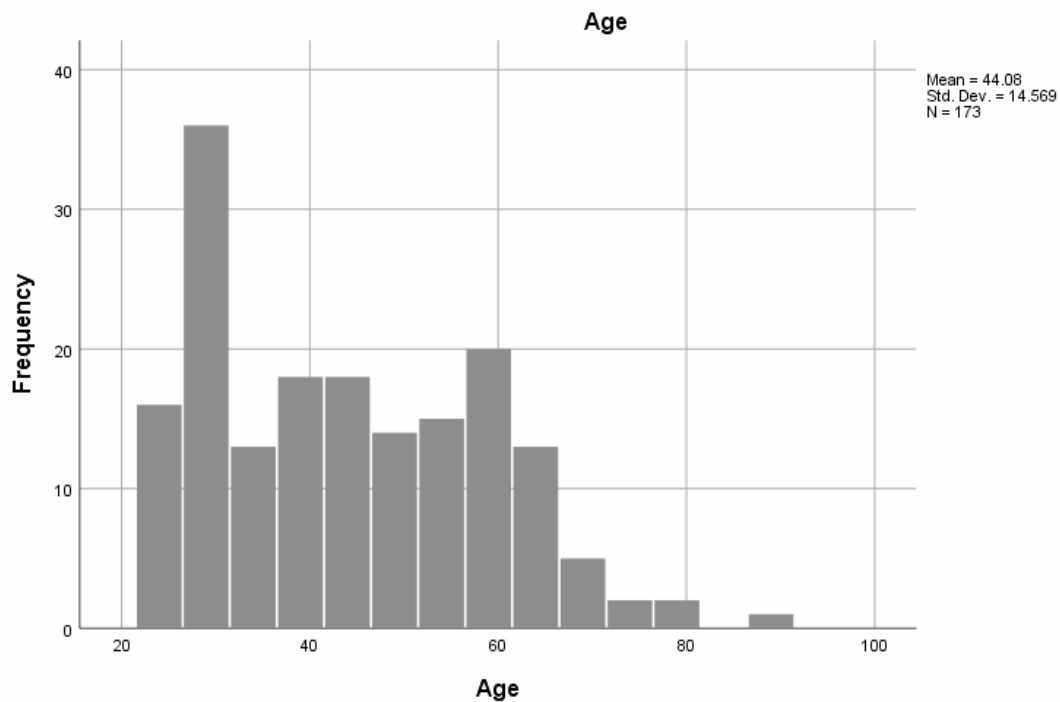**Figure 1**. Age frequency of the number of pharmacists who completed the survey

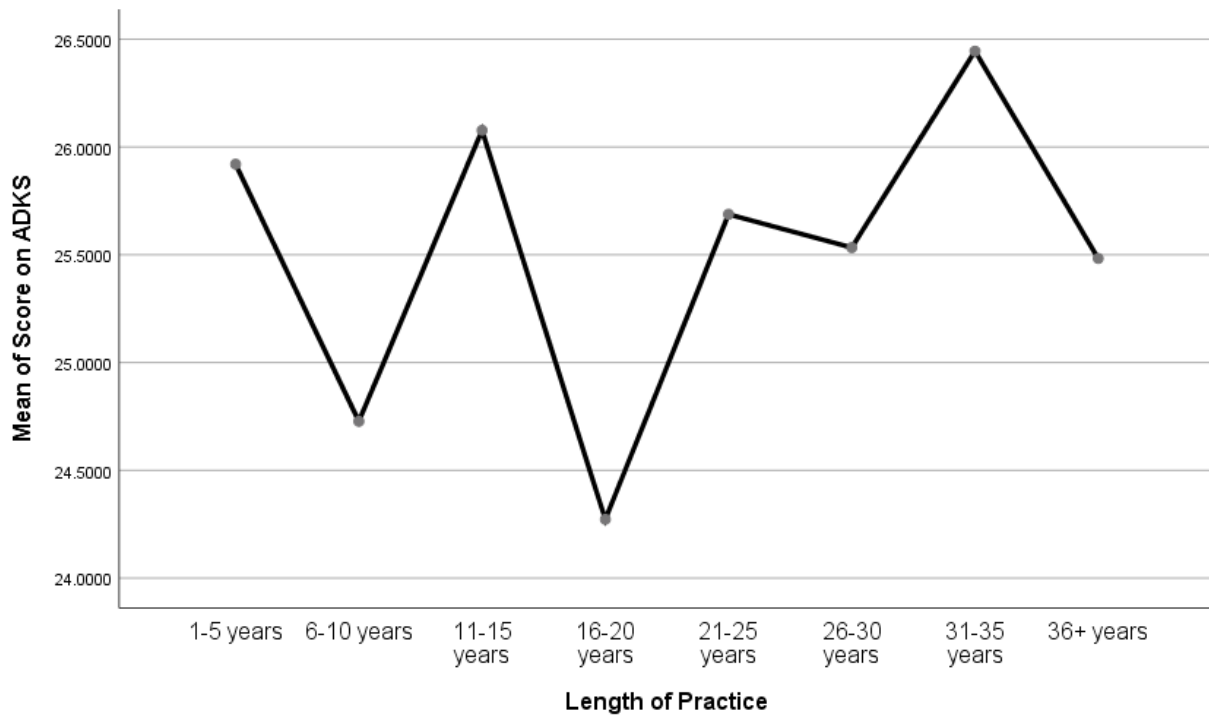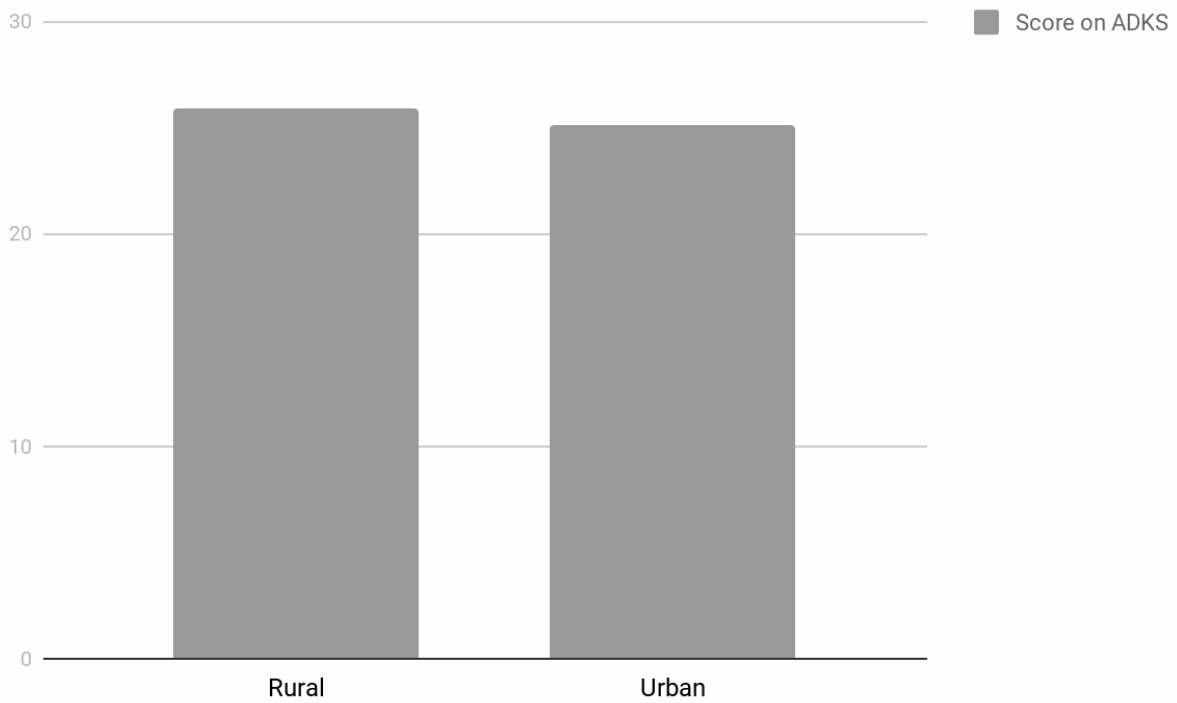**Figure 2**. Length of practice (years) compared to mean score on ADKS

Figure 3. Score on ADKS versus Practice Setting

Figure 4. Average Score on ADKS versus Interest Level