

# Early Detection of Alzheimer’s Disease Using Neuroimaging and Biomarkers:

## A Systematic Review

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### Introduction

- Age is one of the strongest factors with an age-specific rate of doubling every five years after the age of 65. In 2005, there were an estimated 24 million people that were diagnosed with dementia, with the expectation to double every 20 years. It is estimated that over 81 million people will suffer from dementia by the year 2040 (McEvoy, & Brewer, 2010).
- Neuroimaging is among one of the most promising areas of research focusing on early detection of Alzheimer’s Disease. There are three different types of imaging used in neuroimaging; structural, functional, and molecular. These different types of imaging allow for the early detection of Alzheimer’s disease in patients (Alzheimer’s Association, 2016).
- Surrogate biomarkers are often used as endpoints in neuroprotective clinical trials that help differentiate symptoms and effects of the neurodegenerative process of Alzheimer’s. Evidence shows that the most common biomarker used is a brain magnetic resonance imaging, MRI (McGhee, Ritchie, Thompson, Wright, Zajicek, & Counsell, 2014).
- This systematic review is aimed at determining the accuracy of neuroimaging and biomarkers in elderly patients, over the age of 60 that are diagnosed with Alzheimer’s disease, and the outcomes that are present.

### Methods

- CINAHL Complete, PubMed, and ProQuest Medical Library
- PubMed key terms: Alzheimer’s disease, Early Detection, Neuroimaging
- ProQuest Medical key terms: Alzheimer’s disease, Neuroimaging, biomarkers
- CINAHL Complete key terms: Alzheimer’s disease, Neuroimaging, early detection
- Inclusions:
  - 65+ years-old
  - Articles written 2009 to present
  - Scholarly reviewed articles
- Exclusions:
  - Full text
  - Gender
- Total of 15 articles used

### Results

Results of this systematic review were split into two categories:

#### Neuroimaging

- MRI and PET can detect amyloid accumulation, which is one of the markers that is a “clinical onset of AD” (Desai & Grossberg, 2005, p. S36). This results in the earlier treatment of ChEI, which delays “the onset of behavioral and psychological symptoms of AD by 1 year” (Desai & Grossberg, 2005, p. S37).
- Molecular imaging is a necessity for finding particular deposits associated with AD, including functional information and axonal transport and cerebral blood flow changes. A study was conducted using 59 end stage AD patients showing a 96% sensitivity and a 100% specificity for amyloid deposit presence in the molecular imaging, which resulted in 95% confidence interval leading to amyloid deposits being significant to AD diagnosis. The study also concluded that decreasing oxidative stress improved axonal transport rates, learning, memory, and blood flow this then reduced the plaque accumulation by half (Dustin et al., 2016).

#### Biomarkers

- A study was done on 561 patients, which included 253 patients that have been diagnosed with Alzheimer’s disease and 308 that have not been diagnosed with Alzheimer’s. The mean age of these patients was 68.6 years. The study was conducted by performing a CSF biomarker before and after a clinical hypothesis was produced. The clinically suspected diagnosis of CSF results happened in 65.2% of cases, while the actual resulted in 76.9%. These results show a significant improvement for a diagnosis; making CSF biomarkers a key tool in clinical practice (Mouton-liger et al., 2014).
- CSF biomarkers and FDG-PET show high percentages (greater than 90%) of participants with positive findings for the diagnosis of Alzheimer’s in all patients with the disease. This concludes overall that the diagnosis of Alzheimer’s was most often supported by CSF biomarkers and FDG-PET at the early stage of dementia, while CSF biomarkers were the most supported at the earliest stage of diagnosis (Morinaga et al., 2010).
- Groups with a healthier lifestyle, exercising and eating healthy, “have a lower incidence of dementia” (Leibing, 2014, p. 224). With the association of a better lifestyle lowers the cases of patients with dementia, this then leads to targeting certain groups to live a better lifestyle and to detect if the individual has the biomarkers associated with AD earlier.

### Conclusions

- In order for professionals to accurately detect Alzheimer’s disease early, there needs to be more research done on neuroimaging and effects on patients.
- Research in the future and present needs to be accurate and organized to discover a cure to Alzheimer’s disease. It also needs to focus on the importance of early detection.
- Making neuroimaging known as the early detection tool will change the way people look at finding discoveries for Alzheimer’s disease.
- Patients do not have access to updated technology, and face disadvantages of PET scans.
- Limitation to this systematic review:
  - Selection bias
  - Studies primarily done in the United States

### References

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#### Further information

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