

## Neuroimaging referral for dementia diagnosis: The specialist's perspective in Ireland

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### Abstract

**Background:** Neuroimaging is an increasingly important tool in the diagnostic workup of dementia. Neurologists, geriatricians, and old-age psychiatrists are involved in key tasks in the diagnostic process, frequently referring patients with suspected dementia for neuroimaging.

**Methods:** The research design was a postal survey of all geriatricians, old-age psychiatrists, and neurologists in the Republic of Ireland (N = 176) as identified by the Irish Medical Directory 2011–2012 and supplementary listings.

**Results:** Almost 65% of specialists did not have access to 2-[18F]fluoro-2-deoxy-D-glucose positron emission (FDG-PET) or FDG-PET/computed tomography (CT), and 80.3% did not have access to perfusion hexamethylpropyleneamine oxime single-photon emission computed tomography (SPECT) or dopaminergic iodine-123-radiolabeled 2β-carbomethoxy-3β-(4-iodophenyl)-N-(3-fluoropropyl) nortropane SPECT. Most specialists (88.7%) referred patients with mild cognitive impairment or suspected dementia for magnetic resonance imaging (MRI), 81.7% referred for CT, and 26.8% for FDG-PET or FDG-PET/CT. Only 44.6% of respondents were aware of dementia-specific protocols for referrals for neuroimaging.

**Conclusion:** Specialist access to imaging modalities other than CT and MRI is restricted. Improved access may affect patient treatment and care.

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### Keywords:

Dementia; Neuroimaging; Geriatricians; Neurologists; Old-age psychiatrists; Access; MRI; CT; Nuclear medicine imaging

### 1. Introduction

Neuroimaging is increasingly regarded as an essential part of the investigation of a patient with suspected dementia [1]. Structural imaging has traditionally been used to exclude other cerebral pathologies in the assessment of suspected cases of dementia and to reveal findings consistent with Alzheimer's disease (AD) [2–4]. Some guidelines recommend its use in the evaluation of every patient with

suspected dementia [4]. Magnetic resonance imaging (MRI) is the preferred modality to assist with early diagnosis and detect subcortical vascular changes, however, computed tomography (CT) can also be used [2]. Treatable causes of dementia account for only a small proportion of all causes of dementia, however, and AD, vascular dementia (VaD), dementia with Lewy bodies (DLB), and frontotemporal dementia (FTD) are far more common causes [1,5].

With advances in technology, neuroimaging is now considered the most important ancillary investigation in the workup of dementia regarding differential diagnosis and management decisions [3,4,6,7]. Nuclear scans can help differentiate AD,

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VaD, and FTD if a diagnosis is unclear [7]. Guidelines by the National Institute for Health and Clinical Excellence/Social Care Institute for Excellence (NICE/SCIE) note that imaging may not always be needed for those presenting with moderate to severe dementia if the diagnosis is clear, and recommend the use of perfusion hexamethylpropyleneamine oxime (HMPAO) single-photon emission computed tomography (SPECT) or 2-[18F]fluoro-2-deoxy-D-glucose positron emission (FDG-PET) to distinguish between these subtypes if the diagnosis is in doubt [2]. In suspected cases of DLB, the use of dopaminergic iodine-123-radiolabeled 2 $\beta$ -carbomethoxy-3 $\beta$ -(4-iodophenyl)-N-(3-fluoropropyl) nortropane (FP-CIT) SPECT is recommended to confirm the diagnosis if it is in doubt [2].

FDG-PET is reimbursed in the United States for the distinction between AD and FTD [8,9]. In Ireland, PET scans are covered by the major private health insurance providers pending preapproval. FP-CIT (DAT-SPECT) is beneficial in the differentiation of DLB from AD and normal ageing [10]. Although SPECT and PET are not recommended for use as the only imaging measures, these modalities complement structural imaging where diagnostic uncertainty remains [4,11].

In AD, the most common form of dementia which accounts for approximately 60% to 70% of cases [12], atrophy in the medial temporal lobe, including the hippocampus, is an early and specific marker of the disease. Structural MRI imaging can determine volume loss in this region [1,13], and has been postulated as a marker for the progression of the disease [14,15]. The appearance of neuritic plaques is one of the neuropathological hallmarks of AD, the main constituent of which is the amyloid  $\beta$  protein. This protein is considered intrinsic to the pathogenetic process of AD and can be imaged in vivo using PET scans [16]. This allows for an early detection of the disease. Changes in brain metabolism can precede structural brain changes, and temporal, parietal, and posterior singular hypometabolism found in AD can be visualized using FDG-PET and help discriminate AD patients from controls [16]. FDG-PET scans show different patterns of hypometabolism in AD and FTD and can therefore assist in the differential diagnosis of the diseases [8].

At present, most people with dementia do not receive a formal diagnosis [17]. However, a specific diagnosis can influence treatment decisions, such as the use of acetylcholinesterase inhibitors in AD and DLB, the modification of vascular risk factors in VaD or carefulness in the use of neuroleptics in DLB or FTD [1]. Therefore, it would seem good patient management would make some imaging support for the diagnosis indispensable. The European Union (EU) joint action on Alzheimer's initiative, Alzheimer's cooperative valuation in Europe (ALCOVE) has identified four main professions as being responsible for most of the dementia diagnosis pathways: general practitioners, neurologists, geriatricians, and psychiatrists [6]. An exemplary pathway would have patients first recognized in primary care and subsequently referred to secondary care services such as a

memory clinic or directly to geriatricians, old-age psychiatrists, or neurologists, and would involve neuroimaging as an important part of this pathway.

In view of the underdiagnosis of dementia and the significance of neuroimaging in the diagnostic process, it is crucial that specialists have timely access to neuroimaging investigations and are confident in selecting the most appropriate modality. The present study investigated specialists' perspectives on access to neuroimaging investigations for suspected cases of dementia in Ireland and current referral patterns because adequate access and appropriate use of neuroimaging is required if diagnostic rates are to be improved.

## 2. Methods

### 2.1. Study design and participants

The research used a questionnaire-based study design. A postal survey questionnaire was addressed to all geriatricians, old-age psychiatrists, and neurologists in Ireland as identified through the Irish Medical Directory (IMD) 2011–2012. In addition, individual old-age psychiatrists, not contained in the IMD, were identified through a supplementary listing.

A total of 176 individual questionnaires were sent by post to the identified geriatricians ( $n = 84$ ), old-age psychiatrists ( $n = 46$ ), and neurologists ( $n = 46$ ). Respondents were given 4 weeks to return the questionnaire. Returned survey sheets were completely anonymous and there was no follow-up.

### 2.2. Materials

The questionnaire consisted of five main sections and included both open and closed questions. Section A ascertained the demographic characteristics of the sample. Section B enquired about satisfaction with diagnostic capabilities within the health service and access to neuroimaging. Section C established specialists' current referral patterns in neuroimaging in dementia, their reasons for referral, and their use of protocols. Section D asked about the usefulness of reports on neuroimaging investigations.

### 2.3. Statistical analysis

Data analysis was carried out using IBM SPSS Statistics Version 20. Descriptive statistics are reported for most variables. Chi-square analysis including standardized residuals was performed to establish associations between categorical variables. Content analysis was used to examine open questions.

## 3. Results

### 3.1. Demographics

A total of 76 questionnaires were returned corresponding to a response rate of 43.2%. Over half of respondents (58.3%) were male. Most respondents (42.1%) were geriatricians, 28.9% were old-age psychiatrists and just over quarter

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