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Olfactory impairment is associated with functional disability and reduced independence among older adults

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ABSTRACT

Objectives: Despite its relatively high prevalence, population-based data are lacking on whether olfactory impairment influences the functional status and independence of older adults. We assessed associations between olfactory impairment with activities of daily living (ADL) measures and the likelihood of using community support services and/or reliance on non-spouse family/friend support among older adults.
Study design: Olfaction was measured using the San Diego Odor Identification Test (SDOIT) among 1636 participants of the Blue Mountains Eye Study (2002–4). Functional status was determined by the Older Americans Resources and Services ADL scale. Use of services and non-spouse family/friend support was self-reported.
Results: Use of community support services was reported by 15.2% and 5.2% of persons with and without olfactory impairment, respectively. After multivariable adjustment including for cognitive function, participants with compared to those without olfactory impairment were more likely to use community support services and non-spouse family/friend support, odds ratio, OR, 1.82 (95% confidence intervals, CI 1.16–2.86) and OR 1.62 (95% CI 1.14–2.32), respectively. ADL difficulty was reported by 16.9% ($n = 57$) and 4.4% ($n = 45$) of participants with and without olfactory loss, respectively. Olfactory impairment was associated with increased likelihood of experiencing ADL difficulty, multivariable-adjusted OR 1.98 (95% CI 1.10–3.57). Olfactory loss was significantly associated with impaired basic ADL, OR 1.57 (95% CI 1.12–2.20).
Conclusions: The functional ability and independence of older adults is significantly impaired in the presence of olfactory impairment. Early diagnosis of olfactory loss by primary physicians and geriatricians could facilitate timely interventions assisting the maintenance of functional independence in later life.

1. Introduction

Olfactory dysfunction can be total (i.e. anosmia) or incomplete (e.g. partial anosmia, hyposmia, or microsmia) [1]. A decrease in olfactory function with increasing age has been extensively reported [2]. Generally, age-related decline in olfactory function is more severe for men than for women. Unlike alterations in hearing and vision, age-related changes often go unnoticed, and smell ability is rarely evaluated clinically [1]. The basis for age-related changes in smell function is several and includes some of the following: (a) ossification and closure of the foramina of the cribriform plate [3]; (b) development of early neurodegenerative disease pathology [4]; and cumulative damage to the olfactory receptors from smoking and other insults throughout life [1].

We previously showed that among Blue Mountains Eye Study participants aged ≥60 years, the prevalence of olfactory impairment was 27.0% [5]. This rate was comparable to the 24.5% rate observed in the Wisconsin Epidemiology of Hearing Loss Study (EHLS) for persons aged 43–86 years [2]. In addition to its relatively high prevalence, olfactory loss impacts on a wide range of functions [6]. Decreased olfaction results in reductions in appetite leading to weight loss and malnutrition [7]. In the presence of impaired smell, disability and diminished quality of life are observed [8–10]. Many studies have also shown a significant relationship between olfactory impairment and depressive symptoms and poor quality of life [10,11]. More recently olfactory impairment has been shown to predict future cognitive decline [12] and Parkinson disease [13].

Despite an improved understanding of olfactory disorders, little is known about the impact of olfactory impairment on patient's lives [8]. Activities of daily living (ADL) measures are commonly used to assess older adults for disability in carrying out daily

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functions including basic ADL such as eating, and instrumental ADL required to function in the community, such as shopping [14]. In a recent Japanese study of 1407 patients from smell and taste clinics, it was shown that the mean number of activities of daily living affected by olfactory loss was 4.70 ± 3.56 for the impaired group compared to 0.61 ± 1.58 for the non-impaired group ($p < 0.01$) [8]. To the best of our knowledge, there is no population-based data available on the relationship between olfactory impairment with activity limitations as assessed by an ADL scale.

Given that olfactory impairment is associated with several negative consequences, it is surprising that there are no epidemiological data available on the contribution of olfactory loss to use of community support services or need for regular help from non-spouse family and/or friends. Understanding the contribution (if any) of olfactory impairment to the type and extent of home care services, both formal (community support services) and informal (non-spouse family/friend) support is needed, and could assist in long-term planning of health services and policies [15].

In the present study, we aimed to use the Blue Mountains Eye (BMES) cohort, a large, representative population of older Australians, to investigate two main study questions: (1) is olfactory loss and the severity of this loss associated with functional disability as indicated by impaired ADL? (2) Does the presence of impaired olfaction increase the likelihood of receiving support from community services and/or non-spouse family/friends?

2. Methods

2.1. Study population

The BMES is a population-based cohort study of common eye diseases and other health outcomes in a suburban Australian population located west of Sydney. Study methods and procedures have been described elsewhere [16]. Baseline examinations of 3654 residents aged >49 years were conducted during 1992–4 (BMES-1, 82.4% participation rate). Of the baseline participants, 2335 (75.1% of survivors) returned for 5-year follow-up examinations during 1997–9 (BMES-2), and 1952 participants (53.4% of the original cohort, or 76.6% of survivors) returned for 10-year follow-up examinations during 2002–4 (BMES-3). The University of Sydney and the Western Sydney Area Human Ethics Committees approved the study, and written, informed consent was obtained from all participants at each examination.

2.2. Questionnaire and physical examination

At face-to-face interviews with trained interviewers, a comprehensive medical history that included information about hearing, demographic factors, socio-economic characteristics and lifestyle factors, was obtained from all participants. Self-rated health was assessed by asking: ‘for somebody your age, would you say your health is excellent, very good, good, fair, or poor?’ Low self-rated health was defined as fair or poor. Walking difficulty or use of a cane, walker or wheelchair was observed by a trained examiner and categorized as ‘disability in walking’. Visual acuity was measured wearing current glasses, using a LogMar chart and was followed by subjective refraction [16]. For each eye, visual acuity was recorded as the number of letters read correctly from 0 (<6/60) to 70 (6/3). Visual impairment was defined as visual acuity of less than 39 letters (<6/12) in the better eye after subjective refraction. Cognitive function was assessed using the mini-mental state exam (MMSE) administered at both the baseline and follow-up visits. MMSE scores range from 0 to 30 [17], with scores <24 indicating cognitive impairment. The 10-item version of the Center for Epidemiologic Studies Depression Scale (CES-D-10) measures depressive feelings and behaviors experienced during the past week [18]. This modified scale has been validated in older samples and found reliable [19]. Each of the 10 items is coded on a scale of 0–3 to give a maximum of 30 points. Higher scores indicate a greater burden of depressive symptoms. A cut-off score of ≥10 out of a total possible score of 30 was used to define participants with significant depressive symptoms [18].

2.3. Olfaction examination

The San Diego Odor Identification Test (SDOIT) [20] and related olfactory and taste questions were a component of the BMES III examination, and complete olfaction and taste data were obtained from 1636 of 1952 (83.8%) BMES-3 participants. Participants were tested individually with the SDOIT, an 8-item odor identification test with a test–retest reliability relatively similar to the 40-item University of Pennsylvania Smell Identification Test (UPSIT) ($r = 0.86$ SDOIT; $r = 0.94$ UPSIT) [21]. Odorants were presented to participants in random order, in an opaque container covered with gauze. An inter-stimulus pause of 45 s was used to prevent adaptation [22]. A picture board illustrating the odorants as well as distracters was used for participants to identify each odorant. Scores were calculated by the number of odorants identified correctly. We defined mild olfactory impairment as less than 6 but greater than 3 correct responses and moderate as 3 or less correct responses out of a total of 8 possible responses.

2.4. Community support services and informal support

To assess use of community support services and dependence on informal supports, participants were asked:

- Do you get regular help from meals on wheels (MOW)?
- Do you get regular home visits from a community nurse?
- Do you get regular visits from homecare?
- Who usually cleans your house? (you, spouse, daughter, son, other relatives, home help, others)
- Who usually does your shopping? (same choices as above)
- Are you able to go out alone?

Dependence on community support services was defined as regular use of MOW, homecare or community nursing. Reliance on informal support was defined as receiving assistance from someone other than a spouse (family member/friend) for cleaning or shopping. In addition, participants’ ability to go out alone was also assessed.

2.5. ADL scale

The Older American Resources and Services (OARS) ADL scale [23] includes 14 items: seven items assess basic ADL (eating, dressing and undressing, grooming, walking, getting in and out of bed, bathing, and continence), and seven items assess instrumental ADL (using the telephone, travel, shopping, meal preparation, housework, taking medicine, and management of finances). Each item was rated on a 3-point scale: performs the activity without help (2), performs the activity with some help (1), or completely unable to perform the activity (0), hence, higher the score the more independent the person is. Participants reporting that they needed help with any of the activities or were completely unable to perform any of the activities were considered to have impaired ADL.

2.6. Statistical analysis

SAS software (v9.1 SAS Institute, Cary NC) was used for analysis, including t-tests, χ^2 tests and logistic regression. Multivariable