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Visual impairment and the need for vision care services amongst older Finnish people receiving home care

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Abstract

Aim: This study aimed to describe visual performance and the need for vision care services among Finnish older people receiving home care. We evaluated the applicability of the Resident Assessment Instrument of Home Care (RAI HC) in identifying visual impairment (VI) and the need for vision care services among older people.

Design: A descriptive quantitative, cross-sectional design.

Methods: Visual impairment and the need for vision care services for older people receiving home care ($N = 70$) were determined by an optometrist's screening examination and vision assessment by home care workers using the RAI HC instrument. In this study, the definition of visual impairment was visual acuity (VA) <0.63 (logMAR >0.2).

Results: According to the distance VA measurements, 41% of the participants showed VI (<0.63) of the better eye, while the RAI HC assessment revealed VI among 36% of the participants. The Kappa value for interrater reliability in classifying VI was 0.137. The optometrist's vision screening examination recognized a previously unknown and unmet need for vision care services more than twice as often as the RAI HC assessment.

KEYWORDS
home care, RAI HC, vision care service, visual impairment

1 | INTRODUCTION

Worldwide demographic changes have led to an increased share of older people in the population (Ritchie & Roser, 2019), which is also increasing the number of older people in need of long-term care. In Finland, and in other European countries, safe aging at home—with support from additional nursing and home help services—is a national goal that has shifted the focus of long-term care for older people from residential care to home care (Boerma & Genet, 2012; Finnish Institute for Health and Welfare, 2020a). Finland's National Programme on Aging 2030 focusses on preventive measures to improve the functional ability of older people and risk groups (Ministry of Social Affairs and Health, 2020). Vision is a major factor that affects an older person's functioning and living at home. However, up-to-date information on the visual performance of home-dwelling older people receiving home care is not available. In 2019, over 100,000 home-dwelling older people (>65 years of age) received regular home care services in Finland. This represents approximately 8% of this age group (Saukkonen et al., 2020).

Although several studies have shown that visual impairment (VI) affects functional ability, overall well-being and quality of life (Lamoureux et al., 2009; Langelaan et al., 2007), the effects of

impaired vision on the everyday lives of older people have not been widely recognized outside of the vision research community (Burton et al., 2021), such as in services for older people. Older people with VI may have difficulties in instrumental activities of daily life (IADL), such as using the telephone, cooking, shopping or taking care of their medication. VI also affects activities of daily living (ADL), such as eating, dressing and walking (Daien et al., 2014; Horowitz, 2004; Laitinen et al., 2009; Lupsakko, 2004), which may reduce the physical activity of the older person and thus affect general health and perhaps muscle strength, further predisposing them to falls (Burton et al., 2021). Due to the risk of falls and accidents (Wood et al., 2011; Zhang et al., 2015), VI also multiplies the risk of hip fracture (Ivers et al., 2000), which is associated with statistically significant treatment costs. In terms of day-to-day life, VI can also decrease quality of life and negatively impact social activity and increase the risk of isolation and a sense of helplessness (Thederan et al., 2016). This may increase the risk of depression (Lamoureux et al., 2009; van der Aa et al., 2015; van Nispen et al., 2016) and anxiety (van der Aa et al., 2015). VI is also associated with the risk of dementia and the acceleration of cognitive decline (Burton et al., 2021; Rogers & Langa, 2010; Zheng et al., 2018).

The vision of home-dwelling older people receiving home care should be regularly assessed to identify changes in vision in a timely manner. Older people have a higher risk of eye diseases, which could lead to permanent VI. Cataracts, age-related macular degeneration (AMD), glaucoma and diabetic eye disease (Evans et al., 2004; WHO, 2019) are the most common diseases causing VI in older people. AMD is the leading cause of permanent VI among individuals over 50 years of age in Western societies (Lim et al., 2012; Ojamo, 2019). Most vision-threatening conditions are treatable when diagnosis and treatment are obtained early enough. In addition to eye diseases, the main causes of VI among older people are uncorrected or under-corrected refractive errors (Steinmetz et al., 2021), and these could easily be treated. Previous research has shown that unrecognized ophthalmologic problems can be identified by basic screening tests in home care (van Nispen et al., 2019). Research also shows that many eye care interventions are cost-effective and that—on a global level—up to three quarters of moderate to severe VI issues are avoidable (Hajek et al., 2016; Steinmetz et al., 2021). Measuring distance visual acuity (VA) currently serves as the gold standard for assessing vision—although it is not sufficient for identifying the need for vision care services (Chandramohan et al., 2016). The Amsler grid test is a simple tool for examining problems in the central area of the retina, and it can be used in home care to screen for AMD (Faes et al., 2014). Intraocular pressure (IOP) indicates pressure inside the eye, and too high a pressure can be caused by glaucoma. IOP can be easily measured at home with rebound tonometry, where a small sensor quickly and painlessly touches the surface of the eye while measuring the pressure in the eye (e.g. iCare®) (Li et al., 2015; Scuderi et al., 2011). In Finland, basic eye care is provided by optometrists and ophthalmologists working in the private sector and partly by general practitioners of public health care.

Home care workers have the key roles of recognizing vision problems and guiding home-dwelling older people to receive detailed eye examinations by optometrists or ophthalmologists. Resident Assessment Instrument for Home Care (RAI HC) is often used to assess vision in home care. It has been used in many home care units in Finland voluntarily since 2000 and is now becoming statutory from March 2023 (FINLEX 980/2012, 2020). The RAI HC instrument assesses overall health, function, social support, service use, mood and behaviour that guide healthcare providers in developing individual care and service plans. The RAI HC instrument also includes vision assessment to screen for VI (Murphy & Finkelstein, 2018). An international organization called InterRAI has developed RAI instruments for various areas of health care, with the assessment for home care (RAI HC) already developed in 1994 for implementation in U.S. nursing homes (InterRAI, 2021). In Finland, home care units mainly use an RAI HC assessment based on the Minimum Data Set (MDS) HC 2.0 form, which covers three distinct aspects of vision. Recognition of the need for vision care services is based on vision, vision problems and vision deterioration (InterRAI Corporation, 2018). Vision assessment is based on the evaluation of how well the individual functions in vision-related activities, such as reading and recognizing individuals in his/her everyday life. In Finland, an RAI HC assessment is required to be done at least twice a year for every home-dwelling older adult receiving home care. The assessment is performed by a nurse trained to use RAI at the older adult's home together with the person themselves and a close relative, as a normal procedure. The assessment guidelines require checking reading ability with a text sample (e.g. newspaper), both eyes open, and with adequate lightning and current eyeglasses (Murphy & Finkelstein, 2018).

The study aimed to assess the prevalence of VI among older people receiving home care and the need for vision care services. Furthermore, we investigated whether the RAI HC assessment is sufficient as such or whether it should be supplemented by another tool suitable for multi-professional use in order to identify vision problems that required attention. Limited empirical knowledge of the topic motivated the research.

2 | METHODS

2.1 | Design and setting

This descriptive, cross-sectional study investigated VI and the need for vision care services among older people receiving home care in Northern Finland. The research data comprise two parts: (1) participants' RAI HC assessment data extracted from patient records by home care nursing staff; and (2) a vision screening examination performed at each participant's home by an optometrist. The data were collected during November and December 2020.

2.2 | Participants

The participants were home-dwelling older people receiving municipal home care services. The data were collected from 7 home

care units, 7–13 participants per unit, with a total of 70 home-dwelling older people participating in the study. This was approximately 10% of the regular home-dwelling older adults receiving home care services provided by the city of Oulu. The home care organization participating in the study selected the participating units. They excluded four units from the study, where data collection could have been challenging due to the units' small sizes or geographic locations. We used a quota sampling strategy and continued the recruitment of participants until we reached the target number. The home care nursing staff recruited the participants based on inclusion criteria, provided them with preliminary information about the study and asked each subject for their consent to participate in the study. The inclusion criteria were as follows: (1) home care client; (2) 65 years of age or older; (3) up-to-date RAI HC assessment (performed in 6 months); and (4) cognitive skills related to daily decisions that were either not impaired or only slightly decreased according to the RAI HC assessment (so that the screening could be performed reliably).

2.3 | Ethics

The city of Oulu approved, and the Regional Ethics Committee (100/2020) supported the study. All the participants received a written cover letter and provided written informed consent for their wish to participate in the study. The study was conducted using good scientific practices (Finnish Advisory Board on Research Integrity, 2012).

2.4 | RAI HC assessment

The home care staff extracted the participant's RAI HC assessment data from the patient record. The RAI HC assessment of the participants was performed by a home care nurse before the data collection as a normal procedure. Data from the RAI HC assessment included year of birth, gender, all diagnoses that could affect the current condition or require medication and/or symptomatic treatment, falls and the threat of falls, and information related to vision, namely visual function, vision problems and potential deterioration of vision.

2.5 | Vision screening examination

Optometrist (T.P, B. Optom with 15 years of experience) performed the vision examination at each older person's home. The optometrist either visited the participant alone or with a home care worker. The optometrist performed an examination between 8 am–1 pm to ensure the alertness of the older person and the suitability of the home care schedule. Optometrist measured presenting distance VA with the Lea Numbers 4M logMAR chart (Lea-Test Ltd, 2018) and used a lighting box to standardize lighting conditions. The optometrist placed the chart 3.2 m from the person (instead of 4 m) because a shorter distance is more suitable for a home environment where the rooms tend to be small and multiplied the obtained VA values by 3.2/4 to correct for the testing distance. The optometrist measured distance VA separately for each eye, and older people who used eyeglasses wore them during the measurements. The threshold for reading a line was set at identifying at least three of five numbers correctly.

The optometrist examined presenting near VA using the Lea Numbers near chart. Older people kept both eyes open and wore glasses if they had during the measurement. The testing distance was 40 cm, and a line was considered read if older people identified three of the five numbers correctly. The optometrist measured the illumination of the near chart with a lux meter and used additional lighting if the illumination was below 300 lux (the recommended level for reading).

The optometrist measured the IOP of each eye using an iCare® IC200 tonometer and performed the Amsler grid test for one eye at a time at a testing distance of 30 cm. If the participant was using multifocal lenses, the researcher paid special attention to ensuring that the older person was looking through the reading area of the lens and that the lens itself did not distort the grid. The optometrist also collected self-reported data on possible AMD diagnosis and treatment.

2.6 | Data analysis

We analysed data using IBM SPSS® statistics software (version 27.0). We characterized the data using descriptive statistics, including the frequencies and percentages of graded variables. We analysed the interrater reliability of visual impairment to compare the results of distance VA measurements and RAI HC assessments using Cohen's Kappa coefficient. In addition, we analysed the association between falls and distance VI using the chi-squared test, where a p-value (<.05) was used to indicate a statistically significant difference.

2.7 | Variables

The RAI HC assessment describes vision and classifies VI into five categories (0–4): adequate (0), (mildly) impaired (1), moderately impaired (2), highly impaired (3) and severely impaired (4), including blindness. We present the definitions for each of these categories in Table 1.

We classified the measured VA into five categories (0–4), ranging from normal (0) to impaired (1–3) and blindness (4). In Finland, the classification of the International Council of Ophthalmology (ICO, 2002) is generally used as the limit for normal VA, according to which it is 0.8, but because VA decreases by aging (Sjöstrand et al., 2011), values 0.63 or higher are considered to represent normal VA in this study. We also used adjusted VA because highly

TABLE 1 Classification and categories of visual impairment based on visual acuity measurement (distance and near) and RAI HC assessment

Classification of visual impairment				
Visual acuity measurement		**RAI HC assessment**		
VA (decimals)		Category		Definition
≥0.63	Normal	0	Adequate	Can read regular text in newspapers/books
<0.63	Mild impairment	1	(Mildly) impaired	Can read large text, but not regular text in newspapers/books
<0.32	Moderate impairment	2	Moderately impaired	Limited vision, not able to read newspaper headlines, but can identify objects
<0.10	Severe impairment	3	Highly impaired	Questionable recognition of objects, but seems to follow objects with his/her gaze
<0.05	Blindness	4	Severe impairment, including blindness	Blind or can only distinguish lights, colours or shapes but does not follow objects with his/her gaze

intensive tasks, such as reading, require 0.63 VA for older people (West et al., 2002). This limit also makes VA measurement and RAI HC classifications comparable (category 1 in RAI HC is defined as can reed book/newspaper). Otherwise, the classification is based on the World Health Organization's (WHO) classification of vision impairment and blindness (WHO, 2019). Categories 2–4 represent legally low vision. We used the same classification for distance and near VA. We present the definitions of the categories in Table 1. We divided the VI identified with the RAI HC and/or VA measurements into five categories for comparison.

In this study, the thresholds for referring to vision care services in the RAI HC assessment were the triggers that appeared in the vision section. Triggers arise when (1) functional vision is assessed between 1–3, (2) the person has problems with vision (seeing halos, curtains, etc.) and (3) vision has deteriorated in 90 days. The thresholds for referring to vision care services by the optometrist's screening examination were abnormal test results based on the general guidelines of optometry: (1) VA is not normal in one or both eyes, which is defined as <0.63 in this study, (2) IOP is >21 mmHg (Jonas et al., 2017), (3) IOP differences >3 mmHg between the eyes (Choudhari et al., 2013; Williams et al., 2011) or (4) the Amsler grid test is not normal.

3 | RESULTS

3.1 | Demographic characteristics of participants

Seventy (N = 70) older people participated in this study, and the average age was 84 years (range 65–95 years, SD ± 7.38). More than half were 85 years of age or older (56%), and the majority of the participants were female (63%). One-third (33%) used reading glasses, which was the most common form of vision correction, while 27% used multifocals, 20% bifocals and 4% a combination of glasses. Sixteen percent (N = 11) of the participants did not currently use any glasses. About eye diseases, 14% (N = 10) and 11% (N = 8) of the participants self-reported diagnoses of AMD and glaucoma, respectively. Nearly half (43%, N = 30) of the participants had diabetes, but only 3% (N = 2) had a diagnosis of diabetic retinopathy. A small proportion of the participants (4%) reported unoperated cataracts, while 3% (N = 2) of the participants had some other eye diagnosis (e.g. amblyopia) based on RAI HC data. The data did not indicate whether the reported ocular diseases were present in both eyes or in only one. Seventeen percent of the participants (N = 12) had fallen during the last 90 days and half of the participants (50%) had the threat of falling, as assessed by home care staff. We have presented the demographic characteristics of the participants in Table 2.

3.2 | Vision examination and RAI HC assessment

3.2.1 | VI based on presenting VA measurement and RAI HC vision assessment

The majority (59%, N = 41) of the participants had normal distance VA. The RAI HC assessments also revealed that most participants (64%, N = 45) had adequate vision. VA measurements demonstrated that the prevalence of mild VI was 27% (N = 19), with the RAI HC assessments showing a similar proportion. The prevalence of moderate to severe VI was 7% (five), according to both VA measurements and RAI HC assessments. In contrast, the VA measurements classified 7% (five) of the participants as blind, whereas the RAI HC assessments classified only one person as blind. Based on the near VA measurements, 40% (N = 28) of the participants had near vision VI, while 23% (N = 16) had mild near vision VI (Table 3).

A comparison of the VI results from the distance VA measurements and RAI HC assessments revealed weak interrater reliability (Kappa 0.137). VA was normal in 67% (N = 30) of the cases, but mild

TABLE 2 Demographic characteristics of participant

	Total (%)	Gender	
		Female (%)	Male (%)
Age (years)			
65–74	10 (14%)	7 (10%)	3 (4%)
75–84	21 (30%)	10 (14%)	11 (16%)
85+	39 (56%)	27 (39%)	12 (17%)
Total	70 (100%)	44 (63%)	26 (37%)
Eyeglasses			
None at the moment	11 (16%)		
Reading	23 (33%)		
Multifocal	19 (27%)		
Bifocal	14 (20%)		
Far and reading	2 (3%)		
Multifocal and reading	1 (1%)		
Known current diagnosis which may affect vision			
Cataract	4 (6%)		
Glaucoma	8 (11%)		
Age-related macular degeneration (AMD)	10 (14%)		
Diabetes (type 1 and 2)	30 (43%)		
Diabetic retinopathy	2 (3%)		
Some other eye diagnosis	2 (3%)		
No current diagnosis which may affect vision	28 (40%)		
Regular ophthalmic check-ups because of long-term (eye) disease(s)	15 (21%)		
Falls in last 90 days	12 (17%)		
Threat of falls	35 (50%)		

VI was present in 27% ($N = 12$) of the participants who had shown adequate RAI HC assessment results. Moreover, of the 16 adults who showed mild VI based on RAI HC assessments, VA measurements demonstrated mild VI in six adults and normal vision in the remaining 10 (Table 4). Notably, in a comparison of the VI results from the measured distance and near VA, interrater reliability was almost perfect (Kappa 0.826). In this study, we found no association among VI (VA; RAI HC), and falls ($\chi^2 = 0.391$, $p = .749$; $\chi^2 = 1.287$, $p = .325$) or VI and the threat of falls ($\chi^2 = 2.885$, $p = .089$; $\chi^2 = 0.062$, $p = .803$).

3.3 | Need for vision care services

3.3.1 | RAI HC assessment

The RAI HC assessments revealed that 36% ($N = 25$) of the participants had a need for vision care services. The need for vision care services was mainly justified by impaired vision (34%, $N = 24$). Vision problems and deterioration only explained two percent (one) of the identified needs for vision care services (Table 5).

TABLE 3 Prevalence of VI according to RAI HC assessment and screening examination

VI	RAI HC assessment	Vision screening examinations	
Category	*N* (%)	Distance (better eye)	Near (both eyes open)
0	45 (64%)	41 (59%)	42 (60%)
1	19 (27%)	19 (2 7%)	16 (23%)
2	2 (3%)	4 (6%)	6 (9%)
3	3 (4%)	1 (1%)	1 (1%)
4	1 (1%)	5 (7%)	5 (7%)

3.3.2 | Vision screening examination

According to the optometrist's vision examination, over 80% ($N = 57$) of the participants had some abnormalities in test results. Based on the legislation, the optometrist should consult an ophthalmologist in all of these cases. The need for a consultation was mostly due to impaired VA in the worse eye. Near VA, IOP and Amsler grid test together increased the need for vision care services by 12%, which was not recognized with distance VA examination. More specifically, the Amsler grid test alone revealed a need for vision care services in 37% ($N = 26$) of the adults, with near visual acuity and IOP measurements revealing a need for vision care services in 40% ($N = 28$) and 13% ($N = 9$) of the participants, respectively (Table 5).

3.3.3 | Previously unknown and unmet need for vision care services

The previously unknown and unmet need for vision care services concerns participants who have not been diagnosed with an explanatory eye disease, such as diabetes, glaucoma, cataract or AMD. The RAI HC assessment identified such a need for vision care services in 11% ($N = 8$) of older people. The corresponding figure at the optometrist's screening was 30% ($N = 21$). For some participants, the recognized abnormality was explained by previously diagnosed conditions. In some cases, the participants had ongoing contact and treatment at an eye clinic. Since patients with diabetes are regularly screened by retinal imaging in Finland, their vision care needs can be expected to be somewhat under control. (Table 5).

4 | DISCUSSION

This study describes the prevalence of VI and the need for vision care services among a sample of Finnish older adults receiving home

TABLE 4 Interrater reliability of VI based on RAI HC assessment and distance visual acuity measurement

		Visual impairment by RAI HC assessment (*N*)						
	Category	0	1	2	3	4	Total	Kappa*
Visual impairment by distance visual acuity measurement (*N*)	0	30	10	0	1	0	41	0.137
	1	12	6	1	0	0	19	
	2	2	1	0	1	0	4	
	3	0	1	0	0	0	1	
	4	1	1	1	1	1	5	
Total		45	19	2	3	1	70	

*Values ≤0 as indicating no agreement and 0.01–0.20 as none to slight, 0.21–0.40 as fair, 0.41–0.60 as moderate, 0.61–0.80 as substantial and 0.81–1.00 as almost perfect agreement.

TABLE 5 Need for vision care services, including a previously unknown and unmet need for vision care services

RAI HC		Vision screening examination	
Visual impairment		**Visual impairment**	
(cat. 1–3)	24 (34%)/8 (11%)	Distance <0.63 in one or both eyes	48 (69%)/16 (23%)
		Near <0.63 both eyes open	28 (40%)/10 (14%)
Vision problems (halos curtains etc.)	7 (10%)/2 (3%)	**Intra ocular pressure >21 mmHg**	9 (13%)/3 (4%)
Deterioration of vision in 90 days	4 (6%)/1 (1%)	**Amsler grid test**	26 (37%)/9 (13%)
Total need	25 (36%)/8 (11%)		57 (81%)/21 (30%)

care. The study revealed at least mild VI (<0.63) in two-fifths of the participants and moderate or severe VI (<0.32) in one-seventh. If we had defined VI based on WHO classification (<0.5), the prevalence of mild VI would be 10%. There are limited studies of VI in older people receiving home care. In addition, definitions of VI and blindness vary, which challenges comparing the prevalence of VI in the present study with previous reports. In European studies of VI among older people in the community and institution, 20–23% have been reported to have mild VI (<0.5) and 8–12% moderate VI to blindness (<0.32) (Evans et al., 2004; Larsen et al., 2019). Higher proportions of VI have been found in American studies of nursing home residents, with half of the participants showing VA <0.5, and 10–18% defined as legally blind (≤0.1) (Andersson et al., 2020; Owsley et al., 2007).

Although the prevalence of VI in the study population was lower than what has been reported in some European and American studies, it was nevertheless approximately two times higher than the prevalence in the Finnish general population representing the same age group (Uusitalo et al., 2018). According to the Finnish National Health study (FinHealth 2017), mild VI (<0.63) was present in 17% of people >80 years of age, while moderate or severe VI was detected in 5.9% of men and 2.3% of women when VA was assessed with the current optical correction in use (Uusitalo et al., 2018). In this study, the prevalence of moderate or severe VI was statistically significantly higher (14%). The National Health Survey did not include measurements taken in the home environment; thus, differences in subject recruitment may explain the noticeable differences in the prevalence of VI in this study and the National Health Survey. An American study noted a similar discrepancy between nursing home patients and the general population; more specifically, the prevalence of VI was 2–2.75 times higher in nursing home patients than in the general population (Andersson et al., 2020). In this study, the prevalence of moderate or severe near VI was also higher than that reported in the National Health Survey 2017 (17% vs. 7.2% in men and 2.2% in women). However, the results of this study are not necessarily comparable to those of studies of the general population. Further studies with large samples are needed to evaluate the VI of home-dwelling older adults receiving home care.

During the vision screening examination, many participants reported that travelling to see an ophthalmologist or optometrist for a vision consultation was either too difficult or too expensive. This may explain the higher prevalence of VI among home care patients than among people who are more able to take care of their personal matters and move around independently. For this reason, the eyeglasses may not be up to date, which leads to VI due to uncorrected and under-corrected refractive errors. Naël et al. (2019) reported that people who were unable to attend an outpatient clinic showed a higher prevalence of uncorrected refractive errors than other populations. According to the National Health Survey 2017, VI could be improved by updated eyeglasses in more than 50% of cases. In other European studies, the prevalence of under-corrected refractive errors among older adults has been reported to be between 2%–39% (Naël et al., 2019; Sherwin et al., 2012). This study did not disclose the prevalence of uncorrected or under-corrected refractive errors, but these problems were seemingly present because many of the participants had eyeglasses that were several years old, and 16% did not use any glasses at present.

Most of the participants lived alone and could not go for an eye examination by themselves and not all had relatives who could help them access services. Living alone is one of the main reasons for unmet needs among subjects receiving home care, with low monthly income and low education levels being the other main explanatory factor (Otero et al., 2003). According to the Finnish Institute for Health and Welfare, 35% of home-dwelling older adults receiving home care do not receive any help from their relatives (Finnish Institute for Health and Welfare, 2020b). These issues should be recognized in home care services to ensure that older people have access to eye care specialists and treatment when needed. Additionally, equal access to vision care services promotes sustainable development, which is also supported by the prevention of VI, to improve the health and well-being of older people. The high prevalence of vision problems can also be partly explained by the fact that the study was conducted during the COVID-19 pandemic, when participants might have intentionally postponed ophthalmologic examinations and/or updating their eyeglasses.

Based on the RAI HC assessments, 34% of the participants showed VI. A similar prevalence (28–41%) of VI was reported in a study from Ontario that also applied RAI HC assessments (Guthrie et al., 2018). In this study, RAI HC assessments and VA measurements quantified the VI among older people at almost even levels. The VA measurements revealed a higher prevalence of blindness. Although the RAI HC assessments and VA measurements classified the same number of individuals into various vision categories, the individuals were classified differently, resulting in a weak Kappa value between distance VA and the RAI HC assessment. Conversely, the Kappa value was almost perfect between distance VA and near VA, indicating that the person's distance and near VA was almost the same. Therefore, the results would have been similar even if the interrater reliability between the RAI HC assessment and the measured near VA had been compared. In further, it seems that it is adequate to screen only distance or near vision to reveal impaired vision.

Based on a low Kappa value between measured distance VA and the RAI HC assessment, it seems that the RAI assessment is not always performed as instructed. Results indicate that vision assessment is, in practice, much based on the home care staff's observations and questions that are strongly influenced by the person's subjective experiences of their vision instead of using text samples or adequate lighting. When RAI assessment is based on older people's self-assessment, they may rate their vision better than it actually is or base their assessment on the perception that vision problems are a normal part of aging (Bergman et al., 1999; Naël et al., 2019), in which case objective VI may not appear. Conversely, VA was normal in 53% of the residents whose vision was assessed as mildly impaired by the RAI HC assessment. This discrepancy may be explained by impaired contrast sensitivity, colour vision or visual field or by not having good lighting at home or not using existing electric lamps. VA and visual function only demonstrate a moderate correlation (Hidalgo et al., 2009), and VA alone does not describe how well a resident performs in vision-related tasks. This may also explain why fewer blind individuals were identified based on the RAI HC assessments than on the VA measurements. Conversely, this may be due to insufficient lighting when reading was tested. In measuring near visual acuity, additional light was needed in all cases, excluding three. A total of ten participants had moderate to severe VI or blindness based on VA measurement, but in three of these ten cases, RAI HC had assessed vision as adequate. This also indicates that text samples are not regularly used in RAI assessments. The text sample should be used with adequate lighting for RAI assessments, and staff members must receive the training needed for reliable vision screening. More attention should be paid to the general lighting of older people's houses, which also prevents falls (Riazi et al., 2012).

Based on the RAI HC assessments, 36% of the respondents had a need for vision care. A previous study from New Zealand (Parsons et al., 2013) that applied the RAI HC assessment reported that 30% of respondents had a need for vision care, with vision care services being recommended to 23% of them. In this study, RAI HC assessments revealed a previously unknown and unmet need for vision care services in 11% of respondents, with the need mainly explained through a VI. The vision screening examination recognized a previously unknown and unmet need for vision care services more than two and half times as often as the RAI HC assessment (30%), mainly because VA was measured monocularly. A previously unidentified need for vision care services occurred, particularly in participants with mild VI or reduced VA in only one eye. Therefore, the RAI assessment should be developed so that the sample text is instructed to be shown to each eye separately or supplemented by a vision screening test (e.g. VA and Amsler grid) that assesses the vision of each eye separately.

Previous research has shown that care at a residential care home does not ensure adequate ophthalmological care (Thederan et al., 2016); hence, older people's vision problems are easily left unidentified (Cook et al., 2006; Lupsakko, 2004). A lack of ophthalmological care among nursing home residents has also been reported (Zolotar & Schrage, 2019). This study showed a similar dynamic, as the RAI HC assessment did not adequately recognize the need for vision care services. Notably, the prevalence of diabetes was 43% among the residents, but only 21% self-reported regular ophthalmic check-ups (e.g. retinal imaging for diabetes). Due to the low prevalence, the validity of the residents' treatment relationship should be reviewed and sufficient guidance and counselling on the importance of control imaging for maintaining eye health and vision should be provided by home care staff. In this study, the association between VI and falls did not appear, which may be due to the small sample size or the fact that participants mainly stayed in a familiar home environment where they could move safely despite VI.

The results of this study indicate that the significance of vision screening from a public health perspective needs to be emphasized in home care, and vision should be given more attention in holistic and restorative care and in the assessment of functioning. Previous studies suggest that high-quality assessment requires a multidisciplinary approach (Vanneste et al., 2015); hence, home care services could use an optometrist as a consultant when triggers in the vision

section of the RAI HC appear. An optometrist has the competence to assess the need for vision care services by considering changes in previous assessments and the effects of eye diseases on vision. However, it should be stressed that vision screening procedures alone will not decrease the prevalence of VI among older people (Clarke et al., 2018) and must be provided in tandem with up-to-date optical correction services, adequate ophthalmological treatment(s) and necessary visual aids. The presented research indicates that further studies on effective vision interventions for home-dwelling older people are needed.

4.1 | Study strengths and limitations

The study included a limited sample size, and the participants were not chosen at random. It is possible that the nurses could have chosen participants who were known to have vision problems, which would have affected the prevalence of visual impairment in the sample. However, the nurses were instructed to pay attention to selection so that knowledge of vision problems among the older people did not, at least consciously, guide the choice of participants. Furthermore, the RAI HC assessment data may be incomplete and not include all diagnoses that impact vision and the number of previously recognized and adequately addressed visual problems may, therefore, be higher than the results indicated. In addition, the reliability of the RAI HC assessment data is unclear. The RAI HC instrument has been in use in the units for years, but there could have been differences in the skills of individual nurses, which affects the quality of the data. The psychometric properties of the RAI HC (MDS) for visual impairment are also unavailable.

The reliability of the optometrist's screening examination is high, as the optometrist was experienced and familiar with the commonly used and clinically accepted instruments used. The visual screening examinations were performed blinded to the RAI assessments, which were gathered from the patient documents only afterwards. Concerning the distance VA measurements, the lighting conditions were standardized, while near VA was measured with additional light if needed. However, only the lower limit of illumination was considered in the near VA measurements. Lighting could vary with additional light, although the researcher tried to take this into account in the measurements. The results may also have been affected by the older people's alertness, which was considered by limiting the number of participants with impaired cognitive skills and scheduling examinations to take place during the morning hours. The fact that screening examinations were made by a single optometrist may also be a limitation.

In this study, the definition of normal VA (0.63) was lower than what has been reported by the International Council of Ophthalmology (ICO) (0.8) but higher than the threshold used in many other visual impairment studies (0.5). We used adjusted VA because VA mildly deteriorates due to normal age-related changes, and the study participants were all of old age (Haegerstrom-Portnoy & Morgan, 2007; Sjöstrand et al., 2011). Having another threshold for normal VA would have affected the results reported in this paper. The definition of normal VA for older people will always be a topic of discussion. The cut-off VA values, which call for a comprehensive vision examination, are also a subject that can cause disagreement between researchers.

5 | CONCLUSION

The prevalence of VI appears to be more common among older people receiving home care than among the general population representing the same age range. Although the RAI HC cannot assess vision as objectively as measurements by an optometrist, it may be adequate for screening impaired vision among older people if a text sample and adequate lighting are used. However, more attention is needed to ensure that the RAI assessment is performed as instructed to obtain high-quality data. In addition, an RAI assessment should be developed to show the sample text to each eye separately in order to identify the needs for eye care services. Home care nurses should comprehend the importance of usable eyesight for older people and know how to reliably assess vision with the RAI. This enables referral for vision consultation services when needed. Minor vision problems are commonly related to refractive errors and can be managed with up-to-date eyeglasses, while symptoms of eye disease need thorough medical eye examination and treatment.

AUTHOR CONTRIBUTIONS

All authors have agreed on the final version and meet at least one of the following criteria [recommended by the ICMJE (http://www.icmje.org/recommendations/)]:

- Substantial contributions to conception and design, acquisition of data or analysis and interpretation of data;
- Drafting the article or revising it critically for important intellectual content.

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CONFLICT OF INTEREST

All authors declare that they have no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data are not publicly available due to privacy or ethical restrictions.

ETHICAL APPROVAL

Ethical Approval to carry out this research by Regional Ethics Committee of Northern Ostrobothnia Hospital District (100/2020) and the city of Oulu. The study was conducted at all stages in accordance with the Declaration of Helsinki to ensure confidentiality and anonymity of the participants.

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