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The Nursing Home Minimum Data Set for Vision and Its Association with Visual Acuity and Contrast Sensitivity

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Abstract

Objectives—To evaluate the association between the Minimum Data Set's (MDS) Vision Patterns section and near and distance visual acuity and contrast sensitivity in nursing home residents.

Design—Cross-sectional study

Setting—Seventeen nursing homes in the Birmingham, Alabama area.

Participants—371 nursing home residents ≥ 55 years old with Mini-mental State Exams of ≥ 13.

Measurements—The MDS 2.0 assessment for vision from the date closest to acuity and contrast sensitivity assessment was obtained from the resident's medical record. Acuity and contrast sensitivity were measured by the ETDRS chart and Pelli-Robson chart, respectively.

Results—The MDS rating of visual status was associated with both distance and near visual acuity and contrast sensitivity. The MDS performed poorly in distinguishing residents with mild versus moderate visual impairment. For residents who were rated on the MDS as having adequate vision, 45.9% had distance acuity worse than 20/40 in the better eye, 72.8% had near acuity worse than 20/40 in the better eye, and 85.8% had contrast sensitivity < 1.50.

Conclusion—The MDS 2.0 assessment for vision in nursing home residents is positively associated with visual acuity and contrast sensitivity, but does not adequately distinguish between individuals with mild versus moderate visual impairment and classifies many as having adequate vision who have visual impairment. The validity of the MDS 2.0 as a mechanism for triggering comprehensive eye care for nursing home residents is questionable.

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Keywords

MDS; vision; nursing home

Introduction

Vision impairment is a common problem among nursing home residents. Studies estimate that between 24 to 57% of older nursing home residents are visually impaired and 5 to 11% are legally blind.¹⁻⁶ As much as two-thirds of vision impairment among residents may be due to untreated refractive error and cataract.²⁻⁷ It has been demonstrated that refractive error correction and cataract surgery can improve visual function and vision-related quality of life, slow functional decline and reduce depressive symptoms among nursing home residents.⁷⁻⁹ Despite the high prevalence of vision impairment and the existence of interventions proven to be effective in reversing vision impairment in the nursing home, research has suggested that less than 50% of residents ever receive an eye examination after placement.¹⁻⁵ Eye examinations are not federally mandated for nursing home residents.¹⁰

The Omnibus Budget Reconciliation Act of 1987 (OBRA-87) required the implementation of the National Resident Assessment Instrument (RAI) for all nursing homes participating in Medicare and Medicaid programs in the United States. The RAI is comprised of two parts, the Minimum Data Set (MDS) and Resident Assessment Protocols (RAPs). Residents are evaluated using the MDS on admission, quarterly, annually, and whenever there is a significant change in status.¹¹ The MDS is completed by each facility's designated RAI/MDS nurse coordinator and ideally incorporates input from multiple sources, including the resident and other healthcare providers in the nursing home. MDS assessments provide a systematic evaluation for use by care plan teams to determine areas of functional disability among nursing home residents.¹² The visual assessment piece of the currently administered MDS 2.0, a section collectively referred to as "Vision Patterns," assesses three areas (Appendix 1): 1) quality of vision, 2) visual limitations/difficulties, and 3) use of visual appliances. Ratings reflect status over the previous week.

Valid assessments on the MDS 2.0 Vision Patterns questions are important for guiding subsequent care. Assessments of impaired, moderately impaired, or highly impaired vision, the presence of side vision problems, or a known diagnosis of cataracts or glaucoma, will trigger the care plan team to review the Resident Assessment Protocol (RAP) specific to visual function. The RAP is used to identify and review areas that may contribute to visual problems that need additional assessment, and then guides the care plan team in formulating new or updated vision related care plans which target the identified deficient areas. For this system to function as intended, the MDS must be a valid screening assessment of the visual status of residents. The only previous study on this topic evaluated the MDS version 1.0 and showed poor correlation between the MDS vision assessment and visual acuity in that the MDS ratings characterized residents as having better vision than their actual visual acuity measurements showed.¹³ This is problematic since the MDS's goal is to serve as a trigger for further assessment. The purpose of the current study is to evaluate the association between the MDS 2.0 assessment of Vision Patterns and objective measures of visual acuity and contrast sensitivity in a large sample of nursing home residents.

Methods

Study Design and Participants

A detailed description of the study sample has been provided previously.⁴ Briefly, of 33 nursing homes in the Birmingham, Alabama metropolitan area, 17 facilities participated in

the project. The balance were not included because they were either a long distance from the University of Alabama at Birmingham, had other research projects ongoing in the facility, or the administrator declined on behalf of the facility. Each of the participating nursing facilities had an optometrist available who visited the facility on a routine basis to provide eye care services. Potentially eligible residents were identified by the unit charge nurse as persons who would be cognitively able to read letters from a chart even if visually impaired. In addition, residents had to be at least 55 years of age, English speakers, and have a Mini-Mental State Examination (MMSE)¹⁴ score of ≥ 13 since aspects of the main study's protocol required participants to follow directions and answer questions about health and well-being. Research has shown that subjects with MMSE scores greater than 13 can reliably answer questions concerning their health and functional status.¹⁵⁻¹⁷ Written informed consent was obtained from both the resident and their sponsor (family member or guardian) after explaining the nature and purpose of the study. This research project was approved by the University of Alabama at Birmingham Institutional Review Board and followed the Tenets of the Declaration of Helsinki.

Data Collection and Variable Definitions

Data was collected through medical chart review, subject interviews, and direct assessment. The number of medical conditions was based on review of the most current charted ICD-9 lists. Length of stay was based on date of first admission. Visual acuity and contrast sensitivity were measured by trained research staff in the resident's room or other area with adequate lighting. These tests were administered while the resident wore the habitual prescriptive lenses as routinely used in everyday life. Distance acuity was measured with the ETDRS chart using the standard protocol with acuity expressed as logMAR (log minimum angle of resolution) units.¹⁸ ETDRS charts using logMAR units are the gold standard in ophthalmic research and have many design advantages over traditional Snellen charts. Using these charts visual acuity can be measured as a true continuous variable while allowing for conversion to the more familiar Snellen fraction. Near acuity testing was measured using the Lighthouse Near Visual Acuity Chart at 40 cm with acuity also expressed in logMAR units. Contrast sensitivity was measured by the Pelli-Robson chart¹⁹ following the standard protocol with scoring by the letter-by-letter method.²⁰ Pelli-Robson charts are designed with triads of letters of approximately 20/200 size. As one proceeds down the chart contrast of the letter triads fades while the letter size remains constant. Pelli-Robson scores below 1.45 have been associated with nursing home placement, falls, lower levels of physical function and poor performance of activities of daily living and instrumental activities of daily living.²¹⁻²² Meaningful changes in have been shown to be 0.3 log units or six letters.

Assessments made on the Vision Patterns section from the MDS 2.0 completed closest in time to the objective visual function assessment described above, were obtained from the medical record. The Vision Patterns section is comprised of the following three areas: (1) Vision, assessing the resident's ability to see in adequate light with glasses if used. Possible responses are based on definitions associated with near vision capabilities and range from 0 (adequate) to 4 (severely impaired) (Appendix 1); (2) Visual limitations/difficulties, assessing the presence of side vision problems/decreased peripheral vision, and whether the resident sees halos or rings around lights, flashes of lights, or "curtains" over the eyes; and (3) Visual appliances, assessing whether the resident uses specified optical devices; responses are "Yes" or "No". For the purposes of this study, only the vision item was used due to the small number of participants who were rated as having visual limitations/difficulties. Moreover, for vision item levels 3 ("highly impaired") and 4 ("severely impaired") were collapsed to a single group, again owing to the small number of subjects in these groups.

Statistical Analysis

For analysis purposes, logMAR distance and near acuity was converted to Snellen equivalents and then categorized into four levels -- 20/25 or better, worse than 20/25 to 20/40, worse than 20/40 to 20/200, worse than 20/200, and contrast sensitivity was categorized into six levels from 0 to >1.5 in 0.3 unit increments. The association between the categorized measures of near and distance visual acuity and contrast sensitivity and MDS impairment level was evaluated using chi-square tests. T-tests were used to compare these same vision variables in their continuous form (e.g., logMAR) across MDS impairment levels. Specifically, each level of MDS impairment was compared to the adjacent, lower level of impairment; for example, the "impaired" group was compared to the "adequate" group; the "moderately impaired" group was compared to the "impaired" group and so on to assess the vision sections utility in distinguishing visual acuity levels. P-values of ≤ 0.05 (two-sided) were considered statistically significant.

Results

The sample consisted of 371 residents. The mean age was 81 years (SD 8.2) with a range of 60 to 102 (Table 1). Approximately $\frac{3}{4}$ of participants were white. Women comprised 81% of the sample. Most participants had been residents for at least a year with a mean length of stay of 1.9 years (SD 2.0) years and a range of 0.1 to 12.4 years. Mean MMSE score was 20.9 (SD 4.7). MMSE scores less than 24, typically used as a cut point for cognitive impairment indicative of dementia, were seen in 66% (247 of 371) of subjects. Participants had a mean of 5.6 chronic medical conditions (range= 0 to 15). The MDS rating for quality of vision ranged from 0 to 4. The majority of residents (59%) were rated as having "adequate" vision, with 29% rated as having "impaired" vision and 9% with "moderately impaired" vision. Together, "highly" and "severely impaired" vision represented about 2% of the sample.

Mean distance acuity in the better eye for the participants was 0.43 logMAR (~20/54) with a range from -0.06 to 1.1 logMAR (20/17 to 20/251). Distance acuity in the worse eye ranged from 0.02 to 1.2 logMAR (20/21 to 20/317). Acuity worse than 20/40 in the better eye is a frequently used criterion in the United States for defining visual impairment. Using this criteria 211 of 369 (57.1%) of the subjects were visually impaired (Table 3). Acuity worse than 20/200 in the better eye, defining legal blindness in the United States, was present in 23 (6.2%) of participants. The World Health Organization defines low vision as less than 20/60 in the better eye.²³ If this criterion is applied approximately one-third of the population would be defined as having low vision (32%). Mean near acuity was poorer by about a line as compared to distance acuity in both the better and worse eye. Mean near acuity in the better eye was 0.57 logMAR (~20/45) with a range of -0.04 to 1.4 logMAR. Mean near acuity in the worse eye was 0.81 logMAR (~20/129) with a range of 0 to 1.4 logMAR. Clinically, print size of 1.0M (metric notation) is often used as a criterion reference for the size of newspaper text. Print this size is approximately 1.45 mm tall. At the common reading distance of 40 cm this size text requires approximately 20/50 acuity to be read. If the conservative criterion of 20/60 near acuity is applied using the acuity in the better eye, 190 of 369 (51.4%) of the sample would be expected to have difficulty reading regular newspaper size print.

Table 2 shows the distribution of visual acuity and contrast sensitivity in the better eye stratified by MDS rating levels. Almost half of residents who were rated on the MDS as having adequate vision (45.9%) had distance acuity worse than 20/40; for near acuity, this percentage was even higher (72.8%). Conversely, all those who were rated as being severely or highly impaired had distance and near acuity worse than 20/40, with 62.5% and 75% having distance and near acuity, respectively, of 20/200 or worse. About 86% of those rated

on the MDS as having adequate vision had contrast sensitivity worse than 1.50. Conversely, all those rated as severely or highly impaired on the MDS had contrast sensitivity worse than 1.20.

Average visual acuity and contrast sensitivity worsened with increasing MDS impairment ratings (Table 3). Comparisons between the adequate and impaired MDS levels revealed that visual acuity was statistically worse in the impaired group. However, when comparing the impaired and moderately impaired groups, only distance visual acuity demonstrated a statistically significant difference. The declines in visual acuity between the moderately and highly/severely impaired groups were all statistically significant.

Discussion

The present study investigated the association of the MDS's Vision Patterns section with logMAR visual acuity and Pelli-Robson contrast sensitivity measurements. We found that although the MDS 2.0 Vision Patterns section was significantly associated with visual acuity and contrast sensitivity, it was unable to distinguish between persons with mild and moderate visual impairment. Additionally, many residents with visual acuity and contrast sensitivity impairments who would be likely candidates for clinical interventions to improve vision were classified as having adequate vision on the MDS, and thus there would be no trigger for eye care. These results argue against using the MDS as a primary assessment tool for identifying nursing home residents in need of eye care. As it functions currently, the MDS is useful for identifying only those with extremely poor vision. Our results in this regard are similar to those of Thapa and colleagues who found the MDS to have adequate validity in identifying residents with severe visual impairment.²⁴ In their study, 59.5% of residents rated on the MDS as severely visually impaired had measured near visual acuity greater than Jaeger 66, a large typeset denotation used by printers.

This study utilized data compiled from the MDS version 2.0. Compared to the original version of the MDS, the MDS version 2.0 expanded its level of descriptors for the Vision Patterns section from four to five. The original version's Visual Patterns section was found to have marginal inter-rater reliability ($r = 0.55$) between trained research nurses on the vision assessment piece²⁵ and poor reliability ($r = 0.15$) on the visual limitation/difficulties question.²⁶ In the only study that specifically evaluated the validity of the vision patterns section of the original MDS, the vision assessment showed poor correlation with clinically measured visual acuity and was unable to distinguish between persons with mild and moderate impairment; additionally, the MDS assessment of side vision failed to correctly identify any residents with clinically demonstrable loss of side vision.¹³ The results from the present study suggest that little improvement in validity has occurred with the MDS version 2.0.

Regarding the vision patterns section, we have a few recommendations for improvement. First, the descriptors for vision levels should be made more specific in order to improve the ability of the MDS 2.0 to better approximate actual standards for visual acuity definitions for unimpaired, mild, moderate, and severe impairments, and no vision/blindness. For example in the impaired category, the term "large print" is ambiguous and a definition of font size, such as the metric size 4M, would reduce ambiguity. In the moderately impaired category, the ability to identify objects could further be defined into ability to see a specific sized object at a specific distance, such as a 12 ounce drink can at 40 cm. Based on the current definitions there is little clinical distinction between the highly impaired and severely impaired categories. Both represent extreme visual impairment. Moving "sees only light, colors or shapes" to the highly impaired category and reserving severe impairment for the small numbers of persons with total blindness would reduce the overlap. In its current form,

ambiguously defined category levels likely contributes to the MDS 2.0 providing serious overestimates of residents' actual visual functional capabilities.

A strength of the study is that it is the first examination of the validity of the MDS version 2.0's vision pattern section and that visual acuity and contrast sensitivity were assessed using valid and reliable instruments. Weaknesses must also be acknowledged. Residents with MMSE < 13 were excluded because the parent study required participants to answer simple questions about health and activities. Additionally, we were unable to analyze the validity of MDS levels 3 (highly impaired) and 4 (severely impaired) separately due to limited subject numbers in these categories. Based on national MDS data from the Active Resident Reports, 7.5% of the nursing home population had vision rated at MDS level 3, and 2 % at level 4, 27 which is considerably higher than in our sample. Temporal issues can affect validity evaluations of the MDS.²⁸ It is possible that visual status may have deteriorated between the MDS assessment and our study visit when visual acuity and contrast sensitivity was assessed. However, this problem was minimized since the most recent MDS assessment abstracted from the chart was on average 5.6 (s.d. 3.4) months before the vision assessments.

Unless changes in federal mandates take place and a comprehensive eye examination is required for nursing home residents, the MDS Vision Patterns will continue to be a primary way to identify residents with vision problems in need of care and remediation. Unfortunately, evaluation teams are faced with a difficult task. The most affective way to screen older adults for visual impairment remains an unresolved problem. High contrast visual acuity and self report of vision difficulty inadequately characterize vision function.²⁹ Most research supports a battery of tests for vision screening that would be difficult to implement in the long-term care setting.²⁹ The MDS 3.0 is currently under development. Beta versions of the MDS 3.0 show that no modifications have been made to the vision question,³⁰ suggesting that the validity problems discussed here will persist. The side vision question has however been deleted. Future studies should focus on identifying methods to improve the validity of this new version.

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Appendix 1. Items from the MDS 2.0 Vision Patterns Section

Item and Response Options	
Vision	
0. ADEQUATE --	sees fine details, including regular print in newspapers/books
1. IMPAIRED --	sees large print, but not regular print in newspapers/books
2. MODERATELY IMPAIRED --	limited vision, not able to see newspaper headlines, but can identify objects
3. HIGHLY IMPAIRED --	object identification in question, but eyes appear to follow objects
4. SEVERELY IMPAIRED --	no vision or sees only light, colors or shapes, eyes do not appear to follow objects
Visual Limitations/Difficulties	
a.	Side vision problems--decreased peripheral vision (e.g. leaves food on one side of tray, difficulty traveling, bumps into people and objects, misjudges placement of chair when seating self)
b.	Experiences any of the following: sees halos or rings around lights, sees flashes of light, sees curtain over eyes

Item and Response Options

c. None of the above

Visual Appliances

Glasses, contact lenses, magnifying glass

0. No

1. Yes

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Table 1

Demographic and Medical Characteristics (N = 371)

	n/mean	%/SD
Age, n (%)		
60-69	38	10.4
70-79	122	32.9
80-89	155	41.8
≥90	56	16.0
Race, n (%)		
White	272	73.3
Black	98	26.4
Hispanic	1	0.3
Gender, n (%)		
Female	299	80.6
Male	72	19.4
Education, n (%)		
High school graduate or greater	179	50.8
Less than high school graduate	183	49.2
Number of Medical Conditions [†] , M (SD)	5.6	3.0
Length of Stay, years, M (SD)	1.9	2.0
Mental Status, n (%)		
27-30	47	12.7
23-26	104	28.0
20-22	72	19.4
16-19	82	22.1
13-15	66	17.8
Minimum Data Set, Vision n (%)		
0-adequate	220	59.2
1-impaired	107	28.8
2-moderately impaired	35	9.4
3-highly impaired	4	1.1
4-severely impaired	5	1.3
Contrast Sensitivity - Better Eye, log sensitivity, M (SD)	1.14	0.35
Contrast Sensitivity - Worse Eye, log sensitivity, M (SD)	0.83	0.52
Near Visual Acuity - Better Eye, log MAR, M (SD)	0.56	0.32
Near Visual Acuity - Worse Eye, logMAR, M (SD)	0.81	0.37
Distance Visual Acuity - Better Eye, logMAR, M (SD)	0.43	0.29
Distance Visual Acuity - Worse Eye, logMAR, M (SD)	0.64	0.33

[†]Number of individual ICD-9 diagnoses from medical chart

Table 2
Distribution of Visual Acuity and Contrast Sensitivity in the Better Eye Stratified by MDS Rating Levels

	MDS level					X ²	P-value
	Adequate n (%)	Impaired n (%)	Moderately Impaired n (%)	Severely/Highly Impaired n (%)	Total N (%)		
Distance Acuity							
20/25 or better	34 (15.5)	8 (7.6)	0	0	42 (11.4)	80.1	<.0001
Worse than 20/25 to 20/40	85 (38.6)	24 (22.6)	7 (20.0)	0	116 (31.4)		
Worse than 20/40 to <20/200	97 (44.1)	66 (62.3)	22 (62.9)	3 (37.5)	188 (50.9)		
20/200 or worse	4 (1.8)	8 (7.6)	6 (17.1)	5 (62.5)	23 (6.2)		
Near Acuity							
20/25 or better	7 (3.1)	1 (0.9)	0	0	8 (2.2)	72.1	<.0001
Worse than 20/25 to 20/40	53 (24.1)	14 (13.2)	6 (17.1)	0	73 (19.8)		
Worse than 20/40 to <20/200	155 (70.5)	74 (69.8)	19 (54.3)	2 (25.0)	250 (27.8)		
20/200 or worse	5 (2.3)	17 (16.0)	10 (28.6)	6 (75.0)	38 (10.3)		
Contrast Sensitivity							
≥1.50	31 (14.2)	4 (3.8)	0	0	35 (9.5)	136.9	<.0001
1.20 to <1.50	125 (57.3)	43 (40.6)	16 (45.7)	1 (12.5)	185 (50.4)		
0.9 to <1.20	46 (21.1)	32 (30.2)	6 (17.1)	1 (12.5)	85 (23.2)		
0.6 to <0.3	15 (6.9)	15 (14.1)	6 (17.1)	0	36 (9.8)		
0.3 to <0.6	1 (0.5)	8 (7.6)	3 (8.6)	1 (12.5)	13 (3.5)		
<0.3	0	4 (3.8)	4 (11.4)	5 (62.5)	13 (3.5)		

Table 3Mean Acuity and Contrast Sensitivity by MDS Category¹

	MDS Level						
	Adequate	Impaired	P-value 0 vs. 1	Moderately Impaired	P-value 1 vs. 2	Severely/Highly Impaired	P-value 2 vs. 3
Contrast Sensitivity, Better Eye, M (SD)	1.25(.23)	1.05(.36)	<.0001	0.95(.48)	0.13	0.26(.55)	<.0001
Contrast Sensitivity, Worse Eye, M (SD)	0.97(.45)	0.69(.54)	<.0001	0.59(.56)	0.18	0.04(.47)	<.01
Near Acuity, Better Eye, M (SD)	0.47(.24)	0.66(.33)	<.0001	0.74(.39)	0.13	1.19(.36)	<.0001
Near Acuity, Worse Eye, M (SD)	0.70(.34)	0.93(.36)	<.0001	1.00(.38)	0.28	1.34(.15)	<.01
Distance Acuity, Better Eye, M (SD)	0.34(.23)	0.51(.30)	<.0001	0.61(.31)	0.04	0.92(.29)	<.01
Distance Acuity, Worse Eye, M (SD)	0.55(.31)	0.73(.33)	<.0001	0.83(.29)	0.09	1.06(.07)	.05

¹ P-values for t-tests comparing visual function at higher MDS level and next lower level (e.g. 0 vs.1, 1 vs. 2, 2 vs. 3). Categories 3 and 4 were combined for analysis.