Received: 4 September 2020 | Revised: 19 February 2021 | Accepted: 23 April 2021 | Published online: 19 April 2021

DOI: 10.1002/trc2.12172

Alzheimer's & Dementia
Translational Research & Clinical Interventions

RESEARCH ARTICLE

Investigating the effects of impairment in non-verbal communication on neuropsychiatric symptoms and quality of life of people living with dementia

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Funding information
National Institute for Health Research; Biomedical Research Centre at South London; Maudsley NHS Foundation Trust and King's College London; National Institute for Health Research; Biomedical Research Centre at South London; Maudsley NHS Foundation Trust and King's College London

Abstract

Introduction: People living with dementia in nursing homes have complex needs; impairments in cognition, communication, and daily function; neuropsychiatric symptoms (NPS); and poor quality of life (QoL). The current study examines impairments in non-verbal communication as a potential driver of NPS and QoL.

Methods: One hundred nursing home residents with dementia were assessed using the Emory Dyssemia Index (EDI), Neuropsychiatric Inventory Nursing Home version (NPI-NH), Quality of Life in Alzheimer's Disease (QoL-AD) at baseline, 12-, and 24-week follow-up.

Results: The quantile regression (0.5) model indicated that impairment of non-verbal communication was independently associated with the severity of NPS ($P = .001$) and proxy reported QoL ($P < .05$), levels of agitation ($P < .05$), and professional caregiver burden ($P < .05$).

Discussion: These results highlight a novel potential approach to improve NPS and QoL using retained elements of non-verbal communication, particularly for people with severe dementia.

KEYWORDS
care needs, dementia, neuropsychiatric symptoms, nursing homes, quality of life

1 | INTRODUCTION

Worldwide, there are more than 45 million people living with dementia (PlwD); this number is likely to double every 20 years, reaching 75 million by 2030. Approximately one third of people with dementia live in nursing homes in the United States and Western Europe.[1–3] The majority of these individuals have moderate or severe dementia and may have complex care needs resulting from a combination of cognitive and functional deficits, with neuropsychiatric symptoms (NPS) and physical health comorbidities. All of these factors impact on well-being and quality of life (QoL).[4–8] Most of the unmet care needs may arise owing to dementia-related impairments in communication and the difficulty of expressing those needs.[9,10] As communication problems increase with disease progression, they are likely to present

more opportunities for breakdowns and frustration for caregivers and their care recipients.[11,12] Care recipients may respond to these communication breakdowns with a potential increase in frustration and aggression.[13] Impairments in verbal communication have been identified as an important association of impaired QoL and an increase in NPS.[14–18]

Interventions, such as the WHELD training program, which focus on improved verbal communication and increased social interaction, confer significant benefits in NPS and QoL, but these benefits are largely restricted to people with mild–moderately severe dementia who have retained verbal skills. There is a significant unmet need related to the development of interventions tailored to the needs of people with severe dementia.[19]

In severe stages of dementia, care staff's understanding of the non-verbal cues of the person with Alzheimer's disease (AD) in communicating their needs may play a significant role in the delivery of their care. There is preliminary research to suggest that some staff are aware of the importance of tailoring their non-verbal communication with care home residents. For example, a qualitative analysis of ethnographic research reported that staff in a nursing home believed that making the correct interpretations of body language required them to know the resident well.[20]

Non-verbal communication remains a relatively unexplored area in dementia care[21] with very little focus on the potential relationship between non-verbal communication and QoL and NPS. A key question, therefore, is whether we can better understand impairments in non-verbal communication and whether this could offer novel therapeutic opportunities—particularly for people with more severe dementia. NPS are associated with an increase in caregiver burden. Agitation is one of the most common NPS, often occurring during personal care, with a higher impact on caregiver burden,[22–24] with previous work suggesting that verbal communication impairments may be linked to this; however, the contribution of non-verbal communication has not been established.

Both NPS and QoL are extremely important outcomes for PlwD and are potentially related to communication. The current study investigates two primary hypotheses, evaluating associations between both NPS and QoL and non-verbal communication impairment. Our primary hypotheses are that: (1) there is a significant association between non-verbal communication and NPS and (2) there is a significant association between non-verbal communication and QoL. Associations between non-verbal communication and care needs, levels of agitation, and professional caregiver burden were evaluated for secondary hypotheses.

HIGHLIGHTS

- 2.0 People living with dementia (PlwD) in nursing homes have non-verbal communication impairments, which substantially impact neuropsychiatric symptoms and quality of life.
- 2.0 A proxy assessment was conducted to measure non-verbal communication.
- 2.0 Non-verbal communication is likely to play a key role in improving communication and engagement with PlwD.
- 2.0 Awareness of these issues has potential implications for a greater therapeutic input.
- 2.0 There is an urgent need for intervention training programs for care staff using specific communication strategies to modify their cues to meet needs of PlwD.

RESEARCH IN CONTEXT

1. **Systematic review**: Little is known about the full impact and importance of non-verbal communication in people living with dementia (PlwD). Developing and delivering effective interventions to promote quality of life (QoL) and to reduce neuropsychiatric symptoms (NPS) more tailored to the needs of people with limited communication skills will rely on a more detailed understanding of non-verbal cues to connect with others.
2. **Interpretation**: Our results suggest that impairment in non-verbal communication is associated with QoL, frequency and severity of NPS, agitation, and professional caregiver burden of PlwD in nursing homes. These results highlight the importance of non-verbal communication in improving QoL and NPS for people with dementia and highlight specific treatment opportunities.
3. **Future directions**: There is an exciting opportunity to develop and evaluate interventions using preserved non-verbal skills of PlwD to facilitate connection and engagement.

2 | METHODS

A longitudinal cohort design was used to assess the association between non-verbal and verbal communication and both NPS and QoL in people with probable or possible AD in nursing home settings. Proxy-rated assessments were used to evaluate non-verbal cues across three time points: baseline, 12 weeks, and 24 weeks.

2.1 | Participants

Participants were residents in UK nursing homes, who fulfilled the NINCDS/ADRDA (National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association) criteria for possible or probable AD.[25]

All residents lacked mental capacity to consent to participating in this study, according to UK law; informed consent was obtained through the involvement of a nominated or personal consultee who represented the residents' interests and wishes in accordance with the

Mental Capacity Act 2005[26] and International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use Good Clinical Practice (ICH-GCP). The study was fully approved by Cambridgeshire 3 Ethics Committee (REC Reference 09/HO306/53).

2.2 | Measures

Impairment in non-verbal communication was assessed using the Emory Dyssemia Index (EDI) scale.[27] The proxy-rated EDI scale was conducted with care staff who knew the resident well (mainly a key worker). EDI subscales reflect this definition and are rated for frequency of occurrence on a 5-point scale ranging from "never" (1) to "very often" (5). The EDI scale measures impairment in the use of ten individual non-verbal cues including gestures, gaze and eye contact, facial expressions, conversational skills, paralanguage (paralinguistic skills), non-verbal receptivity, space and touch, social rules and norms, chronemics (use of time), and objectics (study of human use of clothing and other artifacts as non-verbal cues). A higher score indicates more severe impairment. EDI was originally validated by teachers for students (10–11 years old) and consistently used clinically with parents to measure non-verbal social behaviors; it has a test–retest reliability of .86 for the total score[27] and a Cronbach's alpha of 0.97.[28] The EDI tool exhibited good internal consistency for measuring impairment in non-verbal communication ($\alpha = .809$) for people with moderate to severe stages (FAST 5–7) of dementia during the current study. A literature review of the available non-verbal communication tools did not identify any specific tools assessing non-verbal communication in PlwD. The findings of the review identified EDI as a brief and potentially appropriate tool for studying non-verbal communication in dementia.[29] The EDI scale was considered best suited for the needs of the current study and the cohort.

Expressive and receptive language function of PlwD was assessed using the Sheffield Screening Test for Acquired Language Disorders (STALD).[30] The cut-off < 15 on the STALD is optimum for detecting overall language impairment with good sensitivity (89%) and specificity (88%). A separate analysis of receptive skill has previously shown that a cut-off < 7 has good specificity (85%) and sensitivity (79%). For the expressive subscale, the cut-off point is < 9 with good specificity (89%) and sensitivity (82%).[31]

Overall NPS were assessed by informant interview using the Neuropsychiatric Inventory-Nursing Home Version (NPI-NH). The NPI-NH[32,33] was developed to assess NPS of PlwD; these included delusions, hallucinations, agitation, dysphoria, anxiety, apathy, irritability, euphoria, disinhibition, and aberrant motor behavior. In addition to the total score, an agitation cluster score was also calculated.[34]

The occupational disruptiveness scale for the NPI-NH was completed to assess professional caregiver burden reflecting how much, if any, increase in work, effort, time, or distress was related to occurrence of NPS.

QoL in dementia was assessed using the Quality of Life in Alzheimer's Disease scale (QoL-AD). There are 13 items including physical health, energy, mood, living situation, memory, family, marriage or significant other, friends, self as a whole, ability to do chores around the house, ability to do things for fun, money, and life as a whole. As the current study focused predominantly on people with moderately severe to severe dementia, the proxy score from an informant (key worker) was used to measure QoL. QoL-AD scales with two or more items missing were excluded.[35,36]

Total number of care needs was assessed using the Camberwell Assessment of Need for the Elderly (CANE)[37,38] and the Functional Assessment Staging Tool (FAST)[39] was used to stage functional dementia severity along with the Mini-Mental State Examination (MMSE).[40]

2.3 | Analysis methods

To assess the primary and secondary hypotheses, a quantile regression was used to investigate the effects of impairment in non-verbal communication on baseline overall NPS, QoL for baseline cross-sectional scores, while controlling for dementia severity (FAST stages), age, sex, and education. The score for NPS (NPI A-J total score) and total QoL-AD proxy-reported score were used as the primary outcome measures. To test the secondary hypotheses, we assessed the association between communication and other outcome measures, including the scores for total number of needs and professional caregiver burden and total score for agitation. Quantile regression was carried out using the package STATA 15 (StataCorp).

To confirm the consistency of cross-sectional associations, which is important given the fluctuating nature of NPS in PlwD, further exploratory Spearman's correlation analysis was undertaken to report on longitudinal associations between the above outcome measures and scores for communication impairment at 12 and 24 weeks. Given that some measures were only collected at baseline, the Spearman's correlation was considered the adequate analysis method compared to the regression analysis for follow-up time points.

An examination of impairment in non-verbal communication between moderate–severe and severe dementia groups was assessed using the Mann-Whitney *U* test with Bonferroni correction. For the ten EDI subscales, the Bonferroni significance level was set at $P < .005$ ($P = .05/10$).

3 | RESULTS

3.1 | Baseline data

One hundred fifty-eight people living with probable or possible AD in 21 nursing homes were invited to take part in the study, of which 100 participants were assessed at baseline for the study; 44 had severe dementia, 53 had moderate or moderately severe dementia, and 1 had mild dementia, per the FAST stages. Thirty-one percent of the sample were male and 69% were female and the mean age was 85 years. Sociodemographic and pathological variables are listed in Table 1.

TABLE 1 Sociodemographic and pathological variables

Characteristics	Baseline scores		
	Mean/percentage	SD	Range
Age	85	6.8	69–98
Biological sex (female)	69	69	69–31
Ethnicity	81 White, 7 African/Caribbean, 4 Asian, 8 Unknown	n/a	n/a
Education	74 School to 16, 6 16–18 years, 6 18 plus—University, 14 Not known	n/a	n/a
FAST	6	0.6	4–7
MMSE	6.13	7.57	0–28
EDI	128.7	36	83–232
STALD[a]	6.49	7.11	0–19
Total number of needs	15.8	3.3	1–23
NPI-NH, A–J Total	11.4	12	0–39
NPI-NH professional caregiver burden	3.7	4.8	0–18
QoL-AD proxy reported	29.82	4.2	21–39

[a]Only 76 individuals with dementia completed STALD ($N = 24$), due to severity of cognitive impairment.
Note: Missing variables: 14 were missing data on Education.
Abbreviations: EDI, Emory Dyssemia Index; FAST, Functional Assessment Staging Test; MMSE, Mini-Mental State Examination; NPI-NH, Neuropsychiatric Inventory–Nursing Home; QoL-AD, Quality of Life in Alzheimer's Disease; SD, standard deviation; STALD, Sheffield Screening Test for Acquired Language Disorders.

TABLE 2 Mann-Whitney *U* test comparing two study groups (moderate/severe and severe dementia) for EDI subscales

Variable	Group	Median	Z	Mann Whitney	*P*-value
Objectics	Moderate–severe AD	20.00	−4.54	584.50	$P < .001$
	Severe AD	28.00			
Non-verbal receptivity	Moderate–severe AD	16.00	−3.24	769.00	$P = .001$
	Severe AD	25.00			
Paralanguage	Moderate–severe AD	9.00	−3.28	756.50	$P = .001$
	Severe AD	13.00			
Social rules	Moderate–severe AD	12.00	−2.68	849.00	$P = .007$
	Severe AD	20.00			
Gaze & eye contact	Moderate–severe AD	8.00	−1.95	966.00	$P = .052$
	Severe AD	12.00			
Facial expression	Moderate–severe AD	10.00	−2.36	900.00	$P = .018$
	Severe AD	12.00			
Hands gesture	Moderate–severe AD	7.00	−1.04	1136.50	$P = .360$
	Severe AD	7.00			
Conversational skills	Moderate–severe AD	14.00	−0.74	1127.00	$P = .406$
	Severe AD	15.00			
Space touch	Moderate–severe AD	10.00	−0.83	1119.00	$P = .408$
	Severe AD	12.00			
Chronemics and use of time	Moderate–severe AD	10.00	−1.04	1096.50	$P = .300$
	Severe AD	11.00			

Note: Data shown for two groups using the Functional Assessment Staging Test (FAST) stages 6 (moderate–severe) and 7 (severe).

3.2 | Impairment of non-verbal communication in moderate–severe and severe dementia

There was a significant difference in level of impairment in non-verbal communication between moderate–severe (FAST stage 6; median = 132.00) and severe stages of dementia (FAST stage 7; median = 167.45), using EDI total score. People with severe dementia exhibited significantly higher EDI total scores compared to people with moderate–severe dementia (U = 745.000, Z = -3.382, $P = .001$). There was also a significant difference in scores between people with moderate–severe and severe dementia for 3 of the 10 EDI subscales. People with severe dementia exhibited significantly greater impairment in non-verbal receptivity (U = 769.000, Z = -3.242, $P = .001$), paralanguage (U = 756.500, Z = -3.282, $P = .001$), and objectics non-verbal skills (U = 756.500, Z = -3.282, $P = .001$), see Table 2. Figure 1 shows hand gestures and gaze were least impaired in moderate–severe stages, followed by gaze, paralanguage, facial expressions, and space/touch non-verbal skills. Likewise, in severe stages of dementia, hand gesture non-verbal skills were least impaired, which was followed by chronemics (use of time), space touch, gaze, and facial expressions.

3.3 | Quantile regression analysis

Findings of the quantile regression (0.5) model indicated that impairment of non-verbal communication was independently associated with the severity of NPS and proxy-reported QoL. Furthermore, the associations between impairment in non-verbal communication and overall NPS ($P = .001$), proxy-reported QoL ($P < .05$), levels of agitation ($P < .05$), and professional caregiver burden ($P < .05$) maintained significance even in the presence of other covariables (Table 3).

3.4 | Consistency associations

Of the 100 residents interviewed at baseline, 79 were followed up at 12 weeks (25 males and 54 female), 23 residents deceased, and

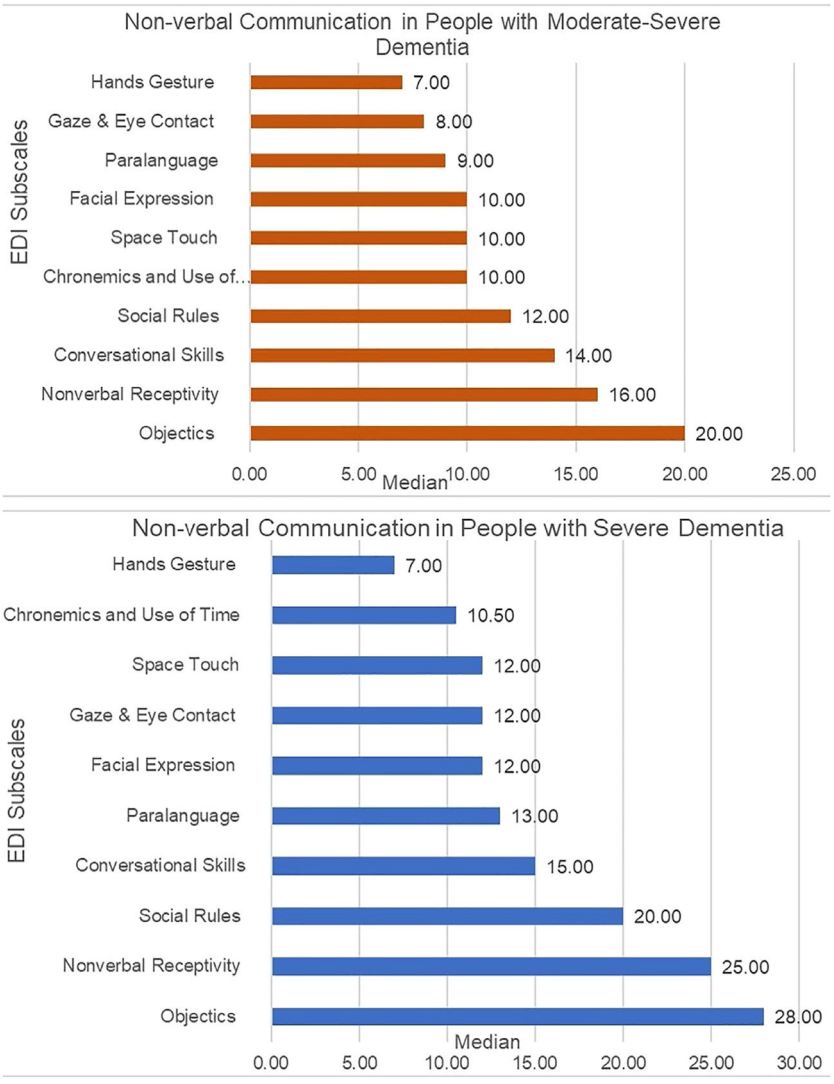

FIGURE 1 Impairment in non-verbal communication in moderatesevere and severe groups, indicating least and most impaired non-verbal communication skills

TABLE 3 Regression output to predict key outcomes

NPI total items A–J	Coef.	Std. Err.	T	P > t	[95% Conf.	Interval]
EDI total, baseline	0.159	0.046	3.430	.001	0.067	0.251
FAST stage	−3.726	4.044	−0.920	.359	−11.757	4.305
Age	-0.221	0.284	-0.780	.439	−0.784	0.343
Sex	0.290	4.110	0.070	.944	−7.872	8.452
Education	0.002	0.005	0.370	.714	−0.009	0.013
_cons	10.914	24.579	0.440	.658	−37.903	59.730
Proxy-reported QoL-AD	**Coef.**	**Std. Err.**	**T**	**P > t**	**[95% Conf.**	**Interval]**
EDI total, baseline	−0.031	0.013	−2.360	.020	−0.057	-0.005
FAST stage	−1.396	1.150	−1.210	.228	−3.680	0.887
Age	−0.065	0.081	-0.800	.423	−0.225	0.095
Sex	0.393	1.168	−0.340	.737	−1.928	2.713
Education	0.002	0.002	1.380	.170	−0.001	0.005
_cons	41.499	6.988	5.940	.000	27.621	55.378
NPI Agitation total	**Coef.**	**Std. Err.**	**T**	**P > t**	**[95%Conf.**	**Interval]**
EDI total, baseline	0.058	0.026	2.230	.028	0.006	0.110
FAST stage	−2.359	2.270	−1.040	.301	−6.869	2.150
Age	−0.050	0.159	−0.31	.755	−0.366	0.267
Sex	−1.484	2.307	−0.640	.522	−6.067	3.099
Education	0.001	0.003	0.290	.769	−0.005	0.007
_cons	5.093	13.800	0.370	.713	−22.316	32.502
NPI CD total	**Coef.**	**Std. Err.**	**T**	**P > t**	**[95% Conf.**	**Interval]**
EDI total, baseline	0-.046	0.020	2.350	.021	0.007	0.085
FAST stage	−2.149	1.721	−1.250	.215	−5.567	1.268
Age	−0.0802	0.121	−0.66	.508	−0.320	0.160
Sex	−1.697	1.749	−0.970	.334	−5.171	1.776
Education	−0.001	0.002	−0.220	.827	−0.005	0.004
_cons	9.109	10.460	0.870	.386	−11.665	29.883
Total number of care needs	**Coef.**	**Std. Err.**	**T**	**P > t**	**[95% Conf.**	**Interval]**
EDI total, baseline	0.008	0.006	1.300	.198	−0.004	0.020
FAST stage	−0.081	0.537	−0.150	.880	−1.149	0.986
Age	0.026	0.038	0.68	.495	−0.049	0.101
Sex	0.845	0.546	1.550	.125	−0.239	1.930
Education	0.000	0.001	−0.480	.632	−0.002	0.001
_cons	11.257	3.267	3.450	.001	4.768	17.746

Note: Data presented quantile regression (0.5) for baseline scores.
Abbreviations: EDI, Emory Dyssemia Index; CD: Caregivers Disruption on NPI measuring professional caregiver burden; FAST, Functional Assessment Staging Test; NPI-NH, Neuropsychiatric Inventory–Nursing Home; QoL-AD, Quality of Life in Alzheimer's Disease.

1 resident transferred to another nursing home. Seventy-one participants (23 males and 48 female) were followed at 24 weeks. Further information on assessment completion is given in Appendix Table A.

There was a significant association between greater impairment of non-verbal communication and increased frequency and severity of overall NPS at 12 weeks ($r = .416$, $P < .001$) and 24 weeks ($r = .301^*$, $P < .05$). An association between impairment in non-verbal communication and reduced proxy-reported QoL was indicated at 12 weeks ($r = -.245^*$, $P < .031$) and 24 weeks ($r = -.434^{**}$, $P < .001$), see Table 4.

Agitation also showed a significant association with impairment in non-verbal communication at 12 weeks ($r = .413^{**}$, $P < .001$) and 24 weeks ($r = .271^*$, $P < .05$). In addition, a significant correlation was identified between greater impairment in non-verbal communication and higher professional caregiver burden at 12 weeks ($r = .444^{**}$, $P < .001$) and 24 weeks ($r = -.275^*$, $P < .05$). The association between

TABLE 4 Associations between impairment in communication and key outcome measures

	EDI total score 12 weeks	EDI total score 24 weeks	STALD total score 12 weeks	STALD total score 24 weeks
NPI total items A–J	.416** $P < .001$ ($n = 78$)	.301* $P = 0.011$ ($n = 70$)	−0.179 $P = 0.205$ ($n = 52$)	−0.234 $P = .127$ ($n = 44$)
NPI baseline agitation cluster score	.413** $P < .001$ ($n = 77$)	.271* $P = .023$ ($n = 70$)	−0.116 $P = .417$ ($n = 51$)	−0.096 $P = .533$ ($n = 44$)
NPI-NH Professional caregiver burden	.444** $P < .001$ ($n = 78$)	.275* $P = .021$ ($n = 70$)	−0.215 $P = .126$ ($n = 52$)	−0.155 $P = .316$ ($n = 44$)
Total number of care needs	0.201 $P = .077$ ($n = 78$)	0.215 $P = .073$ ($n = 70$)	−0.208 $P = .140$ ($n = 52$)	−0.272 $P = .075$ ($n = 44$)
Proxy-reported QoL-AD	−.245* .031 ($n = 77$)	−.434** $P < .001$ ($n = 70$)	0.240 .094 ($n = 51$)	0.273 $P = .076$ ($n = 43$)

Note: Data presented on Spearman's correlation at week 12 and week 24.
Abbreviations: EDI, Emory Dyssemia Index; NPI-NH, Neuropsychiatric Inventory–Nursing Home; QoL-AD, Quality of Life in Alzheimer's Disease; STALD, Sheffield Screening Test for Acquired Language Disorders. ** significant at the 0.01 significance level, *significant at the 0.05 significance level.

impairment of non-verbal communication and the total number of care needs was not maintained at any other follow-up time points. Verbal communication did not present association with any of the outcomes studied at longitudinal intervals.

4 | DISCUSSION

The current study identified significant associations between impairments of non-verbal communication with QoL, NPS, and specific NPS subsyndromes, namely agitation. A significant association with professional caregiver burden was also reported. These associations were further identified at both 12 and 24 weeks demonstrating consistency over time.

Importantly, these results indicate that non-verbal communication, which has been relatively ignored as an intervention focus for people with dementia, could provide a new opportunity to develop interventions with a broad range of benefits for nursing home residents with dementia and for staff, and may be particularly important in developing interventions and facilitating better communication for people with severe dementia.

The current report builds on previously suggested associations between impairments in verbal communication and NPS[15] but indicates that impairments in non-verbal communication have a greater impact on NPS and QoL in people with moderate to severe dementia. A likely explanation is that with a decline in non-verbal communication, people are less able to maintain meaningful social interactions, and less able to communicate care needs, with likely impacts on care needs, caregiver burden, and QoL.[20] Impaired non-verbal communication may also lead to misperception of intentions; an increased likelihood of perceiving risk or threat; and possibly to an increase in agitation, aggression, and other NPS in response.[13]

Previous work has suggested that people with severe dementia obtain less benefit than people with moderate or moderately severe dementia from interventions that promote social interaction and personalized activities. This may relate in part to the reliance on verbal communication strategies within these interventions.[19] The current data emphasize the importance of developing interventions that are more tailored to the needs of people with more severe dementia, who may rely more on non-verbal cues to communicate and connect with others.[19] People with severe dementia have the highest needs and lowest QoL but have been largely ignored by research funders. Our results provide a platform for an exciting opportunity to develop an intervention tailored to the needs of these individuals.

There is emerging evidence that interventions such as storytelling and music, which include some non-verbal elements, confer benefits,[41–45] but the literature pertaining to specific interventions targeting non-verbal communication are much more limited. For instance, a recent small-scale study ($N = 5$) by Ellis and Astell[44] examined non-verbal cues to promote social interaction and communication for PlwD with limited verbal communication skills. All participants retained repertoire of non-verbal cues including eye gaze, emotion expressions, and gestures, characterized with increasing gaze, smiling, and imitation behavior during non-verbal communication interaction intervention sessions.

The findings of this article build on the preliminary evidence, elaborating on specific impairments in key non-verbal cues for people with severe dementia. The current study highlights aspects of non-verbal communication that are relatively preserved even in people with moderately severe and severe dementia, including hand gestures and gaze, which could form the basis of new interventions to promote improved

communication and facilitated social interaction. Of note, an intervention from the learning disabilities literature using non-verbal cues for developing joint attention has shown to improve engagement and interaction.[46–50] Joint attention develops specific skills involving sharing attention through gestures; pointing, showing, and coordinating gaze between targeted objects and individuals to create joint engagement; and a turn-taking channel for mutually sustained engagement. Overall, the current report presents a more in-depth understanding of retained non-verbal skills, and an opportunity to build an evidence-based non-verbal communication platform, working with specific individualized retained non-verbal communication skills to improve interactions in severe stages during which communication can be most challenging. In our cohort, the best retained non-verbal cues included hand gestures, eye gaze, space/touch, and facial expressions and paralanguage. Notably, use of hand gestures was least impaired in both people with moderate to severe and severe dementia. These findings allude to the potential of developing an effective communication interaction program for PlwD with clear recommendations to train care staff to modify their communication cues to meet the needs of individuals with dementia who can no longer speak. Appropriately powered investigational interventional research is required to draw firm conclusions regarding non-verbal communication as a therapeutic tool within the dementia population.

4.1 | Limitations

The current findings contribute to identifying the link between impairment in non-verbal communication and NPS and QoL of PlwD in nursing home settings. There are no gold standards for measuring QoL and there are challenges with all approaches to measuring QoL in PlwD. Both proxy and self-reported QoL measuring scales have their apparent strengths and weaknesses. The current study focused on participants with moderate to severe dementia, for whom inaccuracies in self-report measures necessitate the use of proxy-reported QoL-AD scores, although it is acknowledged that this approach also has limitations.

Caution is needed when inferring an association between non-verbal communication and QoL, as there are a number of potential confounding factors. For the purpose of analysis, the association between non-verbal communication and QoL was significant in a regression analysis that included potential confounding factors, including dementia severity (FAST stages), age, sex, and education, which gives more confidence in the analysis, but replication studies will be helpful in confirming the association.

While further work is needed for the development of interventions focusing on more effective person-centered care, the study highlights a potentially important area for further education for care staff in nursing home settings.

ACKNOWLEDGMENTS

We acknowledge the support of Jean Beh and Jemuwem Eno-Amooquaye in the data collection and editorial assistance of this manuscript. We thank the National Institute for Health Research (NIHR) Biomedical Research Centre at South London and Maudsley NHS Foundation Trust and King's College London for supporting the Care Home Research Network infrastructure that supported the conduct of this study. This study represents independent research funded by the National Institute for Health Research (NIHR) Biomedical Research Centre at South London and Maudsley NHS Foundation Trust and King's College London. The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR, or the Department of Health and Social Care.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to report.

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How to cite this article: Khan Z, Da Silva MV, Nunez K-M, et al. Investigating the effects of impairment in non-verbal communication on neuropsychiatric symptoms and quality of life of people living with dementia. *Alzheimer's Dement*. 2021;7:e12172.

APPENDIX

TABLE A. BASELINE AND FOLLOW-UP TIME POINTS ASSESSMENTS

Descriptive statistics							
Variables	**(N)**	**Mean**	**Median**	**SD**	**25%**	**50%**	**75%**
EDI total score, baseline	100.00	151.03	143.00	43.27	115.00	143.00	187.00
EDI total score, week 12	78.00	153.90	144.50	41.01	121.50	144.50	189.00
EDI total score, week 24	70.00	155.23	148.00	40.71	119.50	148.00	185.00
STALD total score, baseline	76.00	6.49	3.00	7.11	0.00	3.00	14.50
STALD total, week 12	52.00	6.48	1.00	7.62	0.00	1.00	14.75
STALD total, week 24	44.00	6.61	2.50	7.49	0.00	2.50	15.00
Total number of care needs, baseline	100.00	15.74	16.00	2.84	15.00	16.00	17.00
Total number of care needs, week 12	79.00	15.35	16.00	3.37	14.00	16.00	17.00
Total number of care needs, week 24	71.00	15.51	16.00	3.84	14.00	16.00	18.00
QoL-AD proxy-reported total score, baseline	100.00	29.82	30.00	4.37	27.00	30.00	33.00
QoL-AD proxy-reported total score, week 12	78.00	28.63	29.00	5.24	25.00	29.00	32.25
QoL-AD proxy-reported total score week, 24	70.00	28.76	28.00	5.03	26.00	28.00	32.00
NPI total items A–J only, baseline	100.00	14.95	10.00	15.17	3.00	10.00	24.00
NPI total items A–J only, week 12	79.00	13.05	7.00	15.31	1.00	7.00	18.00
NPI Total items A–J only, week 24	71.00	14.54	8.00	15.82	1.00	8.00	22.00
NPI caregiver disruption total items A–J only, baseline	100.00	4.91	3.00	5.90	0.00	3.00	8.00
NPI caregiver disruption total items A–J only, week 12	79.00	5.14	4.00	5.78	0.00	4.00	8.00
NPI caregiver disruption total items A–J only, week 24	71.00	4.31	3.00	5.36	0.00	3.00	6.00
NPI agitation, baseline	100.00	6.44	4.00	7.59	0.00	4.00	11.50
NPI agitation, week 12	78.00	6.65	5.00	7.51	0.00	5.00	12.00
NPI agitation, week 24	71.00	7.70	3.00	13.46	0.00	3.00	12.00

Abbreviations: EDI, Emory Dyssemia Index; NPI-NH, Neuropsychiatric Inventory–Nursing Home; QoL-AD, Quality of Life in Alzheimer's Disease; SD, standard deviation; STALD, Sheffield Screening Test for Acquired Language Disorders.