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Intentional rounding delivering tailored prompts to promote independent eating in older people during lunchtime meals in Nursing Home: a pragmatic clustered pre-post intervention study

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Abstract

Background Eating difficulties may lead to malnutrition in older adults living in nursing homes (NHs). Prompts to encourage independence have been shown to be effective. However, due to limited resources and the varying quality of dining rooms where residents sit together at the table, it is difficult to provide tailored prompts.

Objective Evaluating the effects of interventions based on tailored prompts delivered by deliberately circling the tables (hereinafter, intentional rounding) in the dining room where residents sit to eat their meals on (a) independence in eating, (b) fluid and (c) food intake, and (d) time taken to eat the meal, compared with usual care in NHs with different quality environments.

Methods A pre- and post-intervention pragmatic cluster study with 106 residents of four Italian NHs (NH1, 2, 3 and 4). During lunch, residents were seated at a table and received tailored prompts with a positive focus, mediated by intentional rounding. Data was collected at baseline (T0 and T1, three weeks), during the implementation of the intervention (T2 and T3, one week each) and at follow-up (T4, after one week interruption of the intervention). Self-feeding dependency (Edinburgh Feeding Evaluation in Dementia scale), food and fluid intake (from 0 to 100% of total meal or fluid served) and meal duration (in minutes) were analysed using Seemingly Unrelated Regression, adjusting for the quality of the NH environment and the number of family caregivers present.

Results Eating performance improved in all residents and food and fluid intake increased from baseline (T0) to the end of the intervention (T3); however, residents did not maintain their intake after the intervention was interrupted. The time required for residents to complete the meal was > 19 min at T0 and > 21 min at T3. There were differences in the effectiveness of the intervention depending on the quality of the environment in the NHs.

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Conclusions Compared to usual daily care, prompts from caregivers through scheduled rounds at the tables where residents sit to eat their lunch are effective in improving feeding performance and food and fluid intake. However, after one week, when usual care is resumed, all outcomes deteriorate slightly, indicating that the interventions require continuity.

Clinical trial number Not applicable.

Keywords Dependence, Eating, Environment, Intentional rounding, Pragmatic, Prompts, Nursing homes, Older individuals

Background

Among the several issues of older people living in Nursing Homes (NHs), eating difficulties range from 23 to 50% of residents [1–3]. Over the years, a body of knowledge have been produced on interventions maintaining independence and ensuring adequate nutrition to prevent negative clinical conditions, such as pressure ulcers, sarcopenia [4] and underweight, all predicting increased mortality [5]. However, for nurses and nursing aides, promoting independence in eating is a challenge due to the huge number of residents at need of individualised support at the same, the documented shortages in nursing care and the influence of other environmental factors, e.g., pressure in delivery meals due to competitive tasks and time scarcity. The challenging times that we have in front, due to increased older individuals living in NH, the lack of nursing and informal care resources also in the dining rooms where residents are used to eat, requires innovative approaches to promote the best quality of care. Therefore, this study aims to increase knowledge about how promote independence of residents eating in the dining room in NHs with different quality of environments.

Interventions promoting eating independence and their underlying mechanisms

Studies on interventions to promote independence in eating have steadily increased over the past 60 years. Available reviews [6–9] have summarized the conceptual frameworks to design effective interventions, although only a few studies have explained the reasons and theories behind the interventions tested [9]. Biological (e.g., swallowing disorders), cognitive (e.g., mirror neurons and Montessori method), emotional and behavioural (e.g., behaviour impaired by needs-driven dementia), social (e.g., proximity, familiarity), and environmental (e.g., socio-ecological model) [9] mechanism have been documented as facilitating or hindering the self-feeding skills. To promote and maintaining eating independence, different environmental and behavioural interventions have been measured in their effectiveness [7]. Environmental [7] or indirect [10] interventions include changing routines, environment or social context or a mix of them. Examples of these are the reduction of interruptions, changes in the style of food delivery, music, food aroma, decorations or ambience adaptation, the presence of other residents or informal caregivers [7, 8, 10, 11]. Differently, behavioural [7], or direct [10] interventions are tailored to the older or their caregivers to promote knowledge, attitudes, skills, or habits [7, 8, 10, 11], or at prompting patients by inciting them before and during meal consumption with the intent to increase independence.

According to their nature, prompts delivered by health care professionals to residents living in NHs have been categorised as: (a) tactile (e.g., offering food immediately after tactile prompts); (b) motivational (e.g., adopting positive reinforcements when the resident finalises the eating tasks); (c) role modelling (e.g., residents with feeding difficulties are positioned between independent residents, so that the latter can be see a good example to imitate); (d) verbal (e.g., inviting residents to eat/drink); and (e) non-verbal (e.g., filling the glass) [12, 13]. However, despite their extensive application in daily care, few studies aiming at evaluating prompts' effectiveness have been conducted to date [11]. In 1986 [14], a milestone study involving 42 NH residents reported increased energy and protein intakes for those receiving gentle touch and verbal prompts during meals. Perivolaris and colleagues [15] documented the value of prompts mixed with strategies enhancing the quality of the environment such as music, menu board and cues; moreover, Simmons and colleagues [16] mixed prompts with assistive eating, all documenting improved daily caloric intake and success in weight maintenance. Furthermore, Coyne and Hoskins [17] and van Ort and Phillips [13] reported that direct verbal prompts with positive reinforcement, behavioural guidance and cueing improved eating independence in residents with dementia. In addition, Beattie and colleagues documented an increase in the proportion of food eaten in a case study involving three participants and assessing gentle hand touches on the shoulder and residents reconduction to the Table [18]. However, despite these multiple efforts, available studies present some limitations concerning the involved population. The number of participants was limited, ranging from three [18] to seventy-six [16]; they were affected by mild-severe dementia and not compared to a control group

[8]; moreover, all studies available did not consider the influence of the NH environment that have been recognized to significantly affect eating performance through its physical, social, and cultural influence [19]. Appropriate lighting, sounds, spatial and visual elements, adaptive devices, finger food, food delivery, and dining routines have all been identified as factors influencing eating abilities [19]. Furthermore, person-centred and social characteristics of the environment during the mealtime have been proved to moderate the association between energy intake and eating challenges, highlighting the role of social aspects and the presence of other people during the mealtime [20, 21]. Residents in NHs typically eat at tables with others; therefore, delivering individualised prompts it might affect the eating performance of each resident sitting around a Table [22]. However, delivering tailored prompts in a dining room may not be easy for a range of elements: the number of residents eating together; the risk to create confusion thus altering the calm environment recommended, or the risk to offer more prompts to some residents and leave without stimulation other because of the time scarcity. In addition, research on prompts has not considered the effects of the presence of families, which has been documented to ameliorate eating performance [23] and significantly improve the protein and energy intake [2]. Overall, no study has attempted to combine a systematic approach to the provision of prompts considering the needs of older people eating in a dining room close to other residents, the quality of the NH environment and the presence of family caregivers. The intention of this study was to advance the knowledge in this direction.

Aims

To evaluate the effects of interventions based on tailored prompts delivered by deliberately circling the tables (hereinafter, intentional rounding) in the dining room where residents sit to eat their meals on (a) self-feeding independence, (b) fluid and (c) food intake, and (d) time taken to eat the meal, compared with usual care in NHs with different quality environments.

Methods

Study design

A pragmatic clustered pre – post intervention study design was performed in 2019. In the pre-intervention phase (T0, T1) residents were exposed to the usual care and baseline data on both NHs and residents was collected. The intervention phase was then implemented (T2, T3), followed by a washout phase, during which residents received the usual care. At the end of the washout phase, the final data collection (T4) was conducted (Fig. 1).

Setting and participants

The study was conducted in four public NHs in northern Italy, homogeneous in terms of admission criteria, nursing care offered, and regulatory rules. Residents were eligible if they: (a) had lived in the identified NHs for at least six months; (b) were not clinically unstable as measured by the Val.Graf tool [24] and did not require planned hospitalisation or medication changes; (c) did not have dysphagia; (d) required assistance with eating, as demonstrated by the Edinburgh Feeding Evaluation in Dementia Scale (EdFED) [10], where they reported a score of ≥ 2; (e) were 65 years or older; and (f) were accustomed to eating

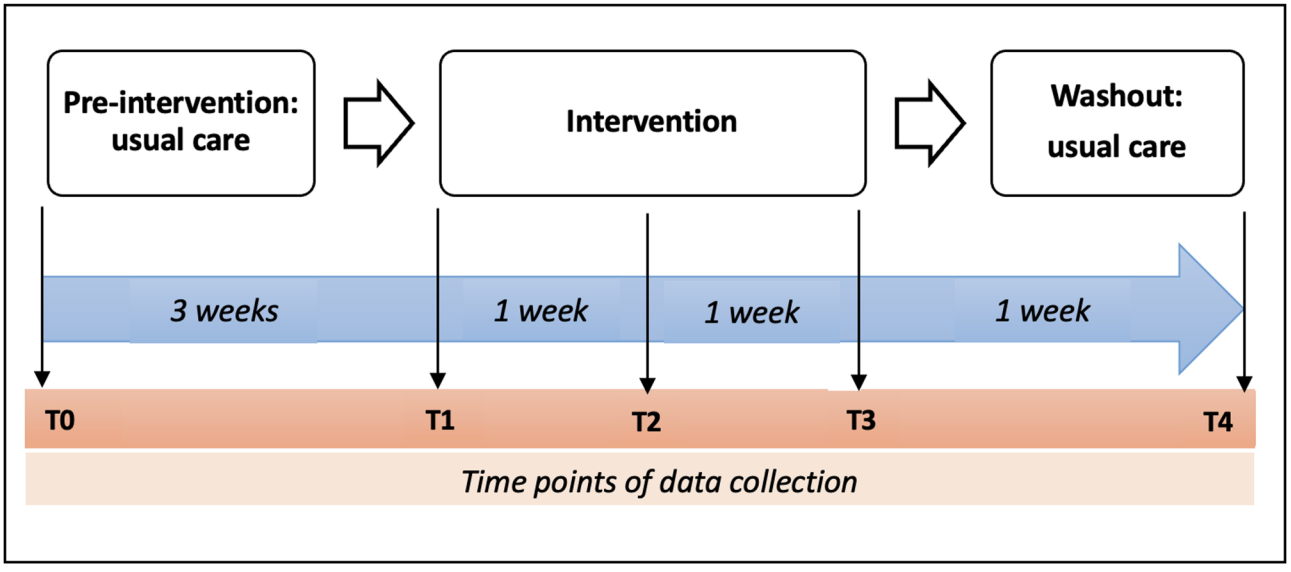

Fig. 1 Study phases. Legend. T0, baseline; Tl the day of the intervention implementation; T2 after 7 days of implementation; T3, after 14 days of implementation; T4 after one week of washout as a follow-up measure

at the dining room table with other residents. Those residents who did not meet the inclusion criteria and those who were admitted during the study were all excluded.

Sample size

The sample size was established considering an average decline of feeding performance of around 0.23 (Standard Deviation 0.80) out of four points (from 0 total independent) as measured every six months in residents living in similar settings in the same region [25, 26]. The size was calculated by estimating the changes in feeding performance with an effect size close to the observed decline (fixed at 0.25), a significance level equal to 0.05 (alpha), and the power of the testing procedure equal to 0.8 (1-beta). In particular, the sample size was computed by using the following formula (based on the paired t-test): n=((t_{n-1,alpha/2}+t_{n-1,beta})^2)/(d^2); where d = eff_size/sd(diff), t_{n-1,alpha/2}, and t_{n-1,beta} were the quantiles of the Student's t distribution (1.98896 and 0.8459733 respectively). As a result, the estimated sample size was 83 residents. However, to avoid the effect of non-sampling errors (for instance, the death of an included resident), the final sample size was 100 residents across the four selected NHs.

Intervention

The intervention combined prompts (Supplementary Table 1) and intentional rounding [27], which combines the theoretical principles of tailored prompts, person-centred care approaches, the human need for proximity and the therapeutic principles of the environment [28]. Prompts were delivered passing from one table to another, starting with the resident with the greatest food dependency and then de-escalating to the others sitting at the same table (= intentional rounding). It was assumed that the prompts offered to the first resident were also useful for those who needed less support. The prompts delivered were:

- prescriptive, supportive, and informative in nature, tailored to residents by progressively focusing on those mostly perceived as effective and preferred by residents by the researcher (e.g., informative vs. prescriptive), thus promoting the person-centre care;
- positively oriented, non-pressing, and positive tone prompts;
- delivered systematically, thus rhythmically and repetitively with appropriate spacing between prompts, intending to avoid stress and anxiety in the residents.

First, a map of residents' sitting positions was prepared by two researchers considering the established daily routines of the NH: each table was formed by the same residents (Fig. 2) to promote relationship. To each table, the degree of dependence in self-feeding was measured with the EdFED [10], the and the resident with the highest dependence was identified.

According to therapeutic environment principles, it has been suggested that sitting near others during mealtimes could promote independence in eating by observing and mirroring the behaviour of others [29]. Therefore, the residents who sat at the same table and ate independently should act as 'role models' for the more dependent residents.

Prompts were delivered by four researchers, one in each NHs. They were nurses, trained to sit in a chair positioned near the resident having the highest dependence in eating, to promote a close eye contact; the distance was around one metre to avoid intrusion and ensure the human need for proximity [28]. Intentional rounds were offered systematically from the beginning of each meal until its end. The rounds were carried out until the last resident had finished his/her meal. Therefore, each resident had the opportunity to receive more prompts at each meal.

Measurement and instruments

Baseline data

First, the quality of the environment of the NHs were assessed using the Italian version of the Therapeutic Environment Screening Survey for Nursing Homes (TESS-NH) tool [22]. The TESS-NH consists of 13 dimensions and 84 items, and the total score ranges from 0 to 149 points, where a higher score means a higher therapeutic environment [30]. Dimensions refer to unit autonomy, outdoor access, exit control, maintenance of spaces, cleanliness, safety, lighting, visual/tactile stimulation, noise, space/setting, familiarity/home likeness, and orientation/cueing [30]. The Italian version validation confirmed the content and face validity and demonstrated good inter-rater reliability (continuous variables, $r \geq 0.971$; non-continuous variable, $K \geq 0.779$), stability over time (Test-retest, $r > 0.848$, $k > 0.976$), and criterion validity ($r > 0.500$) for all dimension except one [22].

Then, the baseline residents' characteristics were collected using multiple tools:

- Demographic data, clinical stability, and verbal and physical aggressiveness: The Italian Val.Graf tool [24] was used. It is an Italian geriatric and multidimensional assessment tool composed of 99 items aimed at evaluating functional, clinical, psychological, and social conditions of residents living in NHs. A higher total score corresponds to a more sever loss of autonomy. The tool proved to be a good criterion validity when compared to other two relevant tools on daily activities and cognitive

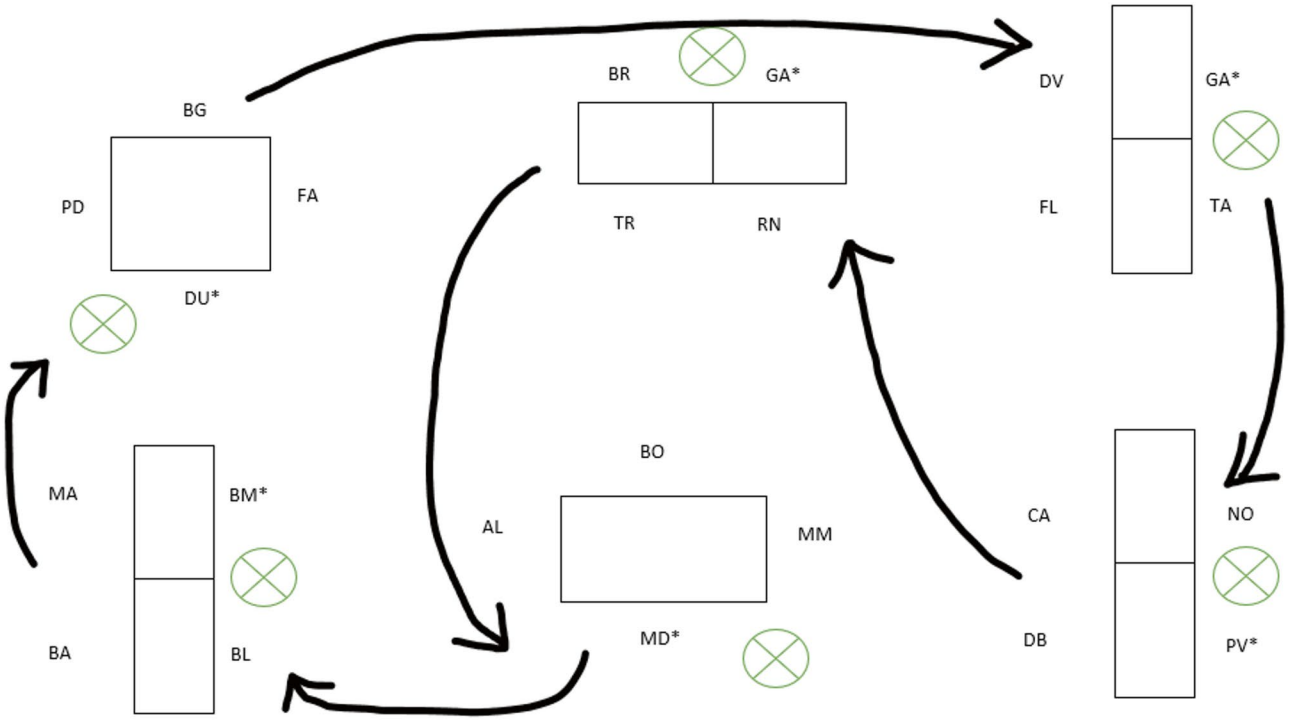

Fig. 2 Example of the map designed to plan the intentional rounding aiming at offering individualised prompts. Legend. BA, MA, PD, BG, FA, DU, BM, BL, AL, BO, MM, MD, BR, GA, RN, TR, FL, DV, TA, DB, CA, NO, PV, identity code of the residents; * residents at high need of prompts; The circles, where the chairs were positioned; Arrows, indicate the direction of the intentional rounding systematically delivered in the same flow each day of the intervention phase

function, where higher scores mean better conditions ($r > -0.96$ and $r > -0.73$, respectively) [24]. In the selected NHs, this tool is completed routinely at the first admission of residents, every six months, and at NH re-admission for those residents transferred to a hospital. In the present study, the latest available Val.Graf assessment on each NH resident was considered.

- Independence in daily activities: the Barthel Index [31] was adopted, where a total score of 0 and of 100 mean total dependence and total independence, respectively.
- Cognitive status: the Cognitive Performance Scale [32] was considered, consisting of six items and a total score ranging from 0 (intact cognitive status) to 6 (severely impaired).
- Depression: the Depression Rating Scale [33] was considered, with a total score of 0 and of 14 indicating no depression and a major depression, respectively.
- Pain intensity: the three points Pain Intensity scale was considered [34], where 0 and 3 showed no pain and severe pain, respectively.

Data was collected by an external researcher trained in TESS-NH [22] and Val.Graf tools.

Process indicators

For each study phase, the number of family caregivers present in the dining room during meals and the number of nurses/care assistants (hereafter: healthcare professionals) involved in serving meals in each dining room were recorded by external researchers who were trained in data collection using a form and who did not deliver the intervention. In addition, the number of prompts per meal during the intervention period (= number of rounds across each table) was also recorded by an external researcher and considered a proxy index for the 'dose' of the intervention.

Outcomes

Four outcomes were assessed at the individual level:

- Eating performances: the EdFED [22] in its Italian validated version was adopted [35]. The instrument was developed to assess feeding difficulties in older individuals with dementia and it is composed of 10 items (four address the level of care required by the resident; six concern behaviours indicating the resident's cognitive deterioration). For each item, the behaviour observed is evaluated using a Likert scale from 0 (never) to 2 (often), while the total score ranges from 0 to 20, where higher scores represent greater eating difficulties [10]. The Italian

version validated through the Mokken scale analysis demonstrated good reliability (rho = 0.83), and a moderate scalability (H = 0.42) and invariant item ordering (HT = 0.41) [35].

- Food and liquids intake: the total amount intake was assessed by measuring percentages [36] from 0%, to 25%, 50%, 75% and 100% of the total meal or liquids served.
- Meal duration: the length of time was measured from the start to the end of the meal using a watch.
- Adverse events: episodes of agitation or other considered to be related with the intervention were recorded by the researchers implementing the intervention at the end of each day.

Data collection procedures

During the pre-intervention (T0) phase NH environment data (TESS-NH score) and baseline characteristics of residents were collected. This phase lasted three weeks; outcome measures were also collected four times.

During the intervention phase, outcomes were collected the day of the start of the intervention after its first implementation (T1), seven days later (T2), and 14 days later, on the last day of the intervention exposure (T3). After one week of washout, the outcomes were re-assessed (T4) (Fig. 1).

Data collection was performed by external researchers who were not involved in the direct care of residents. The timing was established according to the feasibility (resources available trained to perform the outcome measure in four dining rooms, spread in four NHs) and the literature available [7, 8].

Data analysis

Each NH was anonymized and identified with an associated casual number (NH1, NH2, NH3, NH4). Then, also individual variables were anonymised, and an identity code was attributed.

Descriptive analyses were performed, considering each NH as a cluster: frequencies, percentages, means and standard deviations (SD), reporting a 95% confidence interval (CI), were calculated while differences across groups were assessed with parametric and non-parametric tests according to the nature of the variable.

Outcomes were measured as means and SD over time (T0, T1, T2, T3 and T4) by assessing also their correlations. Regarding the outcome measures at T0, given that three evaluations were completed in seven days, after evaluating them as homogenous, it was considered the last evaluation as a reference point, the closest to the intervention phase. Then, correlations or associations were explored between the outcomes and the individual independent variables; only those statistically significant were included in the final model adopting a parsimonious approach. The estimation process results show that the correlations between the individual error terms (specific for each outcome) was moderate to strong in all evaluations among outcomes. Therefore, the multi-outcome linear mixed model was performed and estimated using the library "nlme" in R [37], specifying the correct weighting system and the kind of correlation between the four considered outcomes.

The Seemingly Unrelated Regression (SUR) [38] with the Software R version 3.5.2 [37] was applied because (a) a limited group of cross-sectional units was observed over time; (b) four evaluations were completed at seven days each; and (c) the panel data were sufficiently long (large T), but not ample (small N). Moreover, the SUR approach was considered to investigate the outcomes jointly. In the basic SUR model, the errors are assumed to be homoscedastic and linearly independent within each equation. In the present framework, the error of each equation may have its variance, and each error component was correlated with the others in the same period [38]. The main advantage of this model specification that it accounts for the correlation between outcomes in estimating the individual error terms relevant in this study, as confirmed by the Intra-Class Correlation (ICC) values. To assess the multi-outcome model, the dependent variables were scaled to obtain better computational properties. The drawback of this necessary transformation was that the estimation results were not directly comparable with the results of the single outcomes models. The estimation results were obtained considering T0 (baseline conditions) and NH1 as the reference group of observations; specifically, the benchmark NH reported the worse environment as measured with the TESS-NH tool [22]. For this reason, all the coefficients involving time and NH effects were estimated as differences from the benchmark conditions.

Bias control

To promote quality, data were collected by eternal researchers all trained in the tools. Moreover, in the intervention phase, one researcher from each NHs received four-hour training and supervision to ensure the integrity of the intervention. In addition, the findings of the pre-intervention phase (such as the quality of the environment as measured with the TESSH-NH) were not shared with the researchers involved in the intervention phase, who were therefore blinded in this regard.

The outcomes and the explanatory variables were measured by two independent researchers for each evaluation, trained to collect data and for whom the inter-rater reliability had been confirmed in a pilot phase. The contamination effect between the 'usual care' and the intervention was controlled by evaluating the outcomes at baseline, during the intervention, immediately at the

end of the intervention, and one week after the washout period. Moreover, an intention-to-treat analysis was performed, including all patients recruited, even if they did not eat temporarily at lunchtime as planned cause of hospitalizations or other reasons, e.g., clinical instability.

Ethical considerations

The research protocol was approved by NH authorities (prot. N. 66935, 2017); the access to residents' records was approved by the Regional Ethical Committee (prot. N. 29747, 2018). The study protocol was presented to the nursing head of each unit and to staff members of the NHs. In each, the researchers were introduced to the residents and to their family caregivers and their presence was explained. Residents and family members were all informed regarding the study. In order not to interfere with residents' care, they were not prompted when their caregivers were present.

Results

NH characteristics

In the TESS-NH assessment, the NH1 reported a TESS-NH score of 108 out of 149, the NH2 reported a score of 133, the NH3 reported a score of 113 and the NH4 reported a score of 125. Based on the scores obtained, the NHs were scored as follows: NH1 = poor environmental quality; NH2 = high environmental quality; NH3 = moderate environmental quality, and NH4 = good environmental quality.

Residents' characteristics

Overall, 106 residents were included (Table 1), with age ranging from 86.42 (CI95%, 82.91–86.93) years in NH2 to 88.79 (CI95% 85.99–91.59) in NH1 ($p = 0.811$). Most participants were female in all NHs (from 63.9% in NH4 to 90.6% in NH3, $p = 0.031$) and dependant in daily life activities with an average Barthel total score ranging from 6.00 out of 100 (CI 95% 4.13–7.89) in NH3 to 23.82 (CI95%, 13.92–33.71) in NH1 ($p = 0.000$).

Residents were cognitive decline with a CPS ranging from 2.82 out of 6 (CI 95% 2.11–3.53) in NH1 to 4.70 (CI 95% 4.13–5.26) in NH4 ($p = 0.002$) while in the DRS scores ranged from 1.13 out of 14 (CI 95% 0.58–1.68) in NH3 to 3.50 (CI 95% 2.33–4.66) in NH4 ($p = 0.003$).

The clinical instability was also significantly different across NHs (0.89 CI 95% 0.58–1.21 vs. 1.70 out of 4 CI 95% 1.53–1.87 in NH3, $p = 0.000$), as well as the physical aggressiveness (0.05 CI 95% -0.06-0.16 in NH2 vs. 0.71 CI 05% 0.27–1.14 in NH4, $p = 0.019$). Relatives visited residents on a weekly basis in a variable proportion, from near to all residents (94.1%) in NH1, to a lower proportion (42.1%) in NH2, ($p = 0.011$).

Overall, residents were homogeneous only for age ($p = 0.881$), pain intensity ($p = 0.210$), sedatives regimens ($p = 0.095$), and verbal aggressiveness ($p = 0.079$) (Table 1). All residents concluded the study and only two were hospitalised during the intervention phase, with their in-hospital stay being limited to two days and five days, respectively.

Process indicators

The prompts offered during meals to each resident on average ranged from 2.25 (NH3) to 5.78 (NH2). From none (NH1) to 6.13 (NH3) family caregivers/day were present in the dining room, whereas from 2.03 (NH1) to 7.43 (NH4) healthcare professionals were available in the dining room on average (Table 2).

Table 1 Residents' characteristics at the baseline (T0)

At the resident level	NH1 ($n = 19$) Poor environment quality (TESS-NH = 108)[h]	NH2 ($n = 19$) High environment quality (TESS-NH = 133)[h]	NH3 ($n = 32$) Moderate environment quality (TESS-NH = 113)[h]	NH4 ($n = 36$) Good environment quality (TESS-NH = 125)[h]	*P* value
Age, years (mean, 95% CI)	88.79 (85.99–91.59)	86.42 (82.91–86.93)	87.13 (83.64–90.56)	86.75 (83.76–89.74)	0.811
Female (n, %)	15 (78.9)	17 (89.5)	29 (90.6)	23 (63.9)	0.031
Barthel Index (0–100)[a] (mean, 95% CI)	23.82 (13.92–33.71)	19.21 (11.92–26.49)	6.00 (4.13–7.89)	7.74 (2.76–12.82)	0.000
CPS (0–6)[b] (mean, 95% CI)	2.82 (2.11–3.53)	3.94 (3.03–4.82)	4.20 (3.67–4.72)	4.70 (4.13–5.26)	0.002
DRS (≥ 3)[c] (mean, 95% CI)	2.76 (1.14–4.10)	2.36 (1.59–3.14)	1.13 (0.58–1.68)	3.50 (2.33–4.66)	0.003
Clinical Instability (0–4)[d] (mean, 95% CI)	1.06 (0.93–1.18)	0.89 (0.58–1.21)	1.70 (1.53–1.87)	1.44 (1.14–1.74)	0.000
Pain Intensity (0–3)[e] (mean, 95% CI)	0.47 (0.14–0.79)	0.36 (0.03–0.69)	0.46 (0.13–0.80)	0.76 (0.53–0.99)	0.210
Sedatives (n, %)	7 (41.2)	13 (48.4)	15 (46.9)	25 (73.5)	0.095
Verbal aggressiveness (0–4)[f] (mean, 95% CI)	0.35 (-0.05-0.76)	0.21 (0.01–0.41)	0.27 (0.01–0.72)	0.76 (0.33–1.19)	0.079
Physical aggressiveness (0–4)[g] (mean, 95% CI)	0.29 (-1.40-0.73)	0.05 (-0.06-0.16)	0.10 (-0.10-0.30)	0.71 (0.27–1.14)	0.019
Family relatives, weekly (yes) (n, %)	16 (94.1)	8 (42.1)	17 (56.7)	22 (44.6)	0.011

Legend. CI, Confidence of Interval; n, number; NH, Nursing Home; TESS-NH, Therapeutic Environment Screening Survey for Nursing Home; [a]Barthel Index (from 0 total dependence to 100 total independence); [b]CPS, Cognitive Performance Scale (from 0 cognitive status intact to 6 severe impaired); [c]DRS, Depression Rating Scale (from 0 no depression to 14 major depression); [d]Clinical instability (from 0 stable to 4 high instability [24]), [e]Pain Intensity (from 0 no pain to 3 severe pain [34]), [f]Verbal and physical aggressiveness (from 0 absent to 4 always present (Pascazio et al., 2009)), [g]Behavioural problems (from 0 never to 4 always present); [h] from 0 to 149 points, from poor to high quality of the environment

Table 2 Prompts delivered, caregivers and healthcare professionals available in the dining room on a daily basis/ average

	Prompts offered/ resident/day average (SD)	Family caregivers/day average (SD)	Healthcare professionals/ day average (SD)
NH1 (*n* = 19)	5.10 (4.57)	0.00 (-)	2.03 (0.36)
NH2 (*n* = 19)	5.78 (5.27)	1.11 (0.81)	3.66 (0.87)
NH3 (*n* = 32)	2.25 (4.09)	6.13 (1.77)	2.45 (1.33)
NH4 (*n* = 36)	5.44 (5.88)	3.70 (0.70)	7.43 (1.21)

Legend. NH: Nursing Home; SD: standard deviation

Outcomes

The four outcomes measured results are summarised in Table 3. Eating performance as measured by the EdFED improved between T0 and the end of the intervention (T3), with the highest increase of 2.10 points at NH3 (T0 = 4.38, T3 = 2.28) and the worst of 1.41 points at NH4 (T0 = 4.58, T3 = 3.17) (Table 3). However, at follow-up (T4), the improvement decreased, with differences between NHs (from + 0.60 in NH3 to 1.69 in NH2, Table 3). In addition, residents in all NHs increased their food intake from baseline (T0) to the end of the intervention (T3) (Table 3). However, they did unable to maintain their food intake after the washout period (T4) and reported the worst scores compared to baseline (NH1: T0 = 2.72, T3 = 3.04, T4 = 2.64; NH2: T0 = 3.25, T3 = 3.49, T4 = 2.46). NH3 and NH4 residents improved their food intake in comparison between baseline and T4 (from 2.82 to 2.93 for NH3 and 3.31 and 3.38 for NH4, respectively). In addition, residents increased their fluid intake from T0 to T3 and T4 (Table 3), with the exception of NH3 residents (T0 = 3.84, T4 = 3.81). The average time taken by residents to consume the meal served was > 19 min at baseline and > 21 min at the end of the intervention, with the exception of NH4 residents (16 min). At follow-up, all residents took > 21 min (Table 3), reflecting an increase in the time taken to eat for all residents except those in NH1, where a decrease was noted (T0 = 27.05 min, T4 = 22.64 min).For all outcomes, the data collection trends across the time-points did not show a linear trajectory in the increase or decrease (Fig. 3). Only three adverse events in the form of episodes of agitation (e.g. leaving the dining room) were recorded in NH2 and NH1.

Intra-outcomes correlations

All outcomes were significantly associated with the other outcomes (Table 4). The highest positive correlation was found between food and fluid intake ($r = 0.813$, $p < 0.01$), while the highest negative correlation was between EdFED scores and food intake (r = -0.769, $p < 0.01$). The standard deviations were similar between the outcomes considered and the ICC for each outcome was close to or greater than 0.4. The idiosyncratic error had different standard deviation values for each model component.

Seemingly unrelated regression analysis

Concerning the outcomes included in the regression model (Supplementary Table 2), statistically significant effects emerged for the time variable, demonstrating positive effects of the intervention performed from T1 (the first day of intervention implementation) to the following evaluations for the eating performance (T3: β -0.474,

Table 3 Outcomes as measured over time

	Nursing Home	T0	T1	T2	T3	T4
Feeding dependence EdFED [a], mean (Std Err)	NH1	3.42 (0.78)	1.61 (0.52)	1.67 (0.67)	2.21 (0.68)	1.93 (0.53)
	NH2	4.32 (1.07)	2.63 (0.66)	1.75 (0.45)	2.62 (0.69)	2.63 (0.83)
	NH3	4.38 (0.41)	4.05 (0.65)	2.53 (0.49)	2.28 (0.37)	3.78 (0.43)
	NH4	4.58 (0.55)	3.66 (0.42)	4.75 (0.66)	3170 (0.47)	4.28 (0.57)
Food intake[b], mean (Std Err)	NH1	2.72 (0.18)	3.12 (0.12)	2.93 (0.18)	3.04 (0.21)	2.64 (0.21)
	NH2	3.25 (0.20)	3.79 (0.59)	3.42 (0.19)	3.49 (0.30)	2.46 (0.26)
	NH3	2.82 (0.12)	3.03 (0.09)	3.04 (0.15)	3.01 (0.14)	2.93 (0.12)
	NH4	3.31 (0.13)	3.54 (0.15)	3.18 (0.15)	3.11 (0.14)	3.38 (0.16)
Fluid intake[b], mean (Std Err)	NH1	3.21 (0.39)	4.00 (0.27)	3.93 (0.30)	4.36 (0.20)	4.21 (0.21)
	NH2	3.84 (0.33)	4.19 (0.31)	4.63 (0.18)	4.08 (0.40)	3.81 (0.25)
	NH3	3.60 (0.28)	3.61 (0.26)	4.25 (0.23)	3.43 (0.29)	3.83 (0.29)
	NH4	3.81 (0.25)	4.28 (0.22)	4.19 (0.23)	4.28 (0.20)	4.00 (0.24)
Time required to complete the meal[c], mean (Std Err)	NH1	27.05 (1.88)	19.67 (1.72)	24.73 (1.07)	22.50 (1.85)	22.64 (4.37)
	NH2	28.42 (1.82)	30.56 (3.76)	33.88 (3.25)	27.31 (2.33)	28.63 (3.23)
	NH3	22.00 (2.09)	21.16 (2.17)	17.41 (2.15)	24.00 (2.79)	23.06 (2.00)
	NH4	19.91 (1.16)	27.23 (1.57)	20.55 (1.66)	16.13 (1.42)	21.71 (1.01)

Legend. [a]EdFED, Edinburgh Feeding Evaluation in Dementia scale (from 0 to 20, where higher scores indicate high feeding difficulties); [b]Food and liquid intake (0 = 0%, 1 = 25%, 2 = 50%, 3 = 75% and 4 = 100%) of the meal serve and of the glass of water served, respectively; [c]Time, in minutes; NH, Nursing Home; Std Err, Standard Error; T, time; T0, baseline; T1, the day of the intervention implementation; T2, after 7 days of implementation; T3, after 14 days of implementation; T4, after one week of washout as a follow-up measure

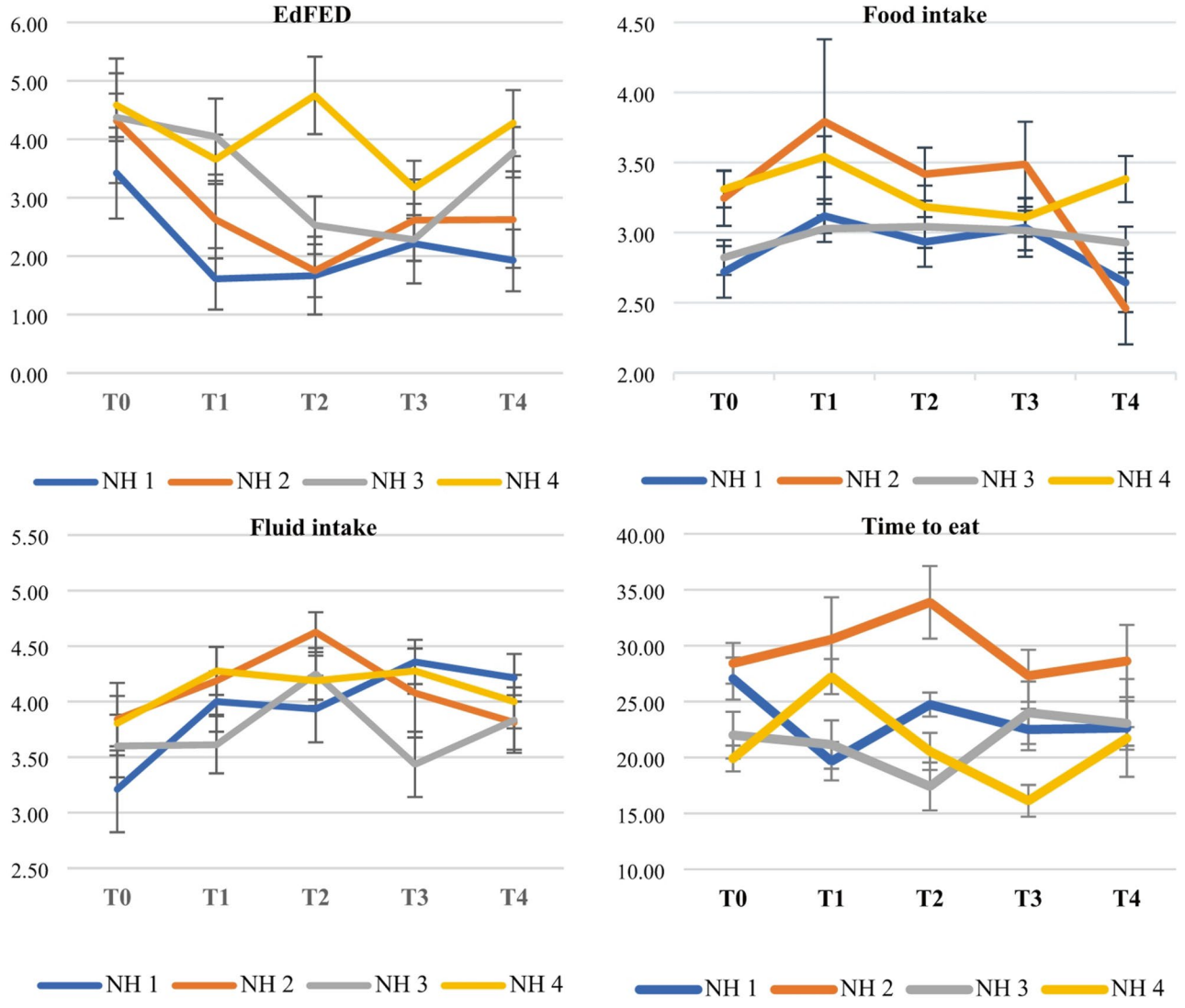

Fig. 3 Trends in outcomes at the Nursing Home levels over time. Legend. EdFED, Edinburgh Feeding Evaluation in Dementia scale (from 0 to 20, where higher scores indicate high feeding difficulties); NH, Nursing Home; T0, baseline; Tl the day of the intervention implementation; T2 after 7 days of implementation; T3, after 14 days of implementation; T4 after one week of washout as a follow-up measure. Food and liquid intake from 0 = 0%, 1 = 25%, 2 = 50%, 3 = 75% and 4 = 100% of the meal serve and of the glass of water served, respectively; Time, reported in minutes

Table 4 Estimated correlations and standard deviations for the individual specific error terms in the multi-outcome models

	SD	Resid SD	ICC	Correlations		
				EdFED	Time	Food intake
EdFED	0.770	0.614	0.611			
Time	0.612	0.719	0.420	-0.088*		
Food intake	0.625	0.787	0.387	-0.769*	0.486*	
Liquid intake	0.629	0.787	0.390	-0.559*	0.283*	0.813*

Legend. EdFED, Edinburgh Feeding Evaluation in Dementia; SD, Standard Deviation; Resid SD, Residual Standard Deviation; ICC, Intra-Class Correlation at the individual level; * < 0.01

$p < 0.05$) the food intake (T3: β 0.814, $p < 0.05$), and the fluid intake (T3: β 1.260, $p < 0.01$). As the model also includes interactions between observational periods and NHs' factor, the estimated parameters can be interpreted as the net effect of time for the Nursing Home presenting id equal to 1.

The number of healthcare professionals available was associated with increased eating difficulties (β 0.205, $p < 0.01$). At the same time, it decreased the fluid intake

(β -0.225, $p < 0.05$) and the time required to end the meal (β -0.228, $p < 0.05$). The number of family caregivers significantly increased the fluid intake (β 0.371, $p < 0.001$).

All the interactions between time and NHs factors can be interpreted in terms of comparison with the benchmark pre-intervention (T0) in the NH1. Regarding the interaction between the environmental characteristics as measured with the TESS-NH and the time point of data collection, different results emerged across the outcomes. Overall, in NH2, where residents were living in the best environment as measured with the TESS-NH tool, no significant interactions emerged, except for the time to end the meal, which emerged to be increased on the first day of the intervention (β 1.304, $p < 0.01$) as compared with the baseline. By considering the NH3 (moderate environment quality), significant differences can be observed with the baseline. Negative effects at T1 both on eating dependence (β 1.167, $p < 0.01$) and T4 (β 1.258, $p < 0.05$) and on food intake (β -1.542, $p < 0.05$) and on fluid intake at T1 (β -2.273, $p < 0.001$), T3 (β -2.788, $p < 0.001$), and T4 (β -2.919, $p < 0.001$) were detected. The time to eat decreased significantly as the effect of the interaction between NH3 and time at T3 (β -1-107, $p < 0.05$). Regarding the interaction between NH 4 (good environment quality) and time, significant effects emerged in worsening the eating dependence (β 0.910, $p < 0.01$) and the food intake (β -1.264, $p < 0.01$) at T2. The interaction effect on the eating time was statistically significant at T1 by increasing it (β 0.945, $p < 0.05$).

Discussion

As far as we know, this is the first study to change the course of research in the field of eating independence by introducing an intervention tailored to the needs of older adults in nursing homes by highlighting the importance of personalized prompts and integrating them into an intentional visit that also considers the quality of the nursing home environment. The novelty of the intervention can be summarised as follows: it was designed and tested an intervention (1) considering not only individual variables (the dependence in eating), but also the quality of the NH environment; (2) embodying the principles of personalised care [28] and the evidence available on prompts [39, 40], and (3) implementing these prompts at the group level with residents eating around tables, tailoring them to those residents at the highest need, (4) through intentional rounding. The intervention also considered the family's presence at the table, adapting the "dose" delivered. While prompts have been already documented in their effectiveness in the early stages of research on eating difficulties [39, 40], our purpose was to expand the knowledge in two directions: measuring their effects by taking into consideration the quality of the environment and the family's presence; and delivering them at the group level, through an intentional rounding. Intentional rounding has been defined as an initiative-taking care method aimed at checking individual needs, at set intervals, with the main aim of anticipating patients' needs, reducing adverse events, and offering comfort [41]. In our study, the intentional rounding was, instead, implemented with the purpose of improving eating independence rather than only detecting needs, thus expanding its scope. Moreover, it is well known how difficult it is to ensure nutrition by appropriately helping those in need, which is becoming challenging in several NHs given the increased number of residents and the scarcity of time [8]. Therefore, innovative interventions can inform caregivers faced with increased needs in the care of residents' dependent in the activities of daily living, ameliorating their outcomes and preventing the frustration among nurses [42].

The NHs and residents' profile

We involved four NHs with different profiles, both in the residents cared for and in the environment quality, with a pragmatic approach. While the differences in the profile of residents reflect the complexity of the needs cared for in the NHs and in line with previous data [8], those concerning the quality of the environment suggest that ameliorations are needed to ensure the best care setting. Evidence has confirmed the role of the environment in supporting or hindering the functional dependence of residents, as well as their wellbeing [7]; the differences in the functional dependence of residents that emerged in our data, in a context where all NH involved were homogeneous in terms of admission criteria, may also express the negative influence of environment quality on residents. In addition, we have adopted a pragmatic approach in which all residents eat in the dining room according to their routine, keeping their usual places at the table. By taking into consideration the several limitations of our study, the findings obtained in an unaltered environment [43] may reflect the effectiveness of the intervention in the real-world of the NHs.

Process indicators

The number of prompts, which was considered a proxy of the "dose" of intervention delivered, was not homogeneous across NHs, and the variations observed may be explained according to the number of health care professionals (with a healthcare professional-residents ratio varying from 1:6 in NH2 to 1:16 in NH3) and family members available in the dining room. Overall, some dining rooms were rich in both formal (health care professionals) and informal (family caregivers) resources, whereas others resulted to be poor, suggesting the need to establish recommendations regarding the minimum

resources to be present during meals in terms of nursing staff.

The variable number of prompts offered by researchers (from an average of around two to five during each lunch), reflects the intent to modulate the dose when caregivers were present, with the aim of minimising residents' stress caused by excessive stimulation.

Outcomes

Overall, independence in food intake, food and fluid intake and time taken to finish the meal improved at all time points from the start of the intervention to its end. Thus, the intervention appears to be effective in improving dependency, food and fluid intake, and resident relaxation during feeding. However, the decline in outcomes documented at T4 suggests that the intervention should be offered continuously over a longer period of time and with an adequate number of staff, as the prompts were given by researchers.

Specifically, eating difficulties decreased after the initiation of the intervention, except for NH4, where limited ameliorations have been detected. Moreover, the average decrease was up to 1.69, suggesting a visible amelioration as compared to that documented by Lin et al. [44], whose study involved 29 residents exposed to a Montessori's intervention for seven weeks, with the interventions being delivered three days/week and resulting in a mean decrease in EdFED score of – 1.57 points, from the initial value of 5.11 out of 20. However, self-feeding difficulties increased again after the washout period, but without reaching baseline levels after one week, suggesting that prompts should be integrated into daily care to improve eating performance.

With respect to the food intake, this was higher on the first day of the intervention and then fluctuated over time, reaching the value of > 75% of the meal served in all NHs. However, also in this case, after seven days of interruption of the prompt's delivery, the food intake decreased in three NHs out of four, reaching values below 75%. The fluid intake also increased, reaching a peak after seven days of continuous prompting in two NHs, and at the end of the intervention phase in the remaining two NHs, with an intake of > 75% of the liquid served. Also in this case, a reduction of the intake was visible after seven days of washout except for one NH.

The time needed to eat increased in two NHs, whereas, in the other two, residents were more efficient in completing their meals, although the time required to end the meal did not show a clear trend. As a comparison, Lin et al. [44] documented an average of 16 min to end the meal, while residents in our study reported higher times, suggesting that in general they were not under excessive pressure during mealtimes: the time required may be considered an indirect indicator of the pressure applied to the residents to end their meals.

Moreover, the significant correlations emerged across the outcomes measured indicate that eating performance is strongly correlated with the food and the liquid intake and less with time, which was instead more correlated with the food and the liquid intake. There is an important debate regarding which outcomes reflect better the quality of nursing care: from a methodological point of view [45], this suggests that, in future studies, measuring the performance in self-feeding may be considered as a proxy of the food intake, or that, in the attempt of reducing the complexities of the measures collected, the data collection of one (fluid) or the other (food) may serve as a proxy indicator.

Regarding the quality of the environment, in NH2, where the residents were living in the best environment, positive effects were found in all outcomes, and no significant interactions between the environment and time emerged, with the exception of the time spent eating the meal, which was significantly longer on the first day that the intervention was implemented compared to baseline (T0 and NH1). In contrast, in NH 3 and 4, both of which had moderate therapeutic environments, different trajectories of outcomes both in food and fluid intake were found, specifically in eating performance, compared to the worst environment in NH1, suggesting that the NH environment plays a role that should be investigated. In the NH4, there emerged the worst findings: the size of the dining rooms may have played a role, given that in addition to the 36 residents, there were on average < 3 healthcare professionals and < 7 relatives.

Additionally, the higher the number of healthcare professionals, the higher the eating dependence emerged, and the lower the food and fluid intake. On the other hand, the number of family caregivers had a positive effect only on fluid intake. Healthcare professionals may have developed a compensative attitude, thus helping physically the residents with some difficulties due to time pressure or lack of knowledge: changing these attitudes may require more time than that used for the project. Differently, family caregivers may have given more attention to the fluid intake, thus prompting them more in this regard.

Limitations

The study has a pragmatic nature and several limitations that should be considered. Above all, we conducted a pre-post study without a true control. In addition, the observed improvements may indicate that the usual care of NH was poor, with the results suggesting that any strategy to improve quality as well as the training [46] had a positive effect. In addition, several other limitations affect the stud. First, only some individual variables [1,

26] were included in the final model by including those that showed significant correlations with the outcomes. However, some of the variables that have been shown to increase eating difficulties (e.g., number of years spent in NH, constipation [47, 48]) were not considered in the model. Second, prompts (e.g. prescriptive, informative) were given without assessing individual residents' preferences, suggesting that this gap should be considered in the future; furthermore, prompts were given by researchers rather than the staff. This decision was made to avoid any form of additional burden on staff resulting from researcher involvement and to measure the effectiveness of the intervention. However, future studies should include staff to also assess the feasibility and long-term sustainability of the intervention. Third, we only considered process-related outcomes, while others (e.g. body mass index or weight changes) were not considered given the short duration of the study. Adverse events such as agitation and/or residents leaving the dining room or refusing to eat (unable to eat; not understanding that they need to eat; not wanting to eat) were recorded but not included in the model due to their infrequent occurrence. In addition, the intervention was only implemented and measured during lunchtime: decreased eating performance during dinner and increased eating performance during breakfast was documented [49], suggesting that future studies should also consider other mealtimes. Not lastly, the size of the dining rooms varied: future studies should also take this into account to measure their impact on the residents' feeding difficulties.

Conclusions

A pragmatic study with four different NHs, characterised by different environments in their quality, was conducted to improve the evidence base and provide practical and replicable interventions. The results suggest that, compared to usual daily care, prompts from nurses through rounding across tables is effective in improving feeding performance and food and fluid intake and reducing pressure at mealtimes. However, after one week, when usual care is resumed, all outcomes have slightly worsened. Thus, health care profesisonals involved in mealtimes should be trained to implement the prompts at table handling as well. In addition, future studies should also include nurses working in NHs to understand both the effectiveness and long-term feasibility of the intervention. This could provide additional insight into the feasibility of integrating this intervention into routine care and ensure long-term sustainability beyond the researchers' involvement. In the meantime, the results will support the training of staff to integrate the prompts into daily practise and implement them systematically. Moderate to strong correlations were found for the outcomes considered in the study, namely dependence in self-feeding, food and fluid intake, and time to meal completion, suggesting that new models of analysis that consider multiple outcomes should be used in this area of research. Differences were found in the effectiveness of interventions in different environments characterised by different therapeutic principles, suggesting that interventions should be environment-sensitive.

Abbreviations

CI	Confidence Interval
EdFED	Edinburgh Feeding Evaluation in Dementia
NH	Nursing Home
TESS-NH	Therapeutic Environment Screening Survey for Nursing Homes
SD	Standard Deviation
CPS	Cognitive Performance Scale
DRS	Depression Rating Scale
DF	Degree of Freedom
HCPs	Health Care Professionals
Std Err	Standard Error
T	Time
T0	Baseline
T1	The day of the intervention implementation
T2	After 7 days of implementation
T3	After 14 days of implementation
T4	After one week of washout as a follow-up measure

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12912-025-03159-w.

Supplementary Material 1

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Author contributions

AP, MH, RW: Made substantial contributions to conception and design, analysis and interpretation of data; AP, AD, ML, BA, TK, VG, FS, SF: Acquisition of data; AP, VB, AG, SC, JL, MM, LG, MH, RW: Involved in drafting the manuscript or revising it critically for important intellectual content; RW, MH: Given final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content; All authors: Agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The research protocol of the present study was approved by Nursing Home authorities (prot. N. 66935, 2017), and the access to resident's assessment records was approved by the Friuli Venezia-Giulia Regional Ethical Committee (prot. N. 29747, 2018). All methods were performed in accordance with the relevant guidelines and regulations (e.g. Declaration of Helsinki). Informed consent to participate was obtained from each participant.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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