Visual Modeling: A Socialization-Based Intervention to Improve Nutritional Intake Among Nursing Home Residents

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Abstract

Purpose: Malnutrition is a widespread, dangerous, and costly condition amongst institutionalized older adults, and can be both a contributor to and consequence of dysphagia for individuals with cognitive impairment. Yet, interventions to maximize intake in individuals with dementia are limited, and frequently problematic, with negative implications for independence and quality of life. The goal of this study was to examine a novel, socialization-grounded intervention based on visual modeling, utilizing the theoretical underpinnings of motor resonance and mimicry.

Methods: To examine the impact of environment on intake, data were collected from 4 nursing home residents (M_{age} = 83.5 years, *SD* = 4.2; 3 females) with dementia. Weight of food and liquid intake was measured across 15 meals and 3 different mealtime conditions: the "baseline condition" in which the individual ate alone, the "watch condition" in which the individual ate in the company of a "mealtime buddy," and the "eat" condition in which the individual consumed a meal while the "mealtime buddy" did the same.

Results: Data visualization supported a weak functional relation between eating environment and amount of intake consumed across participants. Log response ratio estimates suggested a trend for increased weight of food consumed during the eat condition as compared to baseline and the eat condition as compared to the watch condition for some participants.

Conclusions: These results preliminarily support the benefit of a visual model for increased consumption in some individuals with dementia. The presence and magnitude of the effect across conditions varied based on individual-level factors, such as cognitive status, which has implications for implementation. Overall, this study provides initial proof-of-concept regarding

the use of visual modeling as an intervention approach, laying the foundation for larger-scale future studies.

Keywords: Dementia; dysphagia; mimicry; nursing home

Introduction

Malnutrition is a widespread, costly, and dangerous condition, impacting up to 71% of institutionalized older adults (Guigoz, 2006). Unintentional weight loss is associated with higher risks of infection, higher incidence of sarcopenia, decreased immunocompetence, a greater length of hospital stay, and increased mortality (Bock et al., 2016; Salva et al., 2009; Wallace et al., 1995). Malnutrition has additionally been found to correlate positively with cognitive decline (Hickson, 2006), suggesting that individuals with dementia are at increased risk for malnourishment. This risk is likely exacerbated by the numerous comorbidities associated with dementia, including dysphagia, decreased olfaction and gustation, missing dentition, anorexia, and depression (Bulent et al., 2010; Leibovitz et al., 2007).

Malnutrition, like dysphagia, requires multidisciplinary intervention, often involving the physician, dietician, and nursing staff. The speech-language pathologist (SLP) can, and should, also play a key role in the management of this condition. Dysphagia, cognitive impairment, and malnutrition frequently co-occur, and unfortunately, each condition can be a precipitating factor for the others, with a consequent tendency for these conditions to aggregate (Priefer & Robbins, 1997). Further, given the correlation of malnutrition with dysphagia and cognitive impairment, SLPs often have malnourished patients on caseload. In fact, it has been found that 75% of long-term care residents with dysphagia present with multiple clinical symptoms of dehydration (Leibovitz et al., 2007). A primary goal of the SLP in managing an individual's dysphagia is to optimize nutrition while most effectively mitigating risk of airway invasion in a manner that is compatible with the wishes of the patient and/or family. Keeping these goals in mind, it should be clear that an individual's dysphagia is only successfully managed if the

patient is able to achieve adequate nutrition. Additionally, cognitive impairment eventually results in impaired self-feeding (Katz et al., 1963; Roque et al., 2013), with obvious consequences regarding nutrition; thus, a patient's cognitive impairment may only be considered managed when they are able to also successfully acquire nutrition via self-feeding or the appropriate degree of feeding assistance. Taken together, it is clear that while managing an individual's swallowing and cognitive function, nutrition cannot be overlooked by the SLP.

Despite the ubiquitous nature of malnutrition, interventions to maximize food and liquid intake amongst individuals with cognitive impairment are limited, and frequently detract from the mealtime experience and quality of life of the recipient. There are numerous types of mealtime interventions, frequently categorized into: education, environmental modifications, feeding, oral supplementation, and pharmacological interventions (Borders et al., 2020). Of greatest applicability to the SLP are behavioral interventions, which can be broadly divided into two primary categories: direct interventions and indirect interventions (Bunn et al., 2016). Direct interventions, as their name implies, are behavioral interventions performed directly on the individual to elicit a modified behavior. These interventions, given their more personal and individualized nature, tend to be more relevant to the SLP scope of practice, and more conducive to structured therapy. Conversely, indirect interventions are not performed directly on the individual, but rather on the sensory experience surrounding the individual to elicit a modified behavior. The sensory experience of the individual may be influenced by manipulation of the dining surroundings, sounds, procedures, and food, for example. Given that these interventions are not performed directly on the patient, but on the patient's surroundings, they

tend to be more relevant to those directly involved in managing the dining environment, including administration and dietary staff.

Direct Interventions for Improved Nutritional Intake

In regards to direct interventions, among the most common is feeding assistance, which is frequently one-on-one direct feeding (Sandman et al., 1990), as well as verbal prompting and cueing. Feeding assistance may improve intake and increase weight in patients across multiple settings (Abbott et al., 2013; Simmons et al., 2008; Vucea et al., 2014; Wright et al., 2008), and verbal prompting has been found to elicit greater independence with eating and drinking (Abbott et al., 2013).

Despite the existing support for these interventions, the literature indicates many disadvantages to these interventions as well. Evidence regarding the efficacy of feeding assistance has yet to be fully established, with a current systematic review concluding that there is a lack of sufficient evidence to establish feeding assistance as a viable intervention to improve intake (Liu et al., 2014). Moreover, direct feeding assistance is consistently time-intensive (Simmons & Schnelle, 2006) and dependent on degree of staff competency and training (Vucea et al., 2014). Additionally, it should be apparent that the decision to directly feed a patient in lieu of other interventions is one to be considered very judiciously. Research from Langmore and colleagues (1998) has shown that dependence for feeding is highly related to the development of aspiration pneumonia. Thus, it is imperative for SLPs and other members of the interdisciplinary team to prioritize interventions that support independence whenever possible. This issue is one that is constantly faced in the skilled nursing setting, given that as many as 50% of nursing home residents require some form of feeding assistance (Dey, 1997). In

regards to targeted verbal cueing, this intervention has not been found to improve food or fluid intake, or to increase body weight (Beattie et al., 2004; Cleary et al., 2012; Van Ort & Phillips, 1995).

In addition to the aforementioned disadvantages, these targeted/direct interventions are likely to detract from the overall mealtime experience. Stress and anxiety are found to occur in up to 90% of nursing home residents, and have been found to occur more frequently during mealtime (Brodaty, 2003). Additionally, a feeling of autonomy is crucial for individual wellbeing (Doyal & Gough, 1991), and as individuals progress through the various stages of cognitive impairment, self-feeding is often the last skill to be lost (Katz et al., 1963). Thus, the mealtime is frequently one of the last areas in which these individuals retain any sense of autonomy. Consistent reminders to eat and drink more, though likely well-intentioned, may also be read as controlling, and generally limiting to the individuals' perceived autonomy, thus impeding progress toward optimized nutrition (Boyle, 2007; Deci & Ryan, 2000; Gorin et al., 2014). Concurrently, Batchelor-Murphy and colleagues (2018) found that individuals demonstrated less adverse behaviors when the hand-feeding technique utilized by staff was the most naturalistic and provided the participant with the most perceived autonomy.

Considering all of these factors summatively, it is apparent that the field is still in need of more direct interventions that exist as an alternative to direct feeding, and that maximal independence with self-feeding should be prioritized whenever possible when making determinations regarding mealtime support.

Indirect Interventions for Improved Nutritional Intake

In regards to indirect interventions, a current systematic review established five categories of mealtime interventions, three of which can be categorized as entirely indirect (Abbot et al., 2013). They consisted of food improvement, food services, and dining environment. Food improvement includes enhancement of flavor by adding sauces or monosodium glutamate during meal preparation. Food services involve manipulation of the way that the food is presented to the individual, including decreasing portion sizes, switching meal preparation to bulk service, using high-contrast crockery, and adding finger foods. Interventions concerning dining environment involve manipulation of the setting in which the individual consumes a meal, and include, for example, creation of a more home-like environment, improvement of lighting, and addition of music.

Success of these interventions has been mixed (Abbot et al., 2013). Food improvement yielded no overall increase in body weight or intake; however, some individual success was noted. Overall, while food services elicited no improvement in body weight, caloric intake was increased with varying levels of success through bulk services, presentation of familiar foods, addition of snacks, and use of high contrast crockery. Also, in addition to modest improvements in intake, family style dining has been found to have positive implications for communication amongst patients with dementia (Altus et al., 2002). In regards to environmental interventions, a home-like environment demonstrated no overall significant effect, but did occasionally lead to success increasing intake, some types of music (calming) were found to increase caloric intake, and increased lighting was successful in increasing intake when used in conjunction with high contrast crockery (Abbot et al., 2013).

Considering the current evidence regarding indirect interventions, it appears supported that “unobtrusive” indirect interventions can improve the intake of patients, although not across all outcomes and the success sometimes occurs more on an individual level rather than across an entire group (Liu, et al., 2014). Further, the effects of indirect interventions may be better realized when used in conjunction with other interventions. Moreover, it is an ever-present limitation of indirect interventions that they are often more difficult to individualize to a patient, especially in the context of an institutionalized individual, as the environment is frequently shared. However, with the knowledge that the environment is found to improve intake in certain individuals, it should always be considered when developing a plan for management of feeding.

Socialization-Based Interventions for Improved Nutritional Intake

Most recent work has suggested that socialization-based interventions may be a potentially useful hybrid alternative or supplement to the traditional direct and indirect interventions discussed above, as they can be individualized and are also implicit and unobtrusive (Nam & Shune, 2020). The theoretical underpinnings of this intervention draw from the phenomenon of motor resonance, or the activation of neural regions associated with motor movement in response to an observed motor behavior, which can result in direct imitation of the visualized behavior (e.g., Rizzolatti et al., 1999). This phenomenon includes, for example, mimicking of the arm positioning or stance of a conversation partner without conscious awareness. Motor resonance has been shown to be preserved, and possibly even less inhibited due to decreased frontal inhibitory capacities, amongst individuals with Alzheimer’s disease (Bisio et al., 2012; Bisio et al., 2016). Significantly, the capacity for imitation tends to be

improved when the target action is being completed by a human model (Bisio et al., 2016), suggesting that live, visual models of actions may be one potent strategy for desired behavioral responses among individuals with dementia.

Across various healthy populations, the spontaneous, nonconscious imitation of an observed behavior has been previously linked to mimicry of many behaviors, including hand posture and movements (Chartrand & Bargh, 1999), facial expressions, speech patterns, and emotions (Chartrand & Lakin, 2013). This behavioral mimicry has been found to be associated with trust and companionship, and is in fact usually most effective when these feelings are present (Chartrand & Lakin, 2013). Given that the mealtime is an inherently social activity associated with fostering and maintaining social relationships (Evans et al., 2005) and is frequently the primary point of social interaction for those with cognitive and physical impairments (Hopper et al., 2007), it may in many ways be an ideal environment to elicit behavior through mimicry.

Mimicry has been thought to be a contributing factor to the phenomenon of social modeling, or the modulation of physical behaviors in accordance with the behaviors of others. There are a multitude of studies supporting the impact of social modeling on eating and drinking behaviors, suggesting that the eating behaviors of people are heavily mediated by the social norms of others in the environment (Cruwys et al., 2014). Despite the vast research regarding this topic, the primary participating populations have been children and younger adults, with the research questions pertaining more to obesity and overeating than to malnutrition (Cruwys et al., 2014). The number of studies examining social modeling as an intervention to increase intake in cognitively impaired, malnourished, or institutionalized older

adults is significantly sparser. Charras and Fremontier (2010) conducted a study in which they compared two units of two skilled-nursing facilities, one in which the staff began to eat meals at the table with the residents, and a control group with no change in protocol. This study did successfully demonstrate an increase in weight, interactions, and autonomy associated with the use of modeling from the staff. However, while the evidence for social modeling in general is robust, the underlying cause of this behavior is not well understood.

Recent literature has attempted to support a connection between social modeling and mimicry, particularly as related to food/drink consumption. Shune and Foster (2017) and Nam and Shune (2020) observed an influence of mimicry on goal-directed drinking behaviors amongst healthy younger and older adults, respectively. Participants drank water more frequently when their conversation partner was drinking as compared to when the conversation partner was not drinking. Additional research regarding mimicry's underlying influence on the social modeling of drinking have been related to alcohol consumption in young adults, revealing an increased propensity for alcohol consumption while observing the behavior in others, with social integration being a possible motive behind this phenomenon (Koordeman et al., 2011; Larsen et al., 2010; Robinson, et al., 2016). Together, this evidence provides initial proof-of-concept for the use of visual modeling as a non-invasive intervention strategy for increased consumption. Modeling could potentially lead to an imitated, unconscious behavioral response even among individuals with cognitive impairment; however, this is not yet known.

Current Study

The purpose of the current pilot study was to determine if there is a functional relationship between visual modeling of different eating environments and increased food and

liquid intake among institutionalized older adults with varying degrees of cognitive impairment. The mealtime food and liquid consumption of nursing home residents with dementia was compared across three conditions: when eating alone, when eating in the presence of a companion who was not eating, and when eating in the presence of a companion who was also eating. Given the robust evidence for social modeling during mealtime and the ubiquitous nature of behavioral mimicry (e.g., Chartrand & Bargh, 1999; Chartrand & Lakin, 2013), along with the potentially magnified effects amongst individuals with Alzheimer's disease (Bisio et al., 2012; Bisio et al., 2016), we hypothesized that participants would consume the most when eating in the presence of another companion eating. Furthermore, given the social nature of mealtime (Evans et al., 2005; Beck & Ovesen, 2003), we hypothesized that participants would consume the second highest weight of food and liquids when eating in the company of another individual who was not eating, and that they would consume the lowest weight of food and liquid when eating and drinking alone.

Methods

Participants

Four older adults (M_{age} = 83.5 years, *SD* = 4.2; 3 females) were recruited to participate in this study. All participants resided in the same Mid-Atlantic skilled-nursing facility with time spent in the facility ranging from 3 to 16 months. Inclusion criteria included: documented medical diagnosis of dementia; functionally intact or corrected vision; ability to self-feed after set-up assistance; willingness to eat meals in their room; and expected length of stay in the facility of at least two weeks. Participants also needed to have sufficient attentional skills in order to simultaneously engage in self-feeding and conversation, which was operationally

defined as a Functional Communication Measure (FCM) of 4 or above on the American Speech-Language-Hearing Association's National Outcome Measures System (NOMS) (i.e., "maintains attention during simple living tasks of multiple steps and long duration within a minimally distracting environment with consistent minimal cueing"). Prior to participation, all individuals were evaluated by a registered dietitian, and were all determined to be at high risk for malnutrition. Additionally, all individuals were evaluated by a licensed speech-language pathologist to determine the severity of their cognitive impairment on the Global Deterioration Scale (GDS; Reisberg et al., 1982) as well as the Brief Cognitive Assessment Tool (BCAT; Mansbach et al., 2012). Participants who were unable to participate in the BCAT assessment due to severity of cognitive impairment were instead administered the Brief Cognitive Impairment Scale (BCIS; Mansbach & Mace, 2018). Table 1 details the participants' characteristics. Of note, while the medical status of the participants remained generally stable across the duration of the study, Participant 2 did experience a painful tooth abscess during the intervention conditions that was not present at baseline.

Table 1. Participant Demographic Information

	Sex	**Age (years)**	**Race**	**Time in Facility (months)**	**GDS Stage**	**BCAT Score**	**BCIS Score**	**Malnutrition Risk**
Participant 1	F	88	White	16	5	n/a	11/14	High
Participant 2	F	86	White	3	5	20/50	n/a	High
Participant 3	F	79	White	3	3	43/50	n/a	High
Participant 4	M	81	White	4	4	23/50	n/a	High

Note. *BCAT* = Brief Cognitive Assessment Tool; *BCIS* = Brief Cognitive Impairment Scale; *F* = female; *GDS* = Global Deterioration Scale; *M* = male; *n/a* = not applicable

Study procedures were approved by the Institutional Review Board at the University of Oregon and the internal research committee of the Regulatory Compliance Office for the care facility's rehabilitation company. All participants and/or their authorized representative (depending on the severity of cognitive impairment and decision-making capacity) provided signed informed consent. As it was necessary for participants to not know the true nature of the study prior to participation, the initial informed consent document described a cover study exploring the impact of scheduled mealtime visits from a staff or community "buddy" on subjective quality of life. After the study concluded, participants were debriefed regarding the true nature of the study. Regardless of cognitive capacity to provide informed consent, all participants also provided verbal assent prior to each day of intervention. This included general willingness to participate in the procedures of the study, and absence of adverse behaviors in response to the investigator or the intervention.

Task Procedures

A single-subject multi-treatment (A-B-C) design was used to explore the functional relationship between different eating conditions and intake. Data were collected on each participant in their respective rooms during mealtime across three conditions that varied based on the involvement of the "mealtime buddy," who, unbeknownst to the participant, was actually a member of the research team (a confederate): "baseline" (patient ate alone); "watch" (the "mealtime buddy" conversed during mealtime with the participant, but no additional intervention was provided); and "eat" (the "mealtime buddy" consumed a meal with the participant, the primary intervention). For all participants, the confederate was a male SLP employed by the facility. All participants were formerly treated by this SLP, so in all cases

rapport with the participants had previously been established. During the baseline condition, the participants consumed their meals alone after set-up was provided by the confederate. Facility staff were instructed not to influence meal intake through cueing, but were still permitted to perform check-ins during each meal as they normally would. This baseline condition was designed as such to represent a participant's normal intake without any added influence beyond what can be typically expected in a skilled nursing facility. During the watch condition, participants consumed their meals in the presence of the "mealtime buddy." Conversation was permitted to ebb and flow naturally as it would with any mealtime interaction, with the only stipulation being that the confederate was not permitted to influence the intake of the participant beyond meal set-up. This meant that the confederate was able to comment on the food provided, particularly in response to comments the participants made; however, no additional comments were made specifically encouraging intake (e.g., "you should try this"). During the eat condition, participants consumed their meals in the presence of the "mealtime buddy", however in this condition the confederate also consumed a meal in front of the participant. The positioning of the participant and confederate was allowed to reasonably vary as it would in a mealtime setting as long as the participant could consistently observe the confederate eating and drinking without effort (e.g., sometimes the confederate sat directly in front of the participant and other times slightly to the side). The sequence and rate of self-feeding for the confederate was allowed to vary as it would considerably in a functional environment. The confederate's meal was also allowed to differ from the meal of the participant, as it frequently would in a typical dining room setting. Conversation was again

permitted to ebb and flow naturally, but the confederate was not permitted to verbally influence the intake of the participant.

Each condition was repeated once per day for five consecutive days before the next was introduced. The order of the conditions was randomly assigned to account for ordering effects. All data were collected during either breakfast or lunch (due to scheduling limitations, individuals were not seen during dinner), and every attempt was made to balance meal types across conditions for each participant. This meal-type balancing was successfully executed except for one case (Participant 4), in which the individual requested mid-study to subsequently only be seen during breakfast. In regards to mealtime setting, all meals across all conditions were consumed in the participants' rooms in order to control the interactions participants experienced during meals. It is additionally of note that all patients in this study were in single-bed rooms.

Data Collection and Analysis

Meal trays were photographed and weighed (ounces) using a food scale (AccuWeight Digital Kitchen Scale) prior to mealtime onset and post-mealtime to determine weight of food/drink consumed. Trays were weighed twice to ensure accuracy; in the case of a discrepancy, the scale was re-calibrated and the tray re-weighed until the same weight was revealed twice in a row. After each meal, the images of pre- and post-mealtime trays were systematically compared to ensure that all non-edible tray items (e.g., utensils, plates, cups) weighed pre-mealtime were still present on the tray post-mealtime. Any discrepancies in items were accounted for by adding or subtracting the missing or additional item weight to/from the weight of food/liquid consumed. Prior to the initiation of data collection, a log was made of all

possible non-food items that could be placed on a tray and their corresponding weights, which was used as needed. On occasion, food items were dropped or removed by participants for later consumption; in these circumstances, every effort was made to account for weight of food not consumed by the participant. This included reobtaining dropped items and adding them to the tray when possible, and obtaining and weighing equivalent items from the kitchen when participants requested to keep an item but did not consume it during mealtime.

Visual analysis was used to determine whether there was a functional relation between the eating conditions and changes in intake. Given that the robustness of one's diet is heavily controlled in the skilled nursing setting, this study focused primarily on the importance of intake quantity as means of mitigating risk of malnutrition. Consequently, intake was defined as the weight of food/drink consumed (dependent variable). Percentage of food/drink consumed was also calculated for each individual across the conditions in order to obtain additional information about individual consumption patterns. Visual analysis was supplemented by log response ratios (LRR), or the quantification of functional relationships in terms of an effect size based on the logarithm of the proportionate change from baseline (Pustejovsky, 2018). For the purposes of this study, the web-based calculator for single-case effect size was used from: https://jepusto.shinyapps.io/SCD-effect-sizes/ (Pustejovsky & Swan, 2018). For effect size calculations, we used the LRR increasing form, so that positive values indicated improved (i.e., increased) consumption, and the bias-corrected estimator to account for the smaller number of observations across conditions. LRR estimates and the associated measures of percent change were calculated for quantity of intake across all condition pairings. To be consistent with previous literature on behavioral mimicry and social modeling, both the watch and eat

conditions were compared to baseline as well as to each other in order to identify the potential active ingredient(s) of the intervention (i.e., presence of a companion, modeled eating behaviors).

Results

Data visualization supported a weak functional relation between eating environment and amount of intake consumed across participants as the variability, trend, and performance level within and across conditions did not readily suggest consistent improved intake (see Figures 1 and 2). Overall, Participant 3 demonstrated the greatest stability in consumption, and the greatest percentage of food consumed.

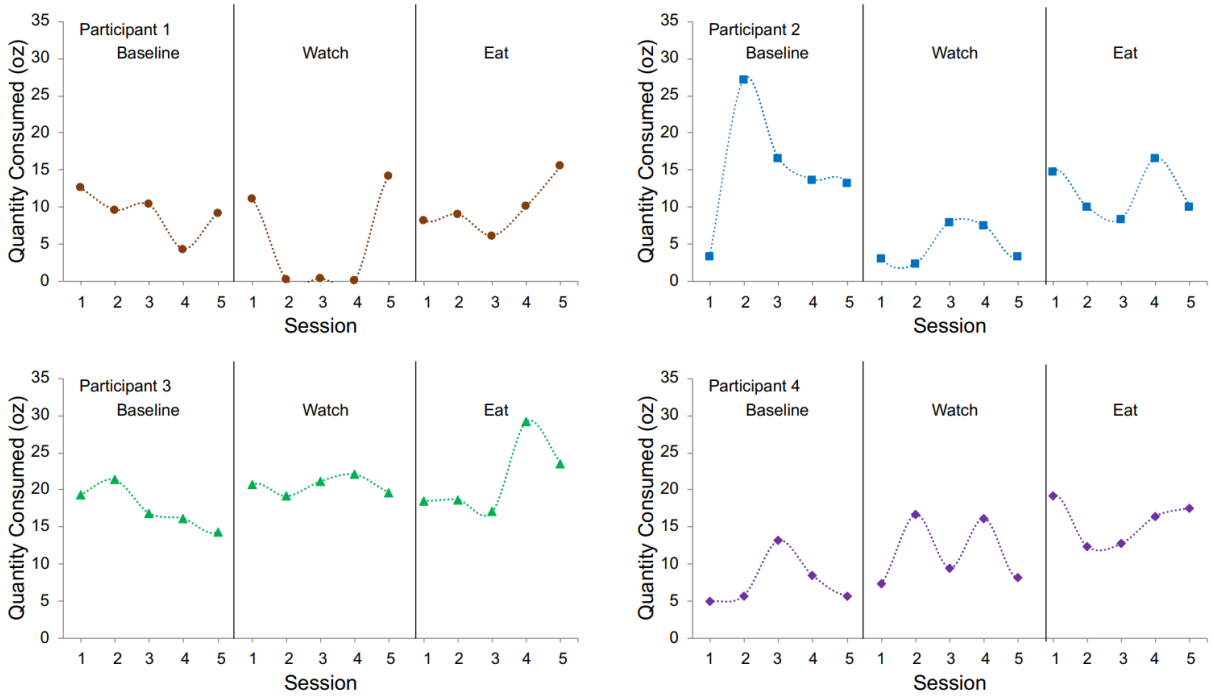

Figure 1. Quantity of food and liquid consumption across baseline and intervention (watch, eat), in ounces. Task order was randomized across participants; however, for comparison between participants, all data is presented here in the same task order.

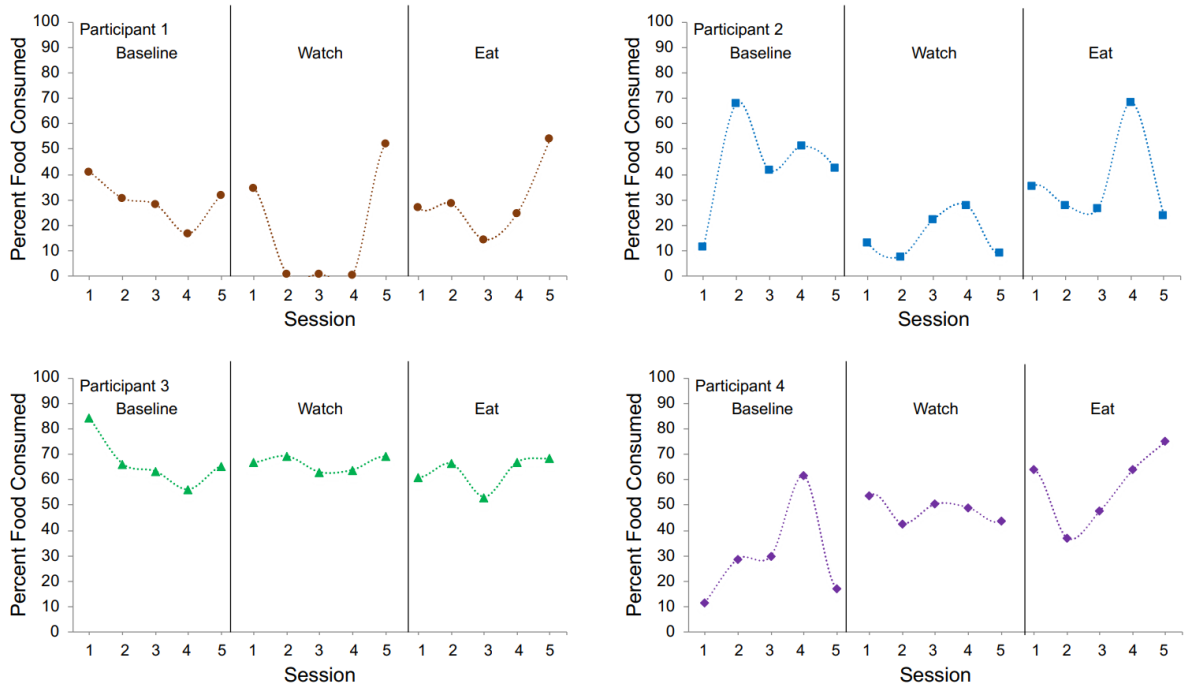

Figure 2. Percentage of food and liquid consumed across baseline and intervention (watch, eat). Task order was randomized across participants; however, for comparison between participants, all data are presented here in the same task order.

LRR estimates suggested a trend for increased weight of food consumed during the eat condition as compared to baseline for two participants (Participants 3 and 4; bias-corrected LRR estimates ranging from 0.20 to 0.70 equivalent to percentage increases of between approximately 22% and 102%) and the eat as compared to the watch condition for two participants (Participants 2 and 4; LRR estimates 0.29 and 0.88, percentage increases approximately 34% and 140%, respectively) (see Table 2). Positive estimates were calculated for an additional 1 participant when comparing eat versus baseline and 2 participants when comparing eat versus watch, although both the confidence intervals and standard error

measures suggested the possibility of no effect. Half of the participants also appeared to consume more during the baseline condition as compared to the watch condition while one participant consumed more during the watch condition as compared to baseline (Participant 3; 16% increase) and there was a trend for the final participant to also consume more during the watch condition (Participant 4; 51% increase). There was only one participant who was noted to consume the greatest weight of food and liquid in the baseline condition as compared to the other conditions (Participant 2). Significantly, this was the participant who had a known tooth abscess with associated pain during the eat and watch conditions, which was not present during the baseline condition. It is noteworthy to observe that this participant demonstrated increased intake (140%) from the watch to eat condition and improved intake during the eat condition to within 21% of her performance without tooth pain, with no significant difference in intake between eat and baseline based on the confidence interval and standard error estimates.

Table 2. Effect size estimates and percentage change in quantity of intake across the three eating conditions.

	Eat versus Baseline[a]			**Watch versus Baseline[a]**			**Eat versus Watch[a]**		
	LRRi Estimate (SE)	**LRRi 95% CI**	**Percent Change**	**LRRi Estimate (SE)**	**LRRi 95% CI**	**Percent Change**	**LRRi Estimate (SE)**	**LRRi 95% CI**	**Percent Change**
Participant 1	0.07 (0.22)	[-0.36, 0.49]	6.67%	-0.41 (0.60)	[-1.59, 0.77]	-33.72%	0.48 (0.61)	[-0.71, 1.66]	60.93%
Participant 2	-0.24 (0.29)	[-0.80,	-21.21%	-1.12 (0.35)	[-1.81, -	-67.22%	0.88 (0.28)	[0.34,	140.42%

		0.37]			0.42]			1.42]	
Participant 3	0.20 (0.13)	[-0.05 , 0.44]	21.77 %	0.15 (0.07)	[0.01, 0.30]	16.29 %	0.05 (0.11)	[-0.16 , 0.26]	4.71%
Participant 4	0.70 (0.21)	[0.28, 1.12]	102.04 %	0.41 (0.26)	[-0.10 , 0.92]	50.78 %	0.29 (0.19)	[-0.09 , 0.67]	33.99 %

[a] The first condition in each pair listing is considered the "intervention" and the second condition the "baseline". A positive estimate and percent change indicates improved behavior in the intervention as compared to baseline.
Note. *CI* = confidence interval; *LRRi* = log response ratio (increasing); *SE* = standard error

Discussion

Adequate nutritional intake is a serious concern for nursing home residents, particularly those experiencing impairments in cognitive and swallowing function. This study sought to determine if there is a functional relationship between mealtime environment and intake, which could support the use of more socialization-based interventions for improved intake in this population. It was hypothesized that the participants would consume the greatest amount of intake when eating in the presence of a confederate modeling the task of eating and drinking in front of the participant as compared to the baseline and watch conditions. It was additionally hypothesized that the presence of company during a meal would yield a greater amount of intake as compared to the baseline condition, but less intake than the eat condition, given the social nature of mealtime.

The results provided preliminary, albeit weak, support that the presence of a visual model may increase the weight of food consumed in some institutionalized individuals with dementia. While visual analysis revealed a weak functional relationship between meal

environment and intake, analyses revealed a trend for increased intake in the eat condition as compared to baseline and eat as compared to watch for half of the participants. These results provide preliminary validation for the application of visual modeling and mimicry to facilitate intake in clinical populations, building on the previous work that has been done among healthy younger and older individuals (Nam & Shune, 2020; Shune & Foster, 2017). This work additionally supports the previous literature connecting eating and drinking behaviors to social norms (Cruwys et al., 2014). Together, the results of the current and previous studies suggest benefits of eating in the company of others who are eating in order to maximize nutrition and mealtime independence. This finding may be of particular importance in the skilled-nursing setting, where many individuals may receive their meals in their own room, rather than in the communal dining room. This may be due to resident choice. However, often depending on staffing, time constraints, and other factors, staff members may themselves opt to serve residents in bed or in their room. Significantly, given the variability in performance and needs of this population, it is not surprising that strategies to increase intake would work for some, but not all, individuals. Relatedly, the lack of stability in intake during the baseline phase and across the conditions, which is not desirable from a data analysis perspective, is expected given the heterogenous nature of intake among this population.

Notably, Participant 2 was the only individual who demonstrated *less* intake in the eat and watch conditions as compared to baseline. However as noted previously, this participant was experiencing a painful tooth abscess in both the eat and watch conditions. Considering her extreme oral discomfort, including during meals, it would not generally be expected that this participant would demonstrate intake comparable to baseline in either experimental condition.

For the watch condition, this was exactly the case; however, remarkably, the implementation of a visual model yielded intake during the eat condition that was actually comparable to this participant's intake without tooth pain. Given this significant change in status, it is reasonable to conclude that this participant responded positively to visual modeling, despite not surpassing her baseline performance.

In regards to our second hypothesis, the watch condition yielded variable results compared to baseline, with half of the participants consuming less intake and two demonstrating a trend for increased consumption. Not surprisingly, the effects of company during mealtime likely vary across different individuals with dementia and may be helpful to some and harmful to others. One possible contributing factor to these results is cognition. It is of note that the two participants with the lowest scores on cognitive testing appeared to be most negatively impacted in terms of intake by the presence of another individual who was not also eating. Conversely, the participants with higher levels of cognitive ability appeared to potentially derive benefit from the social company. Attentional skills are one of the multiple cognitive abilities negatively affected by dementia, and higher-level attentional skills, such as alternating attention, which is crucial for multi-tasking, have been shown to be impacted early in the disease process (Gorus et al., 2006). It is possible that the cognitive demands of excessive conversation added to mealtime, without the facilitating effects of modeling, may actually distract the individual too much for him/her to experience the social benefits of eating around others.

Similar findings were recently reflected in a study conducted by Morrison-Koechl et al. (2021), which examined the impact of various psychosocial factors on food intake in long-term

care residents. Results indicated that social engagement can facilitate intake, however the association may be more complex than expected. For example, after accounting for "eating challenges," it was found that the relationship between low social interaction and decreased energy intake was no longer significant. Interestingly, staff engagement with those residents with higher needs tended to be more task-focused than relationship-centered; differences in the type of engagement in the "watch" condition were not explored here. The notion of dyadic interaction between staff and resident being a potential "interruption" was also posed by Liu et al. (2020) as a possible explanation for why resident intake in their study only increased when the resident did not respond to positive statements made by the staff, meaning that conversations were only one-way. Thus, there is a clear need to further explore the impacts of who is engaging and the types of engagement during mealtimes, particularly in the absence of visual modeling, on resident intake.

Additionally, it is of note that this intervention was generally well-received and perceived as feeling "natural" by the participants, and did not appear to have adverse effects on the individuals in this study. However, no comparisons were made between this intervention and other, more commonly used, interventions for increased intake that are less socialization focused. Given the unobtrusive, "natural" nature of this intervention, an interesting future direction would be to examine the impact of this intervention compared to other commonly used interventions in regards to both intake and resident behavior, as it would be anticipated that visual modeling may elicit less adverse behaviors than more direct approaches.

Clinical Implications

Although more research is needed, this study provides initial proof of concept for the use of visual modeling as a strategy to increase intake among some individuals with dementia. It is clear from the current preliminary study, though, that this strategy may not yield the same effect on all individuals. Importantly, while the strategy did not increase intake for all participants, it also did not appear to harmfully reduce intake of any participant. Thus, visual modeling may provide a viable strategy to trial with appropriate residents as part of the individualized treatment plan development process. Based on the results of the current and previous studies, certain factors should be weighed when considering this intervention. A minimum of adequate vision, functional attention, and motoric capacity to self-feed will be needed to employ this intervention. Additionally, the findings indicate that the clinician may have to consider the amount and type of distracting stimuli in the environment, especially when the individual has greater cognitive impairment. Although an individual at a GDS stage 5 may still benefit from visual modeling, individuals at this stage appear to be more negatively affected by distracting stimuli that do not involve the task of eating or drinking (e.g., conversation alone). This is a significant consideration for mealtimes more broadly given the amount of distracting stimuli an individual is likely exposed to within the typical dining room setting. These individuals may benefit from, for example, a single visual model in a quiet environment, compared to the overstimulating experience of the busy dining room. It may also be important to consider baseline level of intake, as participants who demonstrate near-adequate intake prior to the intervention will naturally have less room to improve compared to those with more significantly reduced intake. For example, an individual who is malnourished or at risk for malnourishment but has near adequate intake will have little room to improve

from this intervention, given that at this time, weight of intake is the only outcome measure investigated. It is still unknown whether the effects of this intervention can be applied to increasing tendency to elect certain foods (i.e., more nutritious options), which may have implications for nutrition without increased intake, however more research is needed on this topic.

Furthermore, this intervention warrants consideration of who is providing the visual modeling. Previously literature has supported that mimicry is most efficacious when feelings of trust and companionship are present (Chartrand & Lakin, 2013). Although this factor was not manipulated in the current study, it is of note that a single clinician who had previously established rapport with all participants provided the intervention. It is plausible that when considering a specific visual model, the ideal candidate will most likely be an individual that the subject knows and regards favorably. However, this remains unknown. It will be beneficial for subsequent studies to comparatively examine the impact of modifications to the visual model to determine the importance of aspects such as familiarity with and regard for the model, as well as the potential to expand the use of visual models from 1:1 to a larger environment.

Based on the current results, skilled nursing facilities may benefit from implementation of programs to facilitate social modeling during mealtime, including providing “mealtime buddies,” or volunteers who eat in the company of the residents, having select staff members eat with nursing home residents, or seating residents with low intake in the presence of individuals who do not have intake concerns. The allowance of staff members to eat with residents has previously been found to result in improvements in resident weight, as well as subjective improvements in mealtime autonomy and engagement (Chartrand & Fremontier,

2010). Previous literature has also approximated the use of a visual model through implementation of group dining, which was found to improve communication amongst residents, but yielded no nutritional improvements (Kofod & Birkemose, 2004). It should be emphasized that those researchers did not explicitly consider visual modeling in their design, and therefore did not consider the eating habits of each resident, which would be necessary to ensure that each malnourished individual was provided with an adequate visual model. This may be a possible contributor to the lack of significant results noted in regards to nutritional outcomes. Further, as has been noted in the current study, modeling may need to be an individualized technique that only works for a subset of the target population, thus negating overall group effects.

The results additionally emphasize the importance of consideration of dining environment in the evaluation of dysphagia and independence for self-feeding. Albeit more subtle, the environment appears to have an influence on one's intake, which has direct implications on self-feeding in the dementia population, given that impaired self-feeding is an expected consequence of this condition (Katz et al., 1963; Roque et al., 2013). This expectation of an individual with dementia to eventually need feeding assistance, paired with the concern for ensuring adequate nutrition, may lead clinicians to initiate direct feeding of these individuals prematurely, before other options have been considered (Dey, 1997). It is known that this decision may have undesirable consequences for swallow safety and quality of life (Langmore et al., 1998). Given this influence, it would behoove the SLP to ensure that an individual is first set up for success in his/her dining environment prior to making determinations regarding one's need for assistance.

Additionally, this study provided objective information about the questionable utility of meal percentages. An initial outcome measure of percent of meal intake (measure by percent weight of food/liquid consumed) was used in addition to weight. Shortly into the study, though, it was demonstrated on some occasions that while participants would consume a higher quantity of food based on weight, their percentage intake appeared to decrease. This was due to significant fluctuations in the weight of the meal provided across all visits, resulting in percentages that did not consistently reflect the actual nutritional intake of the individual. Consequently, this outcome measure was removed from further analysis. It is still prudent to note that the method for calculating percentage in this study was more rigorous that the method frequently used in the nursing home setting (i.e., visual inspection with categorical estimation of mealtime percentage) and yet still was not reflective of nutritional intake. Often clinicians may not be aware of each meal size (Monacelli et. al., 2017). Given this, along with the often-inconsistent nature of daily food records in the nursing home setting, including a tendency to overestimate intake (Simmons, 2000), the common practice of using mealtime percentages in examination of intake and nutrition should likely be considered carefully and in relation to other nutritional factors.

Limitations

This study had several limitations worth noting. First, the current results are based on data from only four participants. Given the paucity of research on this topic, particularly among individuals with cognitive impairments, the intentions of this pilot study were to establish proof of concept on a smaller scale within the clinical population as a necessary first step prior to a larger intervention trial. Furthermore, we were only able to examine intake once per day during

breakfast and lunch; it is possible that the results may have been different if intake was examined across all three daily meals. As noted above, no stability in outcomes was observed during each condition, which likely reflects the typical fluctuations in functioning observed in this population. Future work will benefit from an increased number of participants being observed over a greater number of meals and days (i.e., increased duration of each study condition) in order to continue to examine clinical effectiveness.

Additionally, while this study used weight of food consumed as its primary outcome measure, no data were collected regarding other aspects of malnutrition to determine the potential clinical impacts of change in intake. Given that individuals only experienced each condition for one meal per day over five days, there was not sufficient time to elicit significant changes in overall nutritional status. Future studies that include all daily meals over a longer time period would benefit from additionally examining the impact of visual modeling on important nutritional outcomes such as weight, body-mass index, and malnutrition risk.

Given the need to balance a more naturalistic environment with certain experimental restrictions, there were a few additional factors that could have impacted the results. First, the type and quantity of food provided to participants each day was determined based on the facility's dining staff and varied across the study period. Performance did appear to vary for certain participants based on quantity of food provided. Further, no measures were collected about participant preference for their meals, which could have varied across days and across conditions. As previously mentioned, every effort was made to balance meals between conditions, however this was not always possible. For example, mid-study, Participant 4 requested to only participate in data collection during breakfast time, so he could return to the

dining room for lunches. This participant did not demonstrate a notable difference in intake between breakfast and lunch, therefore we do not believe that this change significantly impacted this participant's results. Additionally, it is beyond the scope of this study to directly attribute the observed results to mimicry, as there are other possible explanations for the potential success of visual modeling. For example, it may not be that the participants are modifying their eating and drinking behaviors consciously for social cohesion purposes, rather than due to unconscious imitation. More research examining the direct temporal relationship between confederate and participant behavior will be beneficial to better elucidate the underlying factors associated with this intervention, and may provide more concrete evidence of mimicry being a contributor.

Conclusions

It is a frustrating truth that with declining cognition, the tools available to clinicians to maximize patient well-being become increasingly limited. However, the results of the current study emphasize the importance of clinicians turning their attention to aspects of the patient experience that can be controlled. At a certain stage of cognitive impairment, an individual may no longer be appropriate for the standard restorative and compensatory approaches employed with other populations. Yet, the development of a robust environment may be sufficient to maximize the individual's performance, and prolong his/her ability to engage in one of the most foundational social behaviors performed by human beings: the act of eating and drinking. The environment should not be overlooked by the SLP when making decisions regarding swallowing and nutrition. The results of current study provide initial proof-of-concept support that visual modeling may be a potential alternative or supplement to more direct approaches to improve

intake in some nursing home patients with cognitive impairment. Thus, this work may serve as foundational literature for future larger investigations of socialization-based interventions, which may yield functional improvements in nutrition without the trade-off of perceived declines in independence, quality of life, swallow safety, and naturalness that may occur with more direct interventions.

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