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Individualized Music Program is Associated with Improved Outcomes for U.S. Nursing Home Residents with Dementia

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Abstract

Objectives—The objective of this study was to compare resident outcomes before and after implementation of an individualized music program, MUSIC & MEMORYSM (M&M), designed to address the behavioral and psychological symptoms associated with dementia (BPSD).

Design: Setting—98 nursing homes (NHs) trained in the M&M program during 2013 and 98 matched-pair comparisons.

Participants—Long-stay residents with Alzheimer’s disease and related dementias (ADRD) residing in M&M participating facilities (n=12,905) and comparison facilities (n=12,811) during 2012–2013.

Intervention—M&M is a facility-level quality improvement program that provides residents with music specific to their personal histories and preferences.

Measurements—Discontinuation of anxiolytic and antipsychotic medications, and reductions in behavioral problems and depressed mood in 2012 (pre-intervention) and 2013 (intervention), calculated using Minimum Data Set (MDS) assessments.

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Conflicts of Interest: K. Thomas, PhD, MA; C. Kosar, MA; J. Ogarek, MS; A. Trepman, MA, MPH, and R. Baier, MPH have no potential conflicts of interest to declare.

Author Contributions: VM and RB obtained the data; KT and VM conceptualized and directed the analysis; CK completed the analysis; KT, RB, CK, and VM interpreted the results; KT and RB drafted the paper; CK, AT, and VM commented on drafts and approved the final paper.

Results—The proportion of residents who discontinued antipsychotic medication use over a six-month period increased from 17.6% to 20.1% among M&M facilities, while remaining stable among comparison facilities (15.9% to 15.2%). The same trend was observed for anxiolytic medications: discontinuation of anxiolytics increased in M&M facilities (23.5% to 24.4%), while decreased among comparison facilities (24.8% to 20.0%). M&M facilities also demonstrated increased rates of reduction in behavioral problems (50.9% to 56.5%) vs. comparison facilities (55.8% to 55.9%). No differences were observed for depressed mood.

Conclusions—These results offer the first evidence that the M&M individualized music program is associated with reductions in antipsychotic medication use, anxiolytic medication use, and BPSD symptoms among long-stay NH residents with ADRD.

Keywords

Alzheimer's disease; antipsychotics; anxiolytics; dementia; long-term care; quality improvement

INTRODUCTION

Objective

Although national goals focus on preventing or curing Alzheimer's disease and related dementias (ADRD),¹⁻³ disease prevalence is increasing with the aging population and is expected to reach 7.1 million people by 2025.⁴ Identifying and disseminating safe and effective interventions can therefore positively impact millions of people living with ADRD now and in the future. Evidence-based interventions are a particularly high priority for nursing homes (NHs), where at least 50% of all residents have ADRD⁵ (about three times higher than among community-dwelling older adults⁶) and 80% of people with ADRD exhibit behavioral and psychological symptoms of dementia (BPSD)⁷ that can adversely affect their experiences and outcomes.⁸

Given the potential risks of using medications, such as antipsychotics, to address BPSD,^{9,10} finding effective non-pharmacological interventions is a high priority. Many patient-level non-pharmacological interventions exist, such as music therapy. Systematic reviews highlight the potential for music therapy to reduce agitation,¹¹⁻¹⁴ aggression,¹² anxiety,¹⁵ and behavioral symptoms,^{15,16} and improve mood.¹⁶ However, investigators note heterogeneous effects and generally weak study designs making the evidence, particularly for NH residents, somewhat inconclusive.¹⁷

One specific personalized music program, MUSIC & MEMORYSM (M&M), is growing in popularity. In M&M, caregivers provide individuals diagnosed with ADRD music playlists that are tailored to their personal history of music preferences.¹⁸ The intervention's potential is illustrated in the award-winning 2014 documentary, *Alive Inside*, which shows residents with dementia moving, singing, and engaging with others when listening to their favorite music.¹⁹ However, its efficacy has not been rigorously established and little is known about its implementation and effectiveness in the nursing home setting. Therefore, the objective of this study was to examine the improvements that might be attributable to receiving M&M among nursing home residents with ADRD. Building on the music therapy literature base and anecdotal evidence of the effectiveness of the M&M program, we hypothesize that

residents with ADRD in nursing homes that implemented M&M would have increased rates of anti-psychotic and anxiolytic medication discontinuation, reductions in BPSD, and improvements in mood compared to residents in matched comparison facilities without the program.

METHODS

Data

Data for this study come from the Minimum Data Set (MDS) 3.0 and LTCfocUS.org for the years 2012 (pre-intervention) and 2013 (year of training, or intervention). The MDS is a federally-mandated assessment completed by clinicians at regular intervals (e.g., admission, discharge, quarterly, annually, and when a significant change occurs) for all NH residents. The resulting data include information about residents' diagnoses, treatments, symptoms, and medications. LTCfocUS.org is a Brown University database containing aggregated information from resident MDS assessments and facilities' Online Survey, Certification, And Reporting data, collected during the state inspections.²¹

Sample

The analytic sample included long-stay residents (i.e., identified as having at least one quarterly assessment, which suggested that they no longer were in the facility solely for post-acute, rehabilitative care) in facilities exposed to M&M during calendar year 2013 and pair-matched comparison facilities. Because we were unable to determine which residents in the nursing home received the intervention, we identified our analytic sample as those who were likely to receive the intervention: residents with a diagnosis of ADRD who were not fully dependent in their Activities of Daily Living (an Activities of Daily Living (ADL) score less than or equal to 24;)²² with some level of cognitive impairment (a Cognitive Function Scale²³ greater than or equal to 2) and who were not receiving hospice in the facility or comatose. A diagnosis of ADRD came from the MDS Active Diagnoses Section (Section I). We included any individual who had an active diagnosis of Alzheimer's disease, non-Alzheimer's dementia, or one of the following ICD-9 codes listed: 290.0, 290.10, 290.11, 290.12, 290.13, 290.20, 290.21, 290.3, 290.40, 290.41, 290.42, 290.43, 294.0, 294.10, 294.11, 294.20, 294.21, 331.0, 331.11, 331.19, 331.2, 331.82, 331.7, or 797.

We obtained a list of facilities that were trained in M&M during 2013 from MUSIC & MEMORY, Inc. We used the 2012 data from LTCfocUS.org to match trained facilities to facilities with similar characteristics and resident composition. We excluded from our comparison all facilities trained by MUSIC & MEMORY, Inc. in 2012 (pre-intervention) or 2014 (n=638). Comparison facilities were matched exactly on geographical location (Medicare region), Medicare 5-Star Compare rating²⁴ (category 2–3 and category 4–5, excluding facilities with the lowest rating, 1-Star), and for-profit status. Among these exact matched facilities, we calculated the absolute difference in facility occupancy rate, proportion of residents under the age of 65 years, proportion of residents with ADRD, total number of beds, and facility total staff hours/day/resident for M&M and candidate matches. We averaged the absolute differences by facility and chose the candidate facility that on average had the smallest absolute difference, or the characteristics closest to those of the

M&M facility. Fewer than 10 homes were matched more than once and were reviewed by hand to choose the best match.

MUSIC & MEMORY Intervention

M&M is a music program that builds upon evidence for individualized music synthesized in a 2013 review.²⁰ In 2006, its creator, a social worker, decided to leverage inexpensive new technology (iPods) to create a personalized music program for people with ADRD. To implement M&M, caregivers (e.g., healthcare providers or family members) create music playlists tailored specifically to each resident's personal history of music choices and preferences.¹⁸

Before implementing M&M, at least one staff member from each facility undergoes training by MUSIC & MEMORY, Inc., a non-profit organization. Staff complete three live 90-minute webinars that focus on: 1) the benefits of personalized music and the legal boundaries for music sharing; 2) how to create personalized music playlists in iTunes®; and 3) how to introduce the program and expand it incrementally over time. Afterwards, staff are encouraged to form teams charged with determining how best to implement M&M, including selecting residents to receive iPods, pilot testing the process of researching music and providing it to residents, and expanding the intervention's use. Staff from certified facilities can access online and print resources for ideas and support about M&M program implementation. These resources include a web site with best practices, one-on-one consultation, and coaching calls on different aspects of the program.

Cost for certification and training depends on the number of residents or the facilities in a corporation, with most paying \$250–\$1000 upfront and then \$200 per year. Some participants also receive “starter kits” with iPods and music gift cards, while others purchase all iPods or request donated equipment or money from families.

Outcomes

Antipsychotic and Anxiolytic Use—We examined whether or not a resident received any anxiolytic and/or antipsychotic medications during the seven days prior to an assessment as reported in Section N of the MDS. The MDS does not report specific drugs, only classes, including “antipsychotic” and “antianxiety” medications.

Behavioral Disturbance Presence and Frequency—We used the Aggressive Behavior Scale (ABS) to measure behavioral disturbance presence and frequency.²⁵ The four items that compose the ABS come from the MDS Behavior section (Section E): physical, verbal, or other behavioral symptoms directed toward others, and rejection of care. Each item receives a score of 0–3 indicating that the behavior was not exhibited in the last week (0) or that it occurred 1–3 days (1), 4–6 days (2), or daily (3). The MDS assessors make this assessment after reviewing the medical record, observing the resident, and consulting with staff and family members when possible. Total ABS scores range from 0–12 and are a resulting sum of the four items. The ABS is reported to have a Cronbach alpha between 0.79 and 0.93, and is highly correlated with the Cohen-Mansfield Agitation Inventory (correlation coefficient = 0.72, $P < .001$).²⁵

Mood—We used the nine-item Patient Health Questionnaire (PHQ-9[®]) severity score to measure mood. The PHQ-9 is a validated interview that screens for symptoms of depression and scores range from 0–27.²⁶ For residents who were unable to complete the PHQ-9, we used scores from the PHQ-9 Staff Observation version (PHQ-9-OV[®]). Staff Assessment of Mood. The MDS assessor is instructed to interview the staff member who knows the resident best to complete the PHQ-9 OV.

Data Analysis

The exact timing of the M&M implementation in 2013 was unknown. To circumvent this limitation, we compared changes in the use of medications, presence of behavioral symptoms, and mood within residents over a 180-day period in pre- and post-implementation years, assuming that M&M will have an effect over the 6-month period in 2013. In each year, the resident's 'baseline' assessment was the first in which study inclusion criteria were met. Outcomes measured at baseline were subtracted from their measurements at the assessment six months later (or closest to this point). Thus, for each resident we identified whether antipsychotics and anxiolytics were discontinued at 180-days, and whether symptoms of behavior disturbances and depressed mood were reduced (indicated by a positive difference between 180-day PHQ-9 and ABS scores) in pre- and post- implementation years in facilities with and without M&M. We then used conditional logistic regression to identify whether rates of medication withdrawal, behavioral symptom reduction, and improvement in mood were different between the pre-intervention and intervention periods among M&M sites vs. pair-matched comparison facilities. We modeled each individual outcome as a function of treatment status, year, the interaction of year and treatment, and facility fixed effects. The coefficient of the interaction term represents the differences-in-differences estimator, and when significant indicates that outcomes in the pre-intervention and intervention period were different for M&M sites and comparison facilities. The conditional logistic model was chosen to account for the matched-pair design, and by including facility fixed effects the effect of M&M was identified on the variation in outcomes across individuals residing in the same facility. Analyses were conducted using Stata MP version 14.1 (StataCorp, College Station, TX). Null hypotheses were tested with a two-tailed alpha of 0.05.

Brown's Center for Long-Term Care Quality & Innovation (Q&I Center), which tests interventions to improve post-acute and long-term care, has access to MDS data under a CMS data use agreement. The Brown Institutional Review Board approved our use of these data to evaluate quality improvement projects.

RESULTS

During the pre-intervention year, matched comparison facilities had a lower proportion of non-whites and lower average lengths of stay of long-stay residents with ADRD (Table 1). Comparison facilities were also more likely to have long-stay residents with ADRD who had a higher mood score, lower rates of behavioral disturbances, and higher rates of anxiolytic medication use.

Difference-in-differences estimates showed statistically significant improvements for several measures among residents residing in facilities that participated in M&M (Table 2). Specifically, we found that the difference in the rates of discontinued antipsychotic and anxiolytic medication use and reduced behavioral problems was greater in M&M facilities compared to pair-matched comparison facilities. Among M&M facilities, the proportion of residents who discontinued antipsychotic medication increased from 17.6% in 2012 to 20.1% in 2013, while remaining stable among comparison facilities (15.9% to 15.2%). The proportion of residents who discontinued anxiolytic medication increased slightly among M&M facilities (23.5% to 24.4%), while decreased among comparison facilities (24.8% to 20.0%). Residents in M&M facilities also demonstrated increased rates of improvement in behavioral symptoms (50.9% exhibiting behavior improvement in 2012 to 56.5% exhibiting improvements in 2013) compared to residents in comparison facilities (55.8% in 2012 and 55.9% in 2013). In 2012, the mean ABS score for all residents in M&M facilities was 0.84 (SD=0.83) and 0.67 (SD=1.52) in comparison facilities (see Table 1). In the following year, the mean ABS score was 0.74 (SD=1.72) in M&M facilities and 0.63 (SD=1.44) in comparison facilities. There was no statistically significant difference in the differences between M&M and comparison facilities observed for changes in mood.

DISCUSSION

Results from this study offer the first evidence that the M&M individualized music program may be associated with reductions in antipsychotic and anxiolytic medication use as well as improvement in BPSD among NH residents with ADRD. While we did not observe relative improvements in mood, this retrospective study builds upon the literature base supporting the potential for personalized music therapy to reduce antipsychotic and anxiolytic use and improve BPSD,^{11–16} particularly among NH residents.^{27–29}

M&M offers a low-cost, non-pharmacological solution to the growing burden that the projected increase in ADRD will place on NH providers. The program is popular and spreading: by the end of 2015, thousands of provider sites across the world had become certified. Twelve states currently have M&M NH demonstration projects underway, including four state-sponsored projects (California, Ohio, Texas, and Wisconsin). Its popularity stems, in part, from the fact that it offers a non-pharmacological alternative to anti-psychotic medications, which can pose significant risks and are the focus of a national patient safety campaign. It is also low-cost: start-up costs for implementing a M&M program include staff training and iPod and music purchases. Apart from those costs, ongoing implementation requires only staff time to identify residents that would benefit from music, research those individuals' music preferences, and incorporate the use of the iPods into daily care routines.

Our work adds to the literature by establishing the effect of a personalized music program in reducing BPSD, anxiolytic, and antipsychotic medication use in a population of long-stay NH residents with ADRD. Previously, meta-analyses found that music-related interventions were associated with reductions in depression,¹⁵ anxiety³⁰ and BPSD^{15,30} among individuals with dementia. However, these findings were not specific to the NH population. While our findings were not consistent with previous studies that have shown that music

effectively improves depression in older adults with ADRD, we did find reductions in behavioral disturbance presence and frequency, as well as reduction in the use of anxiolytic and antipsychotic medications.

This study has many strengths, including a larger sample size than any previously-reported outcomes of individualized music therapy, a matched comparison group, and validated, routinely-collected outcome measures. However, it is a retrospective analysis constrained by the fact that we do not know when facilities were trained during 2013, when or how they implemented the program, and which residents received iPods. We may underestimate the effect by examining outcomes for all long-stay residents with ADRD, when only a subset actually received the intervention. Future work to evaluate this program will consider random assignment of facilities to participate in the M&M program or to serve as comparisons and should include an implementation evaluation that allows us to characterize the residents selected by staff to participate, the delivery of the intervention, and any immediate effects that may be recognizable through residents' participation in the M&M intervention.

As with any program, illuminating the “black box” of implementation is integral to understanding its effectiveness and generalizability. MUSIC & MEMORY, Inc. reports that the programs' use varies widely across NHs, including which residents are selected to receive an iPod, where iPods are stored, and how often residents have access to them. Future research is needed to characterize factors associated with effective implementation in order to standardize staff training and program implementation to optimize program performance and ensure optimal resident outcomes.

We note several additional limitations. First, we assume that the program was in place for all of 2013 and that all long-stay residents with dementia received iPods. Residents may have participated in the intervention before or after their baseline MDS assessments in that year, or may not have participated at all. However, these assumptions result in estimates that are attenuated rather than biased upward. Second, while we attempted to match M&M with comparison facilities based on meaningful observable characteristics, we were unable to fully control for differences that may have affected the outcomes of interest. For example, facilities that chose to take on a new intervention, in this case M&M, may also be interested in adopting other innovative or best practices for dementia care, such as increasingly adopting non-pharmacological strategies and minimizing the use of antipsychotics or anxiolytics. In addition to differences we found in some measured facility characteristics (e.g., resident race and length of stay), it is possible that M&M facilities are inherently different from those that chose not to participate in ways that we are unable to measure with our data.

CONCLUSION

In summary, this study offers the first evidence that the M&M program may be associated with reductions in the use of antipsychotic and anxiolytic medications, as well as BPSD symptoms among NH residents with ADRD. While more insight is required to understand which residents are most likely to benefit from this particular music therapy program and

what improvement they experience, our findings signal that in the aggregate, the M&M program is associated with improvement in the experience of care provided to residents with ADRD in NHs.

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Table 1

Facility Characteristics for M&M Sites and Pair-Matched Comparison Facilities During the Pre-Intervention Year, 2012

Characteristic	M&M Sites (N= 98)	Pair-Matched Comparison Facilities (N= 98)	Test, df, p-value
Total beds, mean (sd)	175.6 (132.1)	164.4 (116.2)	t=-0.63, df=194, p=0.53
Occupancy, mean % (sd)	88.3 (11.4)	89.0 (9.2)	t=-0.51, df=194, p=0.61
Not-for-profit, n (%)	64 (65.3)	64 (65.3)	$\chi^2=0.00$, df=1, p=1.00
Medicare, mean % (sd)	14.9 (11.2)	13.3 (9.0)	t=-1.09, df=14, p=0.28
<65 years, mean % (sd)	13.7 (14.9)	12.1 (13.2)	t=-0.83, df=194, p=0.41
Member of Chain, n (%)	34 (34.7)	39 (39.8)	$\chi^2=0.55$, df=1, p=0.46
Staffing, mean hours/residents/day (sd)	3.7 (0.7)	3.7 (0.7)	t=0.20, df=194, p=0.84
5 Star Nursing Home Compare Rating			$\chi^2=0.00$, df=1, p=1.00
2 or 3, n (%)	48 (49.0)	48 (49.0)	
4 or 5, n (%)	50 (51.0)	50 (51.0)	
Overall Star-Rating mean (sd)	3.5 (1.2)	3.5 (1.1)	t=0.44, df=194, p=0.66
<i>Residents Included in Analytic Sample</i>			
	<i>n= 6298</i>	<i>n=6278</i>	
Age, mean years (sd)	84.4 (9.7)	84.6 (9.2)	t=1.52, df=12574, p=0.13
Female Sex, n (%)	4627 (73.5)	4554 (72.5)	$\chi^2=1.38$, df=1, p=0.24
Non-White Race, n (%)	1978 (31.4)	1225 (19.5)	t=2.32, df=12574, p<0.001
Length of Stay in Nursing Home, mean days (sd)	635.8 (791.1)	581.3 (773.4)	t=-3.91, df=12574, p<0.001
<i>Medication Use, Behaviors, and Mood</i>			
Any Anxiolytic use, n (%)	886 (14.1)	1038 (16.5)	$\chi^2=14.75$, df=1, p<0.001
Any Antipsychotic use, n (%)	1831 (29.1)	1876 (29.9)	$\chi^2=0.97$, df=1, p=0.33
Any Behavioral Problem, n (%)	1679 (26.7)	1604 (25.6)	$\chi^2=1.98$, df=1, p=0.16
Behavioral Disturbance Presence and Frequency \ddagger , mean (sd)	0.8 (1.8)	0.7 (1.5)	t=-5.33, df=12574, p<0.001
Mood \ast , mean (sd)	2.9 (3.7)	3.1 (4.1)	t=3.96, df=11934, p<0.001

\ast Measured using the Patient Health Questionnaire 9-Item Depression Screener or PHQ-9-OV (range: 0–27; higher=worse);

\ddagger Measured using the Aggressive Behavior Scale (range: 0–12; higher=worse)

Abbreviations: sd: standard deviation

Table 2
Difference in 180-Day Outcomes Among Residents in M&M Sites Vs. Pair-Matched Comparison Facilities, 2012 to 2013

Outcome	M&M Sites (N=98)				Pair-Matched Comparison Facilities (N=98)				Diff	t [†] [test, p-value]
	Pre-Intervention Year		Intervention Year		Pre-Intervention Year		Intervention Year			
	N	% Change [±]	N	% Change [±]	N	% Change [±]	N	% Change [±]		
Residents Discontinued Anxiolytic Medications	886	23.5%	994	24.4%	1038	24.8%	1114	20.0%	-4.8%	0.33 z=2.14,p=0.003
Residents Discontinued Antipsychotic Medications	1830	17.6%	1749	20.1%	1875	15.9%	1841	15.2%	-0.7%	0.27 z=2.01,p=0.04
Residents had Reductions in Behavioral Disturbance	1679	50.9%	1703	56.5%	1599	55.8%	1589	55.9%	0.1%	0.22 z=2.01,p=0.04
Residents had Improvement in Mood [*]	3164	46.0%	3442	45.1%	3277	49.1%	3437	47.6%	-1.5%	0.05 z=-1.21,p=0.53

Note. Degrees of freedom in all models is 2.

[±] =Positive change indicates discontinuation of medications, reduction in behavioral disturbance presence and frequency, and improvement in mood over a 180-day period.

^{*} Staff report used when resident report is missing

[†] =Difference-in-Difference Estimator