IMPORTANCE Off-label antipsychotic prescribing in nursing homes (NHs) is common and is associated with increased risk of mortality in older adults. Prior large-scale, controlled trials in the NH setting failed to show meaningful reductions in antipsychotic use.

OBJECTIVE To quantify the influence of a large-scale communication training program on NH antipsychotic use called OASIS.

DESIGN, SETTING, AND PARTICIPANTS This investigation was a quasi-experimental longitudinal study of NHs in Massachusetts enrolled in the OASIS intervention. Participants were residents living in NHs between March 1, 2011, and August 31, 2013. The data were analyzed from December 2015, to March 2016, and from November through December 2016.

EXPOSURES The OASIS educational program targets all NH staff (direct care and nondirect care) using a train-the-trainer model. The program goals were to reframe challenging behaviors of residents with cognitive impairment as the communication of unmet needs, to train staff to anticipate resident needs, and to integrate resident strengths into daily care plans.

MAIN OUTCOMES AND MEASURES This study used an interrupted time series model of facility-level prevalence of antipsychotic medication use, other psychotropic medication use (antidepressants, anxiolytics, and hypnotics), and behavioral disturbances to evaluate the intervention's effectiveness in participating facilities compared with control NHs in Massachusetts and New York. The 18-month preintervention (baseline) period was compared with a 3-month training period, a 6-month implementation period, and a 3-month maintenance period.

RESULTS This study included 93 NHs enrolled in the OASIS intervention (27 of which had a high prevalence of antipsychotic use) compared with 831 nonintervention NHs. Among OASIS facilities, prevalences of atypical antipsychotic prescribing were 34.1% at baseline and 26.5% at the study end (absolute reduction of 7.6% and relative reduction of 22.3%) compared with a drop of 22.7% to 18.8% in the comparison facilities (absolute reduction of 3.9% and relative reduction of 17.2%). In the OASIS implementation phase, NHs experienced a reduction in antipsychotic use prevalence among OASIS facilities (−1.20%; 95% CI, −1.85% to −0.09% per quarter) greater than that among non-OASIS facilities (−0.23%; 95% CI, −0.47% to 0.01% per quarter), resulting in a net OASIS influence of −0.97% (95% CI, −1.85% to −0.09%; P = .03). A difference in trend was not sustained in the maintenance phase (difference of 0.93%; 95% CI, −0.66% to 2.54%; P = .48). No increases in other psychotropic medication use or behavioral disturbances were observed.

CONCLUSIONS AND RELEVANCE Antipsychotic use prevalence declined during OASIS implementation of the intervention, but the decreases did not continue in the maintenance phase. Other psychotropic medication use and behavioral disturbances did not increase. This study adds evidence for nonpharmacological programs to treat behavioral and psychological symptoms of dementia.
Antipsychotic medications are commonly used off label to treat behavioral and psychological symptoms of dementia in nursing facilities,\(^1\),\(^2\) despite increased risk of stroke and death.\(^3\),\(^8\) US Food and Drug Administration black box warnings,\(^9\),\(^10\) and only modest evidence of efficacy.\(^11\),\(^12\) A variety of approaches to reduce nursing facility antipsychotic use have had limited success.\(^13\)–\(^18\) The largest successful intervention reported a mean relative reduction in antipsychotic use of 23%.\(^15\) However, this intervention was resource intensive, requiring hour-long geriatric psychiatrist evaluations, evening meetings with families, up to 6 one-hour nurse trainings, and a 4-hour administrative consultation.\(^16\)

The objective of this study was to evaluate the effectiveness of a statewide intervention program (OASIS) implemented by a state nursing facility trade organization that enrolled more than 100 nursing homes (NHs). OASIS uses an innovative training curriculum built on a hierarchy of needs by Maslow.\(^19\) Unlike most behavioral management programs that focus on reacting to and managing behavioral and psychological symptoms of dementia,\(^20\) OASIS reframes challenging behavior as the communication of unmet biological and psychological needs. OASIS differs from traditional behavior management programs by shifting focus away from the functional and cognitive disabilities that NH residents have toward the personhood of who residents are. The primary hypothesis was that OASIS is associated with greater reductions in antipsychotic prescribing relative to controls, without increasing the use of other psychotropic medications or behavioral disturbances. The secondary hypothesis was that antipsychotic reductions are maintained after OASIS implementation.

**Methods**

**Study Design, Setting, and Nursing Facility Recruitment**

We used a quasi-experimental longitudinal study design with external controls to estimate changes in antipsychotic medication prescribing associated with the OASIS program. The target population included all 424 nursing facilities in Massachusetts. We excluded the 11 nursing facilities in the OASIS pilot study. We used a 2-stage recruiting process. We first ranked nursing facilities by facility-level baseline prevalence of antipsychotic use (ie, January to March 2012) using data from Nursing Home Compare.\(^21\) The state’s nursing facility trade organization sent letters of invitation to the administrators of the highest antipsychotic prescribing facilities. The letter of invitation was followed up by a telephone call 2 weeks later. In the second stage, recruitment was expanded to all eligible facilities. The trade organization enrolled the first 106 nursing facilities that submitted a completed application. The OASIS intervention was a quality improvement program that did not require institutional review board approval. The present analysis was approved by the University of Massachusetts Medical School institutional review board. Informed consent was not required for the evaluation of this statewide quality improvement program.

We analyzed the Centers for Medicare & Medicaid Services (CMS) Minimum Data Set (MDS) 3.0 data (aggregated to the facility level) merged with Nursing Home Compare data for residents living in NHs between March 1, 2011, and August 31, 2013. The data were analyzed from December 2015, to March 2016, and from November through December 2016. The MDS is a federally required assessment for residents in Medicare or Medicaid–approved US nursing facilities and comprises more than 400 items related to resident health and functional status, including medication use and behavior. To complete the MDS assessment, a nurse interviews the resident, consults the medical record, and talks with other caregivers to collect information on the resident’s care, cognitive and physical functioning, and behavior.

Nursing home residents were excluded if they (1) had a US Food and Drug Administration–approved indication for antipsychotic use (schizophrenia, Huntington disease, or Tourette syndrome), (2) were short-term residents (length of stay <90 days), or (3) were missing data on psychopharmacological medication use or behavior. We excluded NHs that (1) had fewer than 30 MDS resident assessments in at least 1 quarter (n = 60), (2) were not open for the entire intervention period (n = 54), (3) could not be linked to Nursing Home Compare (n = 1), or (4) dropped out of the intervention (n = 2) (eFigure in the Supplement).

**OASIS Program**

OASIS is a unique curriculum designed to assist NH staff in meeting the everyday needs and challenges of today’s long-term care population.\(^22\) Originally a 5-module, 10- to 12-hour staff educational program, OASIS was developed for the nursing facility setting. The number of modules was reduced to 4 after piloting the intervention. That adaptation, led by an interdisciplinary team of patient advocates, trained medical professionals, and nursing facility trade organization leaders, was guided by principles for dissemination of evidence-based practices that include highlighting the evidence base, simplifying recommended practices, and developing practical implementation tools and guides for key stakeholders.\(^23\) The content of the original 5 modules (http://www.oasis.today) included (1) Understanding Maslow’s Hierarchy of Needs, (2) Person-Centered Care—Making Strength-Based Care Plans, (3) Behavior as Communication, (4) All About Behavior, and (5) How to Keep Residents and Staff Safe. Modules 1 through 3 were...
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Research Original Investigation

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We conducted sensitivity analyses to address the possibility of regression to the mean. These analyses included removing the top-prescribing facilities from the OASIS group in the base model, repeating the base model analysis with the top prescribers in both the OASIS and comparator groups removed, and repeating the base model analysis in all OASIS facilities compared with New York facilities with the highest tertile of antipsychotic use.

Outcome Measures

The primary outcome variable was facility-level prevalence of antipsychotic use in long-term NH residents. The MDS 3.0 item N0410A captures the number of days antipsychotics were used by a resident in the 7 days preceding the MDS assessment (or since admission or reentry if <7 days). Secondary outcome measures included facility-level quarterly prevalence of psychopharmacological medications that may have been substituted for antipsychotic medications (anxiolytics [N0410B], antidepressants [N0410C], and hypnotics [N0410D]). The behavioral problems considered included physically abusive behavior (E0200A), verbally abusive behavior (E0200B), and rejecting care (E0800) in the 7 days before the MDS assessment. All variables were dichotomized as any in the prior 7 days or none and aggregated to the facility level for each quarter.

Evaluation of the Intervention

We applied the RE-AIM framework to evaluate the Reach, Effectiveness, Adoption, Implementation, and Maintenance of the intervention.24 For reach, we measured the number of facilities invited, the number who agreed to participate and met eligibility criteria, the number of dropouts, and the number who completed all study components. Intervention adoption was reflected by participation at the full-day initial training. Implementation was reflected in participation in follow-up sessions, including 12 webinars, 2 regional trainer support meetings, and the reported number of OASIS training modules completed during the intervention period. We measured attendance at 2 booster sessions. Barriers to implementation were recorded at regional meetings. Because staff turnover is a barrier to implementation, we documented reported leadership and ownership turnovers. Effectiveness was considered to be changes in facility-level antipsychotic use prevalence in the short term (December 2012 through May 2013), and maintenance was considered as the postimplementation antipsychotic use change (June through August 2013). The intervention influence was measured by comparing facility-level antipsychotic use prevalence in these periods with baseline antipsychotic use prevalence (March 2011 through August 2012) within OASIS facilities and non-OASIS facilities.

Facility Characterization

Profit status (for profit, government, or nonprofit) and a facility's overall 5-star rating (with lower star ratings indicating lower quality) were measured using data from Nursing Home Compare.21 We measured nurse staffing levels (including registered nurse hours, licensed practical nurse hours, and certified nursing assistant hours, each per resident day) and 1 or more health inspection deficiencies vs no inspection deficiency because these factors affect quality of care and antipsychotic prescribing.1,25,26

Statistical Analysis

We used descriptive statistics to characterize facilities and the reach, adoption, and implementation of OASIS, including χ2 test for categorical variables and t test or Wilcoxon signed rank test for comparison of normally distributed or nonnormally distributed continuous variables. Facility-level monthly prevalence of antipsychotic use was examined for consistency and validity. We used an interrupted time series model with external controls from Massachusetts and New York facilities to evaluate temporal trends in facility-level antipsychotic use prevalence. The interrupted time series estimation allowed us to test for changes in the trend (level and slope) of antipsychotic use after the intervention, controlling for historical trends.27 We estimated the model using a generalized least squares approach described by Prais and Winsten.28 We tested the first-order autocorrelation assumption with tests by Durbin and Watson.29 We specified the base model to include an intercept and 3 terms to estimate (1) quarterly changes in baseline facility-level antipsychotic use (March 2011 through August 2012), (2) the mean level change per facility in the quarter of the intervention training period (September through November 2012), and (3) intervention trend (December 2012 through August 2013). The final model included an overall interaction term for the OASIS-associated differences in the level change and slopes of the intervention. The influence from the intervention appears as a disruption in the historical pattern. In addition, a secondary analysis based on the RE-AIM framework examined maintenance of intervention trends after OASIS initiation by parsing the intervention period into 3 phases (training, implementation, and maintenance). For all analyses, we use Bonferroni corrections to account for multiple comparisons.30

We conducted sensitivity analyses to address the possibility of regression to the mean. These analyses included removing the top-prescribing facilities from the OASIS group in the base model, repeating the base model analysis with the top prescribers in both the OASIS and comparator groups removed, and repeating the base model analysis in all OASIS facilities compared with New York facilities with the highest tertile of antipsychotic use.
Results

We enrolled the first 25% of Massachusetts NHs (n = 106) with a completed application (eFigure in the Supplement). Because our recruitment strategy targeted high-prescribing NHs, OASIS facilities had a higher prevalence of antipsychotic use before the training was launched (ie, July to September 2012) than the non-OASIS facilities (34.1% vs 22.7%, P < .001).

OASIS facilities (median, 122; interquartile range [IQR], 88-152 beds) were smaller than non-OASIS facilities (median, 140; IQR, 104-200 beds; P < .001). OASIS facilities were more likely to be for profit (77.4% vs 62.0%, P = .009), have corporate ownership (93.5% vs 74.6%, P < .001), and provide resident-only care (78.5% vs 52.9%, P < .001) than non-OASIS facilities (Table 1). OASIS facilities had higher registered nurse staffing hours per resident (mean, 0.8 vs 0.7; P = .01) but lower certified nursing assistant staffing hours per resident (mean, 2.3 vs 2.4; P = .04) than non-OASIS facilities. There was no difference in licensed practical nurse hours per resident. OASIS facilities had a lower health inspection rating (median, 2; IQR, 1-3 vs median, 3; IQR, 2-4; P = .01) and were more likely to have 1 or more fines (47.3% vs 20.8%, P < .001) than non-OASIS facilities.

Ninety-three OASIS nursing facilities participated in the 8-hour, in-person, training session. The mean number of webinars attended by facilities was 6.5 (range, 0-12). Thirteen facilities (14.0%) attended no regional seminars, 32 (34.4%) attended one, and 48 (51.6%) attended both. Four facilities attended one booster session, and 13 attended both.

The postintervention questionnaire response rate was 65.6% (61 of 93). Half of the facilities responding to the postintervention questionnaire reported that they completed all 4 OASIS training modules at their facility. The facility staff most often trained were the directors of nursing, nurses, certified nursing assistants, and activities personnel (eTable 1 in the Supplement). Approximately half of the reporting facilities trained support staff, such as housekeeping and dietary. Physicians and nurse practitioners participated infrequently. Among OASIS NHs responding to the postintervention questionnaire, 18.0% (11 of 61) reported administrator turnover, 31.1% (19 of 61) experienced a director of nursing turnover, 11.4% (7 of 61) had turnover of the OASIS program coordinator, and 29.5% (18 of 61) recorded turnover of the staff development coordinator or educator. Competing dementia care training programs were reported in 67.2% (41 of 61) of facilities completing the end-of-project questionnaire, including 30 using Hand-in-Hand, 16 using Alzheimer Association training, and 11 using the MassPRO dementia care training.

OASIS intervention effectiveness based on change in levels of atypical antipsychotic prescribing is shown in Figure 1, with the mean percentage facility-level antipsychotic use on the y-axis and time (represented in quarters) on the x-axis. The vertical lines (from left to right) mark the beginning of the training period, implementation period, and maintenance period. Q indicates quarter.

![Figure 1. Trends in Prevalence of Antipsychotic Use Over Time by OASIS Training and Highest Prevalence of OASIS Nursing Homes](https://www.jama.com/doi/abs/10.1001/jamainternalmedicine.2017.6596)

The y-axis shows the mean percentage facility-level antipsychotic use, and the x-axis shows time (represented in quarters). The vertical lines (from left to right) mark the beginning of the training period, implementation period, and maintenance period. Q indicates quarter.
reduction of 22.3%) compared with a drop of 22.7% to 18.8% in the comparison facilities (absolute reduction of 3.9% and relative reduction of 17.2%).

As summarized in Table 2, a decreased trend in prevalence of antipsychotic use in the baseline period was found for both OASIS NHs (−0.32% per quarter) and the comparison NHs (−0.33% per quarter) (P > .99 for difference). We first evaluated whether there was an immediate change in prevalence of antipsychotic use in the initial period of OASIS implementation. There was no statistical difference between the 2 intervention arms at the time of intervention implementation (−0.61; 95% CI, −1.91 to 0.68; P = .58). Estimates of the antipsychotic use trend in the postintervention implementation period revealed that, while both OASIS NHs and the comparison NHs were experiencing decreases (−1.20%; 95% CI, −2.05% to −0.35% per quarter for OASIS NHs and −0.23%; 95% CI, −0.97% to −0.37% per quarter for comparison NHs).

### Table 2. Influence of OASIS on Prevalence of Antipsychotic Use

<table>
<thead>
<tr>
<th>Variable</th>
<th>OASIS NHs in Massachusetts (n = 93)</th>
<th>Non-OASIS NHsa (n = 831)</th>
<th>Difference</th>
<th>P Value for Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline prescribing, %</td>
<td>34.1</td>
<td>22.7</td>
<td>11.4</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Baseline period slope, %b</td>
<td>−0.32</td>
<td>−0.33</td>
<td>−0.01</td>
<td>&gt;.99</td>
</tr>
<tr>
<td>Intervention change in level, %c</td>
<td>−0.73</td>
<td>−0.12</td>
<td>−0.61</td>
<td>.58</td>
</tr>
<tr>
<td>Intervention change in trend, %d</td>
<td>−1.20</td>
<td>−0.23</td>
<td>−0.97</td>
<td>.03</td>
</tr>
</tbody>
</table>

Abbreviation: NH, nursing home.

*a* Includes 257 in Massachusetts and 574 in New York.

*b* Change in prevalence of antipsychotic use per quarter (Q1-Q6, from March 2011 through August 2012).

*c* Immediate change in prevalence of antipsychotic use during the first quarter of OASIS implementation (Q7, from September through November 2012).

*d* Change in prevalence of antipsychotic use during OASIS implementation (Q8-Q10, from December 2012 through August 2013).
−0.47% to −0.01% per quarter for comparison NHs), OASIS NHs experienced greater declines (−0.97%; 95% CI, −1.85% to −0.09%; \( P = .03 \)).

To evaluate the extent to which these findings could be explained by regression to the mean, we conducted 3 sensitivity analyses. First, we removed the top antipsychotic prescribers among OASIS facilities. The difference in intervention trend between OASIS and non-OASIS arms remained statistically significant (difference of −1.3% per quarter, \( P = .003 \)) (eTable 2 in the Supplement). Second, we further removed the top tercile of antipsychotic prescribers in the comparators. The OASIS influence remained significantly different (difference of −1.6% per quarter, \( P < .001 \)) (eTable 3 in the Supplement). Third, we compared all OASIS facilities with the top tercile prescribers from the New York facilities. This analysis showed a difference in trend of 0.6% per quarter that was not statistically significant (\( P = .17 \)) (eTable 4 in the Supplement).

An analysis examined the secondary hypothesis that antipsychotic use reductions were maintained after OASIS implementation (eTable 5 in the Supplement). The intervention phase was parsed into 3 separate periods (training, implementation, and maintenance), and analysis showed that the greatest difference was seen in the implementation phase (difference of −1.29%; 95% CI, −2.16% to −0.42%; \( P = .01 \)), but it was not sustained in the maintenance phase (difference of 0.93%; 95% CI, −0.66% to 2.54%; \( P = .48 \)).

Figure 2 and Figure 3 show no evidence of immediate changes in prevalence or trend changes of other psychotropic medication use or behavioral problems during the training and implementation phases. No statistically significant changes were found (eTables 6-11 in the Supplement).

Discussion

This investigation is the largest study to date to demonstrate meaningful reductions in nursing facility antipsychotic prescribing. The OASIS program was associated with a reduction in antipsychotic use prevalence during the implementation phase of the intervention, but it was not sustained in the maintenance phase. No increases in other psychotropic medication use or behavioral disturbances were observed. The
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Drafting of the manuscript: Tjia, Hunnicutt. Critical revision of the manuscript for important intellectual content: All authors.

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Administrative, technical, or material support: Tjia, Blanks, Lapane, Wehry.

Study supervision: Lapane.

Conflicts of Interest Disclosures: Dr Tjia reported that during the past 3 years she has received grant support from the National Institutes of Health, The Donahue Foundation, The Arnold P. Gold Foundation, and the Cambia Health Foundation (none of which had a role in this publication). Dr Tjia also reported having received honoraria for serving on and reviewing grants for the scientific review committee of The Donahue Foundation and having received honoraria and travel support for serving on the geriatric technical expert panel for CVS Omnicare. She reported also being a consulting geriatrician for the CVS Caremark pharmacy and Therapeutics committee, for which she reviews medications and clinical programs for CVS Caremark. Dr Lapane reported that during the past 3 years she has received grant support from the National Institutes of Health, the Centers for Disease Control and Prevention, and Cubist Pharmaceuticals. Dr Wehry reported receiving personal fees from the Massachusetts Senior Care Foundation for OASIS training during the conduct of the study, reported receiving nominal licensing fees for the use of OASIS training materials, and reported receiving speaking fees for conducting OASIS Master Trainer programs. No other disclosures were reported.

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Disclaimer: The content of this report is solely the responsibility of the authors.

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