The effect of assigning dedicated general practitioners to nursing homes

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Objective: To determine whether assigning a dedicated general practitioner (GP) to a nursing home reduces hospitalizations and readmissions.

Data Sources/Study Setting: Secondary data on hospitalizations and deaths by month for the universe of nursing home residents in Denmark from January 2011 through February 2014.

Study Design: In 2012, Denmark initiated a program in seven nursing homes that volunteered to participate. We used a difference-in-differences model to estimate the effect of assigning a dedicated GP to a nursing home on the likelihood that a nursing home resident will be hospitalized, will experience a preventable hospitalization, and will be readmitted. The unit of observation is a resident-month.

Data Collection/Extraction Methods: Data were extracted from the Danish public administrative register dataset.

Principal Findings: We found that assigning a GP to a nursing home was associated with a 0.55 [95 percent CI, 0.08 to 1.02] percentage point reduction in the monthly probability of a preventable hospitalization, which was a 26 percent reduction from the preintervention level of 2.13 percentage points. The associated reduction in the monthly probability of a readmission was 0.68 [95 percent CI, -0.01 to 1.37] percentage points, which was a 25 percent reduction from the baseline level of 2.68 percentage points. Survey results indicated that the likely mechanism for the effect was more efficient and consistent communication between GPs and nursing home personnel.

Conclusions: Assigning a dedicated physician in a nursing home can reduce medical spending and improve patients' health.

KEYWORDS

dedicated physicians, nursing home, preventable hospitalizations, readmissions

1 | INTRODUCTION

In the United States, an estimated 25 percent of long-stay nursing home residents are hospitalized, annually and between 20 and 25 percent of these people are readmitted to a hospital within a month.¹ Many of these admissions are preventable, with recent estimates

ranging from 40 percent² to 47 percent.³ European countries are experiencing the same phenomenon. In Norway, for example, there are about 0.60 hospital admissions per nursing home bed, and Vossius et al⁴ report that between four and 59 percent of nursing home resident hospital admissions in European countries are preventable, with the wide range due in part to the lack of a standard definition of

preventable hospitalizations.* Unnecessary admissions create health problems and contribute to high spending.

A promising way to reduce unnecessary hospital admissions is to improve communication between the physicians caring for nursing home residents and the nursing home staff. Young et al⁵ concluded that there are fewer preventable admissions in nursing homes where nurses are trained to communicate effectively with physicians. Ong et al⁶ found that the most cited reasons for admitting a nursing home resident to a hospital are the lack of an advance care plan, lack of access to GPs after hours, lack of access to palliative care and specialist nurses, and poor communication between patients, relatives, GPs, hospitals, and nursing home staff. Finally, Vossius et al⁴ conclude that improving access to general practitioners (GPs) outside of normal office hours would reduce hospitalizations among Norwegian nursing home residents.

The Interventions to Reduce Acute Care Transfers (INTERACT) program, which has now been implemented in hundreds of nursing homes in the United States, tries to reduce preventable hospitalizations among nursing home residents, in part, by improving communication. INTERACT uses a set of tools to help nursing home staff identify, assess, communicate, and document changes in resident status.⁷ Three recent studies evaluated the impact of INTERACT. Ouslander et al⁷ and Ingber et al⁸ found that nursing homes that volunteered to implement the program experienced reductions in hospitalizations, with reductions in preventable admissions also occurring in the latter study.[†] In a recent study where 85 nursing homes were randomly assigned to receive training and implementation support for INTERACT, however, there was no impact on hospitalizations, readmissions, or preventable hospitalizations.¹

One way to improve communication is to reduce the number of GPs that nursing home staff need to communicate with, and to schedule regular meetings between the GPs and nursing home staff to discuss residents' health conditions and treatment plans. In most countries such as the United States, Denmark, and Germany, nursing home residents retain the primary care physician who treated them before being admitted. In contrast, most nursing homes in the Netherlands and Norway have a dedicated GP who provides primary care for all residents. Two recent papers highlight a trend in the United States toward more skilled nursing facility specialists,^{9,10} but the evidence on how this specialization affects care is still scarce.

We evaluate the impact of a Danish program that reduced the number of GPs that nursing home staff needed to communicate and coordinate with in order to save staff time, improve the quality and consistency of information transmitted between the GP and the staff regarding how residents should be treated, and create a more specialized workforce. The objective was to reduce preventable hospital admissions and readmissions. In 2012, the Danish Ministry of Social Affairs and Integration assigned seven dedicated GPs to seven separate nursing homes. Patients were encouraged, but not required, to select the dedicated GP as their regular primary care provider. The dedicated GP and nursing home staff met weekly to discuss how to treat common health conditions. The Danish program is a potentially important way to reduce preventable hospitalizations

among nursing home residents, which will become increasingly important as populations age.

2 | METHODS

2.1 | Design of the dedicated general practitioner program

Residents in Danish nursing homes have the right to choose their GP. GPs, who are independent and not employees of the public health system, act as the gatekeeper by deciding whether to refer patients to specialists or hospitalize them. Because most residents maintain the GP they had prior to entering a nursing home, the staff at a typical nursing home communicate and interact with many GPs, and GPs do not necessarily specialize in treating nursing home patients. In 2012, the Danish Ministry of Social Affairs and Integration and the Ministry of Health initiated a program in seven nursing homes, located in five municipalities, which volunteered to participate.

In each of these nursing homes, a single GP was assigned to be the dedicated GP for that home. Residents were encouraged, but not required, to select the dedicated GP. The dedicated GPs still maintained their own private practices, so the prospect of seeing more nursing home patients and fewer non-institutionalized patients had to be sufficiently attractive to convince them to participate.

In the first month of the program (September 2012), the percentage of residents who agreed to select the assigned GP ranged from 24 percent to 100 percent across the seven homes. The objective of the program was to reduce the number of GPs the nursing home staff had to communicate with, and dedicate time for a group discussion of patients' treatment plans. The program paid a GP to meet weekly with the nursing home staff to discuss the clinical needs of each of the GP's patients, and to provide training that could be applied to all nursing home residents. The meetings ranged from 1.5 to 3 hours per week and were in addition to the time spent treating patients.

2.2 | Sample inclusion

The National Health Data Authority in Denmark collects extensive data on patients who are treated in the Danish health care system through the National Patient Register system. For purposes of identifying the residents to include in our analysis, we used monthly patient-level information on physician visits, hospitalizations, and deaths from the National Patient Register for the universe of nursing home residents from January 2011 through February 2014. These data allow us to identify the nursing home where a particular resident lived, and thereby identify residents who were exposed to the dedicated GP program.

We restricted the analytic sample to nursing home residents who were 65 years or older. We excluded nursing homes with fewer than 20 residents, on average, because all seven of the nursing homes participating in the program were larger than this.

TABLE 1 Descriptive statistics

	Intervention	Control	Total
Residents using 20 or more prescription drugs in 2011 (%)	32.7	37.1	37.0
Average age (y)	84.7	84.4	84.4
Male (%)	31.3	30.0	30.0
Size of nursing home in January 2012			
20-39 residents (%)	38.1	48.6	48.4
40-79 residents (%)	35.40	45.27	45.15
80 or more residents (%)	26.6	6.17	6.42
% of residents with a preventable hospitalization per month before dedicated GP program	1.99	2.13	2.13
% of residents with a readmission per month before dedicated GP program	2.94	2.68	2.68
% of residents with a hospitalization per month before dedicated GP program	8.59	9.41	9.40
Total number of residents	339	26 466	26 805

Notes: The average monthly share of the three types of hospitalizations is based on an average over the entire preperiod (January 2012-August 2012). The resident count is based on people living in a nursing home in December 2011.

Although we did not observe the precise month when a resident was admitted to a nursing home, we did know whether a person resided in a home at the end of a calendar year. The resident population changes over time as new residents enter nursing homes and others die. In order to make the residents in the two nursing home groups as similar as possible, we include residents if they lived in a nursing home in December 2011 or December 2012. A person is excluded from the sample the month after her death.[‡] In Table 1, we report sample statistics separately for the seven participating homes and 783 control nursing homes. Over the course of the January 2012 to December 2013 sample period, 452 and 34 240 patients resided in the seven intervention and control nursing homes, respectively.

2.3 | Outcome measures

We collected three outcome measures by month for all residents in the sample from the National Patient Register: whether a nursing home resident was admitted to a hospital in that month; whether that admission qualified as a preventable hospitalization; and whether the person was readmitted to a hospital within 30 days of a prior hospitalization. Following the World Health Organization, we defined hospitalizations to be preventable based on ICD-10 diagnosis codes described in Table S1. In the preintervention period, the nursing home residents in the sample experienced an average of 1.97, 0.37, and 0.43 hospitalizations, preventable hospitalizations, and readmissions per person per year, respectively. The hospitalization rate of Danish nursing home residents is similar to that of Norway but higher than most other high-income countries, in part because patients pay very little out of pocket.

2.4 | Characteristics of nursing home residents

We included all demographic and health measures that were available in the National Patient Register to control for the underlying health of nursing home residents: the age of the resident, an indicator for male residents, and an indicator for whether a person received 20 or more monthly prescriptions in 2011 (prior to the GP program). From the National Patient Register and the participating nursing homes, we also observe the primary care physician that each nursing home resident selected in each quarter.

2.5 | Qualitative data

The dedicated GP and one other nursing home staff member at each of the seven intervention and nine of the control nursing homes completed a questionnaire before the intervention (March/April 2012) and after (March 2014).¹¹ The questionnaire, which consisted of 14 questions for the GP and 40 for the nursing home staff, collected information on the amount of time the nursing home staff and GP communicated with one another in person, by phone, and by email, and explored the working relationship between the nursing staff and GP. The nursing home staff also contemporaneously recorded how long they met with GPs to discuss patient treatment via a meeting log book. The qualitative data in the survey allowed us to explore why the program did or did not work.

2.6 | Analytic approach

We used a difference-in-differences model to estimate the effect of assigning a dedicated GP on the likelihood a nursing home resident would be hospitalized, experience a preventable hospitalization, and

be readmitted. The unit of analysis is a resident-month, and the data span January 2012 through December 2013, with the GP program beginning in September 2012. Specifically, we estimate the following linear probability model:

$$y_{ipt} = \alpha + \beta_1 \text{treat}_{ip} + \beta_2 \text{after}_t + \beta_3 \text{treat}_{ip} * \text{after}_t + \beta_4 x_{ip} + \eta_t + \lambda_p + \varepsilon_{ipt} \quad (1)$$

Residents, nursing homes, and months are indexed respectively by i , p , and t . y_{ipt} is one of three dichotomous outcome variables for whether resident i in nursing home p in month t was hospitalized, whether she had a preventable hospitalization, and whether she was readmitted to a hospital within 30 days following a hospitalization. The variable treat_{ip} indicates whether resident i lived in a nursing home p that had a dedicated GP from September 2012 thereafter. The variable after_t is an indicator that equals one for months after the program was initiated.⁵

In Table 1, we report data on the outcomes and characteristics of residents who lived in a nursing home in December 2011, prior to the implementation of the dedicated GP program, separately for residents of the intervention and control nursing homes. The values of the three outcome variables before the intervention were not statistically different between the two groups of homes. There were also no statistical differences in patient characteristics between intervention and control homes. The one characteristic that did differ between the two groups is nursing home size. The seven intervention nursing homes are larger than the control homes, even when homes with an average resident census less than 20 were omitted.

The vector x_{ip} contains the following control variables: age, age-squared, an indicator for males, and an indicator if a person filled 20 or more prescriptions in 2011. The variables η_t and λ_p are month and

nursing home fixed effects, respectively. The former capture the trend over time and seasonal pattern in nursing home resident hospitalizations. The nursing home fixed effects control for unobserved time-invariant nursing home characteristics such as unobserved patient health, staffing levels, the availability of hospitals in the area, and treatment styles of local physicians and hospitals.¹² The variable of interest is the interaction term, $\text{treat}_{ip} * \text{after}_t$, which measures the change in the intervention relative to the control nursing homes.

Our identifying assumption is that assigning a dedicated GP at the seven nursing homes was the only factor causing hospitalization rates to change in the intervention homes after September 2012 relative to control homes. Although y_{ipt} is dichotomous, an ordinary least-squares model should provide consistent estimates given the large number of observations.¹² Standard errors were clustered at the level of a nursing home to account for correlation of the error terms between patients within the same nursing home.

Although we were able to determine which residents at the intervention nursing homes switched to the dedicated GP in our baseline specification, we estimated Equation (1) as an intent-to-treat model. That is, we did not treat patients differently according to whether they selected the dedicated GP. Our concern is that residents may base their decision regarding whether to switch GPs, in part, on the perceived quality of their original vs the assigned GP. The change in GP quality may in turn be correlated with unobserved variables that affect hospitalizations.

3 | RESULTS

In Figures 1 and 2, we depict trends in the percentage of residents who were hospitalized with a preventable hospitalization and the

FIGURE 1 Average percent of residents experiencing a preventable hospitalization [Color figure can be viewed at wileyonlinelibrary.com]

FIGURE 2 Average percent of residents readmitted to a hospital [Color figure can be viewed at wileyonlinelibrary.com]

percentage who were readmitted to the hospital within 30 days of being discharged, respectively, at the two types of homes.[†] In Figure S1, we depict the percentage of residents hospitalized for any reason. Each time period is a two-month interval, running from January 2012 through December 2013. The dedicated GP program began September 2012, in the 9th month of the 24-month sample period.

The overall hospitalization rates (Figure S1) were fairly similar for the first 6 months of the sample period for residents of the intervention and control homes. By the end of 2013, the hospitalization rate in the intervention homes was about two percentage points lower than at the control homes. A similar pattern is evident in Figure 1 for preventable hospitalizations, although the difference between the two types of homes was larger at the end of 2013. In Figure 2, there was little difference in the readmission rates for residents of the two types of homes, although the readmission rate in the intervention homes is more volatile due to the smaller sample size.

In Table 2, we report the results of the regression models for the three outcome variables. There are two specifications (columns) for each dependent variable: a regression without and with resident-level control variables. Consistent with Figures 1 and 2 and Figure S1, the estimated coefficients on the *treat*after* interaction terms were negative in all six specifications of Table 2. Moreover, the coefficient magnitudes did not change substantially when we included resident characteristics in the even-numbered columns. This indicates that the characteristics of the residents at the intervention nursing homes did not change much over time relative to the control nursing homes. In column 2 of Table 2, residents in the intervention homes had a 0.66 percentage point lower probability of being hospitalized each month after the dedicated GP program was implemented relative to before, relative to residents in the control homes. This coefficient was not significantly different from zero. The

program was effective at reducing preventable hospitalizations—those that should be most amenable to an intervention. In column 4 of Table 2, residents in the intervention homes had a statistically significant 0.55 percentage point lower probability of experiencing a preventable hospitalization each month after the dedicated GP program relative to before, relative to residents in the control nursing homes. During our sample period, the mean proportion of nursing home residents with a preventable hospitalization in a month was 0.021, which indicated that the program reduced the hospitalization rate by 26.2 percent.

Because overall admissions fell at the intervention relative to the control homes, there were fewer opportunities for reductions in readmissions among the former homes. Nevertheless, the estimated impact of the program was similar for the hospital readmission rate, with the coefficient significant at the 10 percent level. In column 6 of Table 2, residents in the intervention homes had a 0.68 percentage point lower monthly probability of being readmitted to a hospital within 30 days of an initial admission after the dedicated GP. This indicated that the program reduced the readmission rate by 25.2 percent.^{**}

The coefficients on the control variables had the expected signs. Older nursing home residents experienced more hospitalizations and readmissions. Male nursing home residents and those who used many prescription drugs prior to the intervention were more likely to be hospitalized and readmitted.

We examined whether it took time for the program to work and whether the impact increased over time. Specifically, we replaced the *treat*after* variable with five separate interactions, one for each of the five quarters when the program was in place (ie, the fourth quarter of 2012 and all four quarters of 2013). In Figure S2, we plotted the parameter estimates for the effect of having a dedicated GP

TABLE 2 Difference-in-differences estimates

	Hospitalization		Preventable Hospitalization		Readmission	
	(1)	(2)	(3)	(4)	(5)	(6)
Treat*after	-0.0042 (0.0036)	-0.0066 (0.0113)	-0.0048* (0.0025)	-0.0055** (0.0024)	-0.0061* (0.0036)	-0.0068* (0.0035)
Age		0.0033*** (0.0002)		0.0009*** (0.0002)		0.0012*** (0.0001)
Age-squared		-0.000*** (0.0000)		-0.000*** (0.0000)		-0.000*** (0.0000)
Male		0.0218*** (0.0014)		0.0033*** (0.0006)		0.0101*** (0.0007)
Filed 20 or more prescriptions in 2011		0.0431*** (0.0014)		0.0118*** (0.0006)		0.0106*** (0.0006)
Mean of dep. variable	0.094		0.021		0.027	
R-squared	0.10	0.11	0.03	0.03	0.03	0.03
Observations	578 523	578 523	578 523	578 523	578 523	578 523

Notes: All estimations include nursing home and month fixed effects.

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$.

assigned to a nursing home on the three outcome variables, separately by three-month period, or “quarter.”^{††} We depicted the 95 percent confidence intervals in these figures.

For total hospitalizations, we found no significant effect associated with the GP program in any of the five quarters (Panel 1). For preventable hospitalizations (Panel 2), the estimated effect of the dedicated GP program grew over time in absolute value, becoming significant in the fourth and fifth quarter after implementation. This is consistent with the surveys, where the respondents indicated that it took about 6 months for the GPs to learn about their new patients, to communicate effectively with the staff, and to initiate new treatments.¹¹

The impact may also have increased over time as more nursing home residents in the intervention homes switched to the dedicated GP. In the 2 months prior to the program, an average of 56 percent of the residents in the seven homes selected the dedicated GP as their physician. This percentage increased to 64 percent after 4 months and 69 percent after 8 months, where it then stabilized. For readmissions (Panel 3), the temporal pattern was less clear. The estimated impact of the program was significant in the third quarter after its implementation, but not thereafter.

The dedicated GP program may have had a stronger impact for particular types of nursing home residents. To explore this, we performed regressions separately for male vs female residents; for residents who live in large vs small nursing homes; and for residents who filled 20 or more prescriptions in 2011 prior to the GP program vs those that did not. We report results of these subgroup analyses in Table 3. Each coefficient on the treat*after variable in Table 3 is from a separate regression, and all models include resident control variables as well as nursing home and month fixed effects. The most interesting results were for preventable hospitalizations, where the estimated impact of the program was stronger for residents who were relatively sick, as proxied by their prior use of prescription drugs. Small and larger nursing homes both experienced reductions in preventable hospitalizations and readmissions.

3.1 | Sensitivity analysis

The identifying assumption of the difference-in-differences model is that in the absence of the dedicated GP program, hospital admissions and readmissions would have trended similarly at the intervention and control nursing homes. Although this assumption cannot be tested with certainty, we did examine whether the three outcome variables experienced a similar trend at the two types of nursing homes prior to the program. Specifically, we included a separate treat*prior indicator variable for each of the three quarters before the program began. These tests are presented in Figure S3. For overall and preventable hospitalizations, we did not find significant preperiod differences, confirming the existence of parallel trends prior to the program (Panel 1 and 2). We found a significant difference for readmissions in the first quarter of 2012, 6 months before the program began, but not in the quarter immediately prior to program implementation (Panel 3).

In Table S2, we report the results of several robustness tests. Each cell in Table S2 reports the coefficient on treat*after from a separate regression. The program nursing homes are located in five of the 98 municipalities in Denmark. Because the five municipalities that participated in the program could differ from the remaining municipalities, we estimated the model with a sample restricted to nursing homes from the five program municipalities only (the first row of Table S2). The results are consistent with those presented in Table 2; the coefficients for both preventable hospitalizations and readmissions are significant at the five and 10 percent levels, respectively.

We also tested for serial correlation by collapsing all periods into a single preintervention and a single post-intervention time period. Specifically, the dependent variable was one if a nursing home resident was admitted (or readmitted or experienced a preventable admission) in the first 8 months of 2012 (or zero otherwise), and separately was one if she was admitted between September 2012 and December 2013. As can be seen in the second row of Table

TABLE 3 Heterogeneous effects—sample stratified by gender, medication use, and nursing home size

	Observation	Hospitalization	Preventable hospitalization	Readmission
Gender				
Men	171 548	−0.0029 (0.0185)	−0.0092 (0.0071)	−0.0070 (0.0080)
Women	406 975	−0.0087 (0.0097)	−0.0038 (0.0030)	−0.0065* (0.0033)
Medication				
Filed 20 or more prescriptions in 2011	197 903	−0.0002 (0.0127)	−0.0092*** (0.0033)	−0.0082 (0.0059)
Less than 20 prescriptions	380 620	−0.0110 (0.0122)	−0.0037 (0.0036)	−0.0069 (0.0043)
Nursing home size				
50 or more residents	185 898	−0.0099 (0.0136)	−0.0048* (0.0027)	−0.0022 (0.0045)
Less than 50 residents	392 625	−0.0035 (0.0177)	−0.0059 (0.0041)	−0.0103** (0.0051)

Notes: Each cell reports the coefficient on treat*after from a separate regression. All estimations include nursing home and month fixed effects.

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$.

S2, all three coefficients were negative but only the readmission treat*after coefficient was statistically significant. The lack of significance of the results for the preventable hospitalizations could have been caused by less statistical power when the data were collapsed to two instead of 24 periods.

4 | DISCUSSION

Our analysis indicates that the GP program reduced preventable hospitalizations and readmissions. This model offers a promising opportunity for other health care systems to emulate in order to improve the health of nursing home patients and reduce their spending. We reviewed surveys with both participating GPs and the nursing home staff as well as a meeting log book to explore the mechanism behind this reduction. The nursing home staff at the intervention homes reduced their telephone and electronic interactions with a GP by 30 minutes and 14 minutes per resident per week, respectively. For the staff at the control nursing homes, their telephone and electronic contact with a GP were only reduced by 10 minutes and four minutes per resident per week, respectively. Thus, reduced hospitalizations seem to stem in part from more efficient communication between nurses and GPs.

Our results are consistent with existing evaluations of nursing homes that volunteered to implement programs that included a component on improving communication between providers. Nursing homes that implemented INTERACT II experienced a 17 percent reduction in admissions, which similar in size to our results.⁷ Ingber et al⁸ report that nursing homes implementing multifaceted programs, including measures to improve communication, reduced hospitalizations by 2.2 to 9.3 percentage points and preventable hospitalizations by 1.4 to 7.2 percentage points.^{††}

Assigning a dedicated GP to a nursing home also encourages physicians to specialize, to a greater extent, in geriatric patients. Other studies have shown that physician specialization can improve patients' health¹³ and reduce medical spending.¹⁴ A few countries have already adopted a model of clinical specialization in nursing

homes. The Netherlands, for example, assigns a specially trained physician to each nursing home and has dedicated paramedical and psychosocial staff. The United States appears to be evolving naturally to a more specialized model of physician care in nursing homes, but there are still fewer than 7000 physicians or advanced clinicians who bill at least 90 percent of their episodes from a nursing home.^{9,10}

This paper has some limitations. The impact of the program at the intervention nursing homes may not generalize to the control nursing homes in Denmark or to homes outside of Denmark. The seven intervention nursing homes were larger than the control homes. Because they volunteered to participate, these homes may have been more motivated and/or able to reduce preventable hospital admissions than the control nursing homes. Three recent studies have argued that the motivation of a nursing home⁷ or hospital^{15,16} has an important effect on its ability to reduce admissions or readmissions.

A similar concern regarding possible selection bias is that early in the program it was challenging to recruit physicians to be a dedicated GP. Consequently, the GPs who ultimately agreed to participate may have been relatively interested in geriatrics and/or skilled at working with these patients. An additional concern is that there might not be enough GPs willing to participate if the program were implemented broadly. Finally, although we measured the impact of the program for 15 months, the long-term effect could differ. An important future research project would be to randomly assign GPs and nursing homes to a program such as was implemented in Denmark, especially because Kane et al¹ found less promising results with INTERACT when homes were randomly assigned vs when they volunteered.

5 | CONCLUSION

We investigated whether assigning a dedicated GP to a nursing home reduced hospitalizations among nursing home residents. Using panel data for the entire Danish nursing home population and a difference-in-differences model, we found that assigning a dedicated GP was associated with a 26 percent and 25 percent reduction

in the probability a resident experienced a preventable hospitalization or a readmission, respectively. We found no significant effect on overall admissions. Qualitative data indicated that the mechanism was improved communication between the dedicated GP and the nursing home staff. Finally, the lack of any effect in the first quarter of the program suggested that it takes time to improve communication between the dedicated GP and nursing home staff.

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ENDNOTES

* Preventable hospitalizations are sometimes defined in the literature objectively based on a patient's primary diagnoses and sometimes based on a subjective evaluation by GPs or nursing home staff. We use the World Health Organization's (WHO) definition of a hospitalization that could have been avoided if symptoms were previously identified and treated effectively.

† The facilities in Ingber et al⁸ also implemented other interventions in addition to INTERACT.

‡ Over the 24-month observation period, a total of 13 819 residents died.

§ In the regressions, we do not actually include an indicator for "treat" or an indicator for "after" because the latter variable is collinear with the nursing home fixed effects for the seven intervention nursing homes, and the former variable is collinear with the September 2012–December 2013 set of monthly fixed effects.

¶ The preventable hospitalization and readmission percentages are unconditional and not conditional on an admission.

** The mean monthly readmission rate during the sample period was 0.027.

†† The first three-month period began in September 2012, and the final three-month period ended in November 2013, so the "quarters" in the regression do not align with calendar quarters.

‡‡ Baseline hospitalization levels were not reported in Ingber et al⁸ so we cannot compare the magnitude of their results relative to ours in percentage terms.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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