The Opportunity for Collaborative Care Provision: The Presence of Nursing Home/Hospice Collaborations in the U.S. States

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Abstract
This study estimated the proportion of U.S. nursing homes (NHs) collaborating with Medicare hospices and identified state-level factors associated with this collaboration. Collaboration was classified as present when at least one of a NH’s residents dying in July through December, 2000 received hospice. Seventy-six percent of NHs (n = 12,174) had hospice collaborations, with proportions ranging from 37% in Wyoming to 96% in Florida. State-level factors associated with greater collaboration included having a lower proportion of persons 65+ residing in rural areas, lower NH occupancy and larger hospices, and Medicaid NH reimbursement which was not case-mixed and was paid directly to NHs (not to hospices) for hospice-enrolled residents. Considering the high amount of estimated NH/hospice collaboration, care provision by both NHs and hospices appears to be a potentially viable approach for providing comprehensive end-of-life care in the majority of U.S. NHs. Findings suggest the rural composition of a state as well as its policies and healthcare market characteristics either foster or discourage NH/hospice collaboration.

Key Words
Hospice, nursing home, state policy, interorganizational collaboration

Introduction
Increasingly, nursing homes are fast becoming the final place of care for frail older adults dying of chronic progressive illnesses as well as for short-stay residents with complex care needs. In 2001, 23% of non-traumatic deaths occurred in nursing homes. However, there is evidence of far less than optimal care in many nursing homes and, research supports the notion that many nursing homes may not have the capacity to meet the growing need to provide competent, coordinated, compassionate and comprehensive end-of-life care. Research has consistently documented the inadequate assessment and undertreatment of pain in nursing homes as well as poorly managed dyspnea. Additionally, feeding tube use for residents with late-stage dementia is widespread in nursing homes despite the lack of evidence demonstrating any health benefits from this intervention and, despite research findings...
questioning the effectiveness of performing versus not performing cardiopulmonary resuscitation on nursing home residents with late-stage dementia, there is a two-fold difference in the rate of documented “do not resuscitate” (DNR) orders in nursing homes. In this era of increasing diversity and complexity of nursing home residents’ needs, many nursing homes are challenged by staffing shortages, high staff turnover, adversarial legal climates and reimbursement that many feel is inadequate. Considering this, collaboration with hospice providers to improve and enhance care and support provided to terminally ill residents (and their families/significant others) appears advantageous. Research shows nursing home hospice residents, compared to nonhospice residents, experience fewer hospitalizations near the end of life, have fewer invasive treatments (i.e., enteral tubes, intravenous fluids, and intramuscular medications), more often have pain assessments performed, and receive analgesic management for daily pain that is more in agreement with guidelines for management of chronic pain in long-term care settings. Family members of persons who died in nursing homes perceived improvements in care after hospice admission. Additionally, nursing home staff and administrators indicate hospice helps to provide more one-on-one care to dying residents. Furthermore, there appears to be a hospice “spill-over” effect since non-hospice residents residing in nursing homes with a greater hospice presence (i.e., a greater proportion of residents enrolled in hospice), versus in nursing homes with no or a limited hospice presence, are less frequently hospitalized at the end-of-life and more frequently have a pain assessment documented. In addition to the quality benefits observed with hospice enrollment in nursing homes, hospice care as an approach to improving end-of-life care in nursing homes doesn’t appear to increase Medicare and Medicaid expenditures; a recent study has found expenditures in the last month of life (when most residents enroll in hospice) are not significantly higher when hospice care is provided to nursing home residents. A limitation to dependence on hospice collaborations for improving and/or enhancing end-of-life care in nursing homes is its low use by nursing homes and their residents. While nursing homes can offer hospice care to their residents by developing working relationships (including formal contracts) with Medicare- and/or Medicaid-certified hospice providers, previous research (based on 1995 to 1997 data) estimated only 30% of nursing homes had such collaborations. Additionally, while residents who privately pay for nursing home care as well as Medicare-eligible residents with Medicaid-reimbursed nursing home care (i.e., dual-eligible residents) can elect Medicare hospice, only 1% of all U.S. nursing home residents (those with a terminal and non-terminal conditions) in Medicare- and/or Medicaid-certified nursing homes were estimated to be enrolled in hospice at the time of nursing home survey (surveys occurred between July, 1995 and through April, 1997). Research focusing on nursing home residents who died has found between 5 and 20 percent of these residents enrolled in Medicare hospice prior to death, depending on the year and the U.S. state(s) studied.

In this research, we use calendar year 2000 resident assessment (MDS) data merged with Medicare enrollment and claims data to estimate the proportion of nursing homes in the 48 contiguous states (excluding Alaska and Hawaii) having any collaboration with hospice. Unlike the previous national estimate, which was derived from nursing home self-reported data and reflected hospice enrollment at one point in time (at the time of a nursing home’s Medicare/Medicaid survey), we estimated collaboration based on hospice utilization by nursing home residents who died between July and December 2000. Observations across this six-month time period provide a greater opportunity to observe short hospice stays, which frequently occur. Since we are also interested in how state policies and market characteristics may be associated with the prevalence of collaboration, we examine the association between the proportion of a state’s nursing homes collaborating with hospices and the state’s long-term care policies, hospice and nursing home market characteristics, and its proportion of older adults living in rural areas.

**Methods**

Resident assessment (MDS) and Medicare enrollment and claims data for 2000 were
merged and used for this analysis. An approved Data Use Agreement from the Centers for Medicare and Medicaid Services (CMS) was in place as was approval from Brown University’s Institutional Review Board. Resident assessment (MDS) data (within 120 days of death) were used to determine if a person resided in a nursing home prior to his/her death and Medicare enrollment data determined a resident’s date of death. Nursing homes caring for any Medicare or Medicaid residents (approximately 96% of U.S. nursing homes) conduct standardized assessments of residents and data from these assessments make up the MDS. In the time period studied, private-pay and Medicaid residents had assessments by Day 14 of their nursing home stay; Medicare skilled nursing facility residents had assessment by Days 5, 15, 31, 61 and 91. All residents had quarterly, annual and discharge assessments performed. Reassessments were required when a significant change occurred, although not necessarily upon hospice admission. For residents who died in the last six months of 2000, Medicare Claims data provided information on whether Medicare hospice was received prior to death and the MDS closest to death was used to determine the nursing home in which residents resided prior to death. The total number of nursing homes caring for Medicare and/or Medicaid residents across the 48 contiguous states in the six-month study period was 16,164.

The outcome of interest was the proportion of nursing homes in a state collaborating with hospice. When one or more of a nursing home’s decedents (identified by the last MDS prior to death) received Medicare hospice prior to death (per merged Medicare claims data), the nursing home was classified as collaborating with hospice. To determine the proportion of collaboration in a state, the number of nursing homes in a state classified as having a hospice collaboration was the numerator and the total number of nursing homes in a state with any decedents in the six-month study period was the denominator. A comparison of this study’s estimate with another Rhode Island (RI) estimate was made. This study estimated 68% of RI nursing homes collaborated with hospices in 2000 and an estimate based on a 2003 RI nursing home survey (with a 72% response rate) was 79% (unpublished data). Since Rhode Island hospices in recent years have been increasing their collaborations with nursing homes, the 2000 estimate appeared to be valid, at least in this one state.

The association between three state policy/reimbursement variables and collaboration were studied. A state’s Medicaid reimbursement policies were considered to be potentially important since in states with higher Medicaid per diems, or with case-mix reimbursement (which generally pays higher per diem amounts for sicker or needier residents), nursing homes may be more reluctant to accept a 5% Medicaid per diem reduction and/or to experience delays in per diem payment which are common when Medicaid residents receive hospice care. When dual-eligible nursing home residents receive Medicare hospice care, 95% of the nursing home’s Medicaid per diem must be paid directly to the hospice, who then pays the nursing home. Since many states do not have systems accommodating electronic submission of nursing home claims by hospices, per diem payment to hospices often is delayed. In the year 2000, six states paid nursing home per diems for hospice residents directly to nursing homes, not to the hospices; these states were Oklahoma, Connecticut, New Hampshire, Oregon, Pennsylvania and South Carolina. Considering the above, we examined how the presence of case-mix payment, a state’s average Medicaid nursing home per diem, and whether a state’s payment of nursing home per diems directly to nursing homes (rather than “passing it through” hospices) were associated with collaboration. Data on the presence of a case-mix reimbursement system in a state and its average Medicaid nursing home per diem were obtained by a national survey, which included follow-up interviews of state Medicaid officials. This survey was conducted in conjunction with a larger study and is described in detail elsewhere. Also studied was whether a state had a certificate of need for hospice programs in the year 2000. Since previous research suggested hospice for-profit status and hospice operational status (hospital-based or free-standing) were associated with the presence of a nursing home hospice collaboration, we also examined these variables, which were obtained from provider survey data collected and shared by the National Hospice and Palliative Care Organization (NHPCO). We used data
generated for a Government Accounting Office hospice report (and based on Medicare claims data) to obtain information on the average daily patient census of a state’s hospices. The number of hospices within a state was also examined. To examine the association between nursing home market characteristics and collaboration, we studied the variables of average nursing home occupancy (in 1999), the average number of nursing home beds per 1,000 persons 65+ in a state, and the proportion of Medicaid residents in a state’s nursing homes. Values for these variables were obtained from a policy publication from the American Association of Retired Persons (AARP). Lastly, data in the AARP publication (and obtained from U.S. Census data for 2000) on the proportion of a state’s 65+ population living in rural areas were studied. Prior to using this variable, analyses were conducted to determine whether it or a state’s population density was a better “rural” variable to use in this study. While a higher proportion of persons 65+ residing in rural areas was inversely correlated with higher population densities (r = -0.59; P < 0.001), the state-level 65+ rural variable appeared to be superior since increases in this variable, compared to increases in the population density variable, were more highly correlated with levels of nursing home/hospice collaboration in a state (r values of -0.67 and 0.29 respectively; both P-values < 0.001).

Means (with standard deviations), medians and percentages were used to describe the variable values for states, and correlation statistics were used to describe the linear relationship between some continuous variables. For comparison purposes, we examined continuous variable values by whether the proportion of a state’s nursing homes collaborating with hospice was below or at or above the U.S. median of 72%. To determine the statistical significance of comparisons across groups the t-test statistic for unpaired groups was used for continuous variables, and the chi-square statistic was used for nominal variables. Scatter plots with trend lines are used to show the linear relationship between selected state-level variables and the outcome variable.

**Results**

Seventy-six percent of U.S. nursing homes in the 48 contiguous states collaborated with hospice programs in the last six months of 2000. The proportion of nursing homes with at least one nursing home decedent who received Medicare hospice care ranged from 37% in Wyoming to 96% in Florida (Table 1). The (unweighted) average of the states’ proportions was 71%, and the median was 72%. Figure 1 shows the proportion of nursing homes collaborating with hospices within each of the 48 states by the quartile into which each state’s value fell and, Table 1 ranks the states by the proportion of nursing homes collaborating with hospice, and includes selected state characteristics. As can be observed, in states with lower versus higher proportions of collaboration there tends to be larger proportions of older adults living in rural areas (Table 1 and Fig.1). Also, in states with lower versus higher proportions of collaboration, hospice programs appear to be smaller, nursing home occupancy rates higher and there appears to be more presence of Medicaid case-mix reimbursement.

Table 2 further explores the above observations by comparing variable values for states by whether the proportion of nursing homes collaborating with hospice in a state is below the U.S. median of 72%, or is equal to or above the median. States with higher versus lower proportions of collaboration had more and larger hospice programs (Table 2). However, in additional analyses, when controlling for the number of hospices in a state, states with larger hospices had a significantly greater likelihood of having a greater proportion of nursing homes collaborating with hospice (and the number of hospices in a state was not significantly associated with the volume of collaboration; data not shown). Figure 2 shows the linear relationship between hospice size and the proportion of a state’s nursing homes collaborating with hospice; the correlation estimate was 0.52 (P < 0.001). Table 2 and Figure 2 also show the presence of an inverse correlation between higher nursing home occupancy and greater nursing home / hospice collaboration (r = -0.34, P < 0.05) as well as between a higher proportion of older adults living in rural areas and greater collaboration (r = -0.67, P < 0.001). A statistically significant linear correlation between number of nursing home beds and a state’s proportion of nursing homes collaborating with hospice was not present (data not shown).
In the six states paying Medicaid nursing home per diems for hospice residents directly to nursing homes, versus to hospices, there were significantly more nursing homes collaborating with hospices (Table 3). Also, in states having a Medicaid case-mix reimbursement system, compared to states where nursing home per diems were not adjusted for case-mix, less nursing home/hospice collaboration occurred ($P = 0.11$). However, this association between collaboration and the presence of case-mix reimbursement was not observed when examining only states having larger hospice programs (Table 3). For states with smaller hospice programs (average daily patient census in state below median of 17), nursing home/hospice collaboration was significantly less when case-mix reimbursement was present, versus not.
Fig. 1. The proportion of U.S. nursing homes contracting with Medicare hospice programs, by state in July-December 2000.

A similar modifying effect of hospice size was observed when comparing states with greater versus lower proportions of persons 65+ living in rural areas; in states having larger hospice programs, the amount of nursing home/hospice collaboration did not significantly differ by the proportion of older adults living in rural areas; in states having larger hospice programs, the amount of nursing home/hospice cooperation did not significantly differ by the proportion of older adults living in rural areas.

Table 2

<table>
<thead>
<tr>
<th>Variable Values for States Below OR Equal to or Above the U.S. Median for Nursing Homes Collaborating with Hospice Programs</th>
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<tbody>
<tr>
<td>Nursing Home (NH) Per Diem Payment</td>
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<tr>
<td>Average Medicaid reimbursement rate (CY 2000)</td>
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<tr>
<td>Nursing Home and Hospice Markets</td>
</tr>
<tr>
<td>1. Proportion of hospices for-profit</td>
</tr>
<tr>
<td>2. Average number of hospices in state</td>
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<tr>
<td>3. Average daily patient census of hospices in state</td>
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<td>4. Proportion of hospices hospital-based (Based on total n of 35)</td>
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<td>5. Proportion of hospices freestanding (Based on total n of 35)</td>
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<tr>
<td>6. Nursing home occupancy in 1999</td>
</tr>
<tr>
<td>7. Average NH beds per 1000 persons 65+ in state</td>
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<tr>
<td>8. Average proportion of Medicaid patients in NHs</td>
</tr>
<tr>
<td>Rural Population</td>
</tr>
<tr>
<td>Average proportion of a state’s 65+ population living in rural areas</td>
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^a_P < 0.01.                                                                                                          
^b_P < 0.05.                                                                                                          
^c_P < 0.001.
Table 3

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<tr>
<th>State Policy</th>
<th>Proportion of Nursing Homes Collaborating with Hospice (%)</th>
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<tbody>
<tr>
<td>1. Hospice certificate of need</td>
<td></td>
</tr>
<tr>
<td>Present (n = 11)</td>
<td>68</td>
</tr>
<tr>
<td>Not Present (n = 37)</td>
<td>72</td>
</tr>
<tr>
<td>2. Medicaid pays nursing home per diem for hospice residents to hospices</td>
<td></td>
</tr>
<tr>
<td>(not directly to nursing homes)</td>
<td></td>
</tr>
<tr>
<td>Yes (n = 42)</td>
<td>70&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>No (n = 6)</td>
<td>78&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>3. Medicaid case-mix nursing home reimbursement</td>
<td></td>
</tr>
<tr>
<td>Present (n = 30)</td>
<td>70</td>
</tr>
<tr>
<td>Not Present (n = 18)</td>
<td>74</td>
</tr>
<tr>
<td>a. Medicaid case-mix reimbursement in states with smaller hospice programs&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Present (n = 15)</td>
<td>58&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Not Present (n = 9)</td>
<td>67&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>b. Medicaid case-mix reimbursement in states with larger hospice programs&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Present (n = 15)</td>
<td>82</td>
</tr>
<tr>
<td>Not Present (n = 9)</td>
<td>80</td>
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<sup>a</sup><sup>P</sup> < 0.05.
<sup>b</sup> Smaller hospice programs have an average daily patient census of < 17 (the median) and larger programs have an average census ≥ 17.

Discussion

The opportunity for collaborative nursing home/hospice care to dying nursing home residents exists in 76% of U.S. nursing homes (in the 48 contiguous states) which were estimated to have collaborations with hospice in place. This estimate is much higher than the previous estimate of 30% which was based on hospice enrollment at the time of a nursing home’s survey (between July, 1995 and April, 1997).<sup>20</sup> The observed increase in collaboration is felt to reflect both increased collaboration areas (data not shown). Also, while the presence of hospice certificate of need was not significantly associated with the level of nursing home/hospice collaboration in a state (Table 3), its presence was associated with larger hospice programs; in states with hospice certificate of need legislation the hospice average daily patient census was 34 while it was 18 in those states without such legislation (<sup>P</sup> < 0.04; data not shown).
over time as well as the identification of hospice enrollment over a six-month time period (rather than at one point in time—the time of survey). As in the study by Petrisek and Mor, we found the proportion of nursing homes contracting with hospices varied across states and by hospice and nursing home market characteristics. Also, when more of a state’s older adults lived in rural areas, lower levels of nursing home/hospice collaboration were observed. A state’s Medicaid payment policies also did appear to be associated with the volume of nursing home/hospice collaboration. In states with case-mix reimbursement and in the 42 states adhering to the federal regulations requiring payment of Medicaid nursing home per diem for hospice residents to hospices (rather than directly to nursing homes), lower levels of collaboration were observed. Study findings support the notion that in the majority of U.S. nursing homes, the nursing home/hospice collaboration is a viable approach for providing comprehensive end-of-life care to dying nursing home residents and their families/significant others. Findings also emphasize, however, that hospice care in nursing homes is not equally accessible across all U.S. states. Whether changes in healthcare policy and/or hospices’ organizational structures and/or operations can foster such nursing home/hospice collaborations in these underserved states is of research interest.

Lower average nursing home occupancy in a state was associated with a greater amount of nursing home/hospice collaboration. It may be that when more nursing home beds are unoccupied, there is more interest in hospice collaboration by nursing home administrators/owners since such a collaboration could potentially give the nursing home a competitive advantage. The presence of larger (versus smaller) hospice programs in a state was associated with a greater proportion of nursing home/hospice collaborations in that state; this was observed even when controlling for the number of hospices in a state. Larger hospices probably have a greater capacity (including financial resources) for providing care in nursing homes since initiation of such a specialization requires training of hospice team members, training of nursing home staff on hospice philosophy and care practices, and on admission criteria, and development and implementation of policies and procedures needed to provide well-coordinated care in the nursing home. This greater capacity of larger hospice programs is supported by other research in California which showed larger hospices and hospices which were part of a chain to be significantly less likely to restrict care to potentially more costly patients (those lacking a caregiver, unwilling to forgo hospital admission, receiving chemotherapy, and others). Still, the association between larger hospice size and greater nursing home collaboration could be associated with more aggressive pursuit of nursing home collaborations by larger hospices who wish to maintain their large patient census; this may especially be the case when large hospices are located in competitive hospice markets.

The observed association between lower nursing home/hospice collaboration in states with larger proportions of older adults residing in rural areas is consistent with previous research which found in rural areas (versus urban areas) access to Medicare hospice was significantly less. Also, the presence of generally smaller hospice programs in states where greater proportions of older adults live in rural areas (Table 1) was also consistent with previous research. Of interest is that in states with larger hospice programs (average daily census at or above the median of 17) the proportion of nursing homes collaborating with hospices did not differ by rural status (by whether a state’s proportion of rural older adults was below or at or above the median U.S. value of 31.7%). As discussed below, how larger hospice programs are sustained in rural states or geographic areas needs further exploration.

Medicaid reimbursement policies relating to Medicare/Medicaid (dual-eligible) nursing home residents who access a Medicare hospice have previously been cited as being a barrier to nursing home/hospice collaboration, and this is supported by study findings. In the six states paying Medicaid per diems directly to nursing homes, higher levels of nursing home/hospice collaboration were observed. As previously noted, when a dual-eligible resident elects hospice, regulations require states to “pass through” 95% of the Medicaid per diem to the hospice who then pays the nursing home. Even though many hospices pay nursing homes 100% of the Medicaid per diem, Medicaid per diem payment is often paid later
to hospices (delaying payment to nursing homes). This later payment results because many states do not have computer programs allowing hospices to electronically bill for nursing home per diems. As has been previously recommended, elimination of the policy requiring payment of Medicaid nursing home per diems to hospices (rather than directly to nursing homes) could potentially result in increased availability of hospice care in nursing homes. Without elimination of this payment policy, implementation of systems allowing hospices to electronically bill for nursing home per diems would probably decrease payment delays and could in turn increase the willingness of nursing homes to collaborate with hospices.

The presence of a Medicaid case-mix payment system was associated with lower levels of nursing home/hospice collaboration; but, since state case-mix reimbursement systems generally differ, the reasons for this association are not entirely clear. However, some states make adjustments to nursing home payment rates that are not made when Medicaid per diem is paid to hospices; therefore reimbursement to nursing homes in these states may be even lower than the 95% of the “normal” Medicaid reimbursement. The association between case-mix payment and collaboration observed in calendar year 2000 is troubling since subsequent to 2000, in an attempt to reduce Medicaid budgets, some states began removing residents enrolled in hospice from a nursing home’s calculated case-mix rate. Since hospice residents usually require more care, removing them from a nursing home’s calculated case-mix reimbursement rate essentially reduces a nursing home’s reimbursement rate, and the more referrals the greater the reduction. According to anecdotal reports from hospice providers, this Medicaid practice when implemented has had a chilling effect on hospice referrals. Given this, it is likely that the negative association between case-mix reimbursement and collaboration observed in this study may be even more dramatic today.

Other factors not addressed in this study are known to influence whether nursing homes and hospices choose to collaborate as well as the amount of collaboration desired (i.e., number of hospice referrals). A major factor felt to impact the collaboration decision is the challenge associated with two organizations and two specialties (nursing home versus hospice professionals) working together to provide end-of-life care. There are knowledge differences between nursing home and hospice staff and these stem in part from the fact that palliative care has not been included in core training for nurses, nursing assistants or other disciplines outside of hospice. These two providers also have differing regulatory requirements and oversight. Reports from hospice and nursing home representatives, and from state surveyors, highlight this divergent training and orientation of nursing home and hospice professionals; nursing home staff and their surveyors view the nursing home’s role as restoring health or providing rehabilitative services while hospice staff view their role as providing palliative care. So, some nursing home administrators may be hesitant to collaborate with hospices because in part they fear surveyor citation when care approaches are different than what regulations encourage (such as the honoring a dying resident’s wish not to eat or drink when regulations encourage sustenance, which may translate into the provision of IV fluids or the insertion of a feeding tube). In addition to different training and perspectives of nursing home and hospice professionals, initiation of hospice care in nursing homes is administratively burdensome. Policies and procedures must be established to achieve well-coordinated billing, staffing and other operational functions; to integrate care and care planning across programs and staff; and to ensure consistent and coherent communication at the administrative, clinical and staff supervisory level. Hospices providing large amounts of care in the nursing home often have special care teams for nursing home residents and manuals and forms specific to providing and coordinating this care provision. Considering this, of interest is how some smaller hospices are able to provide care in nursing homes. Also of interest is the policy, market or community characteristics facilitating the existence of larger hospice programs in states such as Alabama where a large proportion of older adults live in rural areas. A project study now being conducted at Brown University (and funded by the Robert Wood Johnson Foundation) aims to identify how successful nursing home/hospice collaboration is achieved, particularly in rural areas and by
smaller hospice programs. The goal of the project is to disseminate knowledge and resources capable of facilitating the initiation and ongoing operation of (successful) nursing home/hospice collaborations, and thus, potentially increasing access to hospice care in nursing homes. Based on previous research,\textsuperscript{13,14,16,17} it is believed this increased availability of hospice care in nursing homes can lead to improved end-of-life care for dying nursing home residents.

Not addressed in this study is the proportion of dying nursing home residents who enroll in hospice. The willingness of residents and their families to choose hospice and of nursing home staff and/or physicians to suggest that hospice as an option varies substantially across nursing homes and states,\textsuperscript{24} and this is the focus of other ongoing work. Also, while findings provide insight into state factors associated with the occurrence of nursing home/hospice collaboration at the state level, to obtain a more complete understanding of the factors influencing decisions to collaborate and how provider characteristics may modify or interact with healthcare policy and market characteristics, statistical modeling which considers nursing home, healthcare market as well as state-level factors is needed (i.e., multilevel modeling).

In summary, considering the high estimated proportion of nursing homes collaborating with hospices in U.S. states and the benefits of hospice care documented by previous research,\textsuperscript{13,14,16,17} care provision by both nursing homes and hospices appears to be a potentially viable approach for providing comprehensive higher-quality end-of-life care in most U.S. nursing homes. However, this collaboration is noticeably lower in many states and this appears to be associated with the presence of Medicaid case-mix reimbursement, the payment of Medicaid nursing home per diem for hospice residents to hospices (rather than directly to nursing homes), higher nursing home occupancy, smaller hospice programs, and with a higher proportion of a state’s 65+ population living in rural areas. To the extent that policy can be changed or local market forces aligned to support nursing home/hospice collaborations, they may be a viable approach for providing end-of-life care in some of the 24% of U.S. nursing homes who weren’t collaborating with a hospice in July through December 2000. We need to understand how market alignment, community support and/or hospice organizational structures or operations may allow for increased access to hospice care in these underserved areas. Also, we need to understand how both nursing home and hospice providers can operationalize a collaboration so it is less burdensome and more successful, especially as reflected by hospice referral rates and lengths of hospice stay. Nonetheless, even though collaborations can be improved or be more widespread, in July through December, 2000, 76% of U.S. nursing homes had collaborations in place allowing for Medicare hospice access. If this level of collaboration is still present, dying residents in most U.S. nursing homes could have access to both nursing home and hospice care, and thus potentially have a greater likelihood of experiencing fewer end-of-life hospitalizations and invasive treatments as well as higher-quality pain assessment and management.\textsuperscript{13,14,16,17}

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