



## Evaluation of aging in place model with home care services and registered nurse care coordination in senior housing

Marilyn J. Rantz, PhD, RN, FAAN<sup>a,\*</sup>, Lorraine Phillips, PhD, RN<sup>b</sup>, Myra Aud, PhD, RN<sup>b</sup>,  
Lori Popejoy, PhD, RN<sup>b</sup>, Karen Dorman Marek, PhD, MBA, RN, FAAN<sup>c</sup>,  
Lanis L. Hicks, PhD<sup>d</sup>, Isabella Zaniletti, MA<sup>e</sup>, Steven J. Miller, MA<sup>b</sup>

<sup>a</sup> Sinclair School of Nursing and Family and Community Medicine,  
School of Medicine, University Hospital Professor of Nursing, University of Missouri, Columbia

<sup>b</sup> Sinclair School of Nursing, Columbia, Missouri

<sup>c</sup> College of Nursing, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin

<sup>d</sup> Health Management & Informatics, School of Medicine, University of Missouri, Columbia

<sup>e</sup> Medical Research Office, University of Missouri, Columbia

### ARTICLE INFO

#### Article history:

Received 25 June 2010

Revised 20 July 2010

Accepted 27 August 2010

#### Keywords:

Aging in place

Nurse care coordination

Assisted living

Nursing home

Elderly

### ABSTRACT

A state-sponsored evaluation of aging in place (AIP) as an alternative to assisted living and nursing home has been underway in Missouri. Cost, physical, and mental health assessment data reveal the cost-effectiveness and positive health measures of AIP. Findings of the first four years of the AIP evaluation of two long-term care settings in Missouri with registered nurse care coordination are compared with national data for traditional long-term care. The combined care and housing cost for any resident who received care services beyond base services of AIP and who qualified for nursing home care has never approached or exceeded the cost of nursing home care at either location. Both mental health and physical health measures indicate the health restoration and independence effectiveness of the AIP model for long-term care.

Cite this article: Rantz, M. J., Phillips, L., Aud, M., Popejoy, L., Marek, K. D., Hicks, L. L., Zaniletti, I., & Miller, S. J. (2011, FEBRUARY). Evaluation of aging in place model with home care services and registered nurse care coordination in senior housing. *Nursing Outlook*, 59(1), 37-46. doi:10.1016/j.outlook.2010.08.004.

As people age, most want to remain as active and independent as possible for as long as possible, maintain an excellent quality of life, and live at home surrounded by family and friends—not in institutions like nursing homes.<sup>1–4</sup> According to a recent AARP

survey, most people age 45 and older want to remain in their current residence for as long as possible. This tendency increases with age; 92% of those between the ages of 65 and 74, and almost all of those over the age of 75 (95%), want to remain at home.<sup>5</sup> The goal of

This research was supported in part by a grant from the Centers for Medicaid and Medicare Services: Aging in Place: A New Model for Long-term Care, Grant #18-C-91036; US Administration on Aging, Technology to Enhance Aging in Place at TigerPlace, Grant #90AM3013. Parts of this paper were presented at the American Academy of Nursing's annual conference, November 5-7, 2009, Atlanta, Georgia.

\* Corresponding author: Dr. Marilyn J. Rantz, Sinclair School of Nursing and Community Medicine, School of Medicine, University Hospital, University of Missouri, 2440 Shady Hills Lane, Columbia, MO 65279.

E-mail address: [rantzm@missouri.edu](mailto:rantzm@missouri.edu) (M.J. Rantz).

0029-6554/\$ – see front matter © 2011 Elsevier Inc. All rights reserved.

doi:10.1016/j.outlook.2010.08.004

aging in place (AIP) is to allow people to remain at home and be provided with supportive health care services as needed.<sup>1</sup> Faculty at the University of Missouri (MU) are evaluating an AIP model of care that combines home care services and registered nurse (RN) care coordination in two independent congregate senior housing buildings. One is specially designed and state designated as the only AIP site where care can be provided through the end of life, hereafter known as "AIP 1 TP."<sup>6</sup> The other is an independent living apartment setting within a continuing care retirement community (CCRC), where RN care coordination and some services help people remain independent for as long as possible before moving to traditional care settings within the CCRC, hereafter known as "AIP 2 MW." The purpose of this article is to describe the findings of the first four years of the state-sponsored AIP evaluation of these two long-term care settings in Missouri. Cost and health assessment data are presented and compared with traditional long-term care data.

The typical long-term care trajectory forces older adults to move from home, to independent senior housing, to assisted living, and then to nursing home as their health and functional abilities decline. The first move is often the result of inadequacies of the home environment to accommodate healthy aging. Structural features of the home, such as stairs, width of doorways and hallways, and bathroom and kitchen design, may impact a person's ability to function safely and, consequently, result in a move to senior housing, assisted living, or a nursing home.<sup>2</sup> Once an older adult moves into an assisted living or nursing home environment, state and federal regulations define what services may be provided, staffing patterns, building safety standards, and how payment for care is made. Although regulations differ from state to state, they often define a specific level of ability that a resident must maintain to remain in independent housing or assisted living environments. Regulations require that a resident move to a higher level of care as their health deteriorates and their self-care abilities decline. For AIP to be successful, a facility must adjust the services provided and level of care criteria to meet a resident's increasing care needs, thus avoiding the need to discharge the resident to a higher level of care.<sup>7</sup> RN care coordination is essential for AIP because care is provided in different settings from a variety of health care disciplines.<sup>2</sup>

## Background

---

In 1996, faculty from the University of Missouri (MU) Sinclair School of Nursing (SSON) imagined a new model of care that would allow residents to age in place without the fear of forced relocation. Several faculty had active research programs about older adults; they were familiar

with findings of early nursing home diversion<sup>8,9</sup> and community-based nursing case management demonstrations.<sup>10-13</sup> Faculty toured best-practice long-term care sites around the country and met with a variety of health care providers from a range of disciplines, community leaders, and other geriatric researchers to define the AIP model of care. Based on these discussions, the final model combined the best of community-based health care with intensive RN care coordination.<sup>3</sup> Unfortunately, state long-term care regulations were not flexible enough to execute the AIP vision.

The faculty of the SSON began working to change statutes and regulations that would enable AIP to happen. Working with state legislators and officials, community leaders, and health care industry advocates, legislation in 1999 and 2001 established four AIP pilot sites. MUSSON, in partnership with AIP 1 TP, applied for and received designation as an AIP pilot site. AIP 2 MW was added later to increase the sample size and to evaluate the effect of AIP RN nurse care coordination and other care services in a traditional CCRC elder apartment site, where there are industry incentives to move residents from apartments to traditional long-term care as care needs increase.

In 1999, MUSSON established Sinclair Home Care, a licensed home health agency specializing in the care of frail older adults, as a department within the school. To enable launching the operation, the school received a grant from the Centers for Medicare and Medicaid Services (CMS) to establish the home health agency and evaluate AIP.<sup>14</sup> Sinclair Home Care provides clinical experiences to students from nursing, medicine, and other health professions. The agency developed innovative ways to care for and manage the care of older adults.<sup>14</sup> Sinclair Home Care was specifically developed to provide care to the residents of AIP 1 TP, AIP 2 MW, and other independent and public housing sites, with the goal of implementing and evaluating the AIP model of care.

Results from the initial evaluation indicate that community care with RN care coordination improved clinical outcomes when compared with individuals of similar case-mix in nursing homes.<sup>15,16</sup> Moreover, the addition of RN care coordination to home-based long-term care programs provides savings to the total cost of health care to the Medicare and Medicaid programs when compared with nursing home-based and home and community-based services.<sup>17</sup> The AIP care model at AIP 1 TP and AIP 2 MW is based on these findings, combining home health services with RN care coordination.

## The Locations

---

AIP 1 TP was specifically developed as an ideal AIP housing environment for elders and to evaluate the AIP

model. Built by Americare Systems, Inc. (Sikeston, MO), a leading long-term corporation, in collaboration with the University of Missouri, AIP 1 TP opened in 2004 as a 31-unit building with a variety of apartment styles including studio, alcove, and one and two bedrooms, all meeting universal access standards. The facility was built to nursing home standards, licensed as an intermediate care facility (ICF), and operated as independent housing.<sup>6</sup> When AIP 1 TP was licensed as an ICF, Americare was granted a number of exceptions to the state ICF regulations so that residents could truly age in place as their self-care abilities declined. These included hallway width variations that allow for seating at comfortable intervals when walking, full kitchens and screened porches in each apartment, and traditional care regulations of nursing homes. A 23-unit addition opened in January 2009.

AIP 2 MW, independent senior housing apartments, is a four-story, 68-unit building with one- and two-bedroom apartments. It is part of a CCRC with a skilled nursing facility, assisted living facility, special dementia care unit, and independent housing including both single-family homes and apartments.

At both facilities, residents live in independent apartments with such services as meals, transportation, and housekeeping provided. A variety of social activities are planned, both on and off campus. Residents at both facilities have access to exercise equipment and classes.

## AIP Care Services

Sinclair Home Care provides the care services at AIP 1 TP and AIP 2 MW. Care is delivered in a wellness center where residents may have their vital signs checked, receive assistance with medications, have minor problems addressed, and discuss health issues with an RN care coordinator. The Wellness Center at AIP 1 TP is open three days per week; at AIP 2 MW, it is open two mornings per week. In addition, four AIP private visits are prepaid and available annually, on request, to assess and assist residents with health care problems. An RN is on call 24 hours per day, 7 days per week to triage emergency situations.

At AIP 1 TP, the care coordination is more intensive because an RN coordinates all residents' health care with physicians, family members, and other health care providers. Sinclair Home Care provides additional services to AIP 1 TP that includes health promotion activities, such as exercise classes five days per week and social work assistance to help with life transitions. To facilitate care coordination and ensure ongoing evaluation, a semi-annual health care assessment is completed for all of the AIP participants at AIP 1 TP and annually at AIP 2 MW; additional assessments are done as needed, with changes in residents' conditions, such

as hospitalizations. The monthly fee for AIP services is lower at AIP 2 MW, a reflection of the less intense care coordination and fewer services provided. The AIP monthly service fee is included in the monthly apartment rent for both sites. Residents may also contract for additional health care services, such as personal care, medication management, or other professional services. These are billed monthly to residents and are paid for privately or through long-term care insurance. About 30% of the people living at AIP 1 TP use long-term care insurance for some or all services and rent to live there.

The health assessment includes a variety of established standardized assessments, including the geriatric depression scale (GDS),<sup>18-20</sup> mini-mental state exam (MMSE),<sup>21</sup> Short Form-12 Health Survey,<sup>22</sup> minimum data set (MDS) RUGSIII quarterly,<sup>23</sup> and a fall risk assessment. The MDS was chosen to allow for comparisons to the institutional-based long-term care community. The other assessments, except the fall risk assessment, were chosen because they are established research tools with good validity and reliability and could be incorporated into the specialized home health software used by Sinclair Home Care. The fall risk assessment is a tool available in the software package and is similar to other established standard fall risk assessments.

Unlike traditional home health that is intermittent care, Sinclair Home Care admits the residents of AIP 1 TP and AIP 2 MW for continuous care management. The RN care coordinator monitors the residents through routine assessment, during acute episodes of illness, and through regular contact with residents.<sup>14</sup> Special attention is paid to those who do not use the wellness center to ensure that they remain healthy. This monitoring permits the RN care coordinator to detect problems early and offer interventions to prevent or delay more severe problems. When problems are identified, or when someone suffers from an acute illness, the goal is to restore the person to the best possible health so they can remain independent. Depending on the severity of the problem, rehabilitation may be done through Medicare home health care, a short stay in a rehabilitation facility, a Medicare skilled nursing facility, or through private-pay nursing or therapy services in the resident's apartment. If an assistive device or some personal care assistance is needed to enable independence, Sinclair Home Care arranges these services. The services may be provided by family, through private-pay personnel selected by the resident or family, or by the Sinclair Home Care staff. All care is delivered in ways that encourage independence and self-sufficiency of residents; therefore, when additional care is required, the least amount of service that is needed is planned. As health and self-sufficiency are restored, the additional care services are withdrawn, so increased care costs (either by private-pay or private long-term care insurance) are typically time-limited.

## Sample

From the beginning of the AIP evaluation in 2004 through December 2008, all residents of AIP 1 TP ( $n = 66$ , 36 of whom were discharged to other living arrangements or who died) and most of the residents of AIP 2 MW apartments ( $n = 95$ , 48 of whom were discharged) were admitted to the AIP program (Table 1). Participation and use of services in the program is voluntary; however, all fees for base AIP services are included in the housing costs, and participation in the state evaluation of AIP is written into facility admission agreements, so residents are encouraged to use the health promotion services. The median age at admission is  $84.0 \pm 6.2$  at AIP 1 TP and  $84.9 \pm 6.6$  at AIP 2 MW. The gender breakdown is 18 (27%) men and 48 (73%) women at AIP 1 TP and 24 (25%) men and 71 (75%) women at AIP 2 MW. The majority of participants are Caucasian; only one is Asian.

All participants in the AIP program signed MU Institutional Review Board informed consent for the use of their health records for this evaluation. The complete population of AIP participants is included in the analyses.

## Methods

Descriptive statistics were used to analyze the data from the AIP population because of the nonrandom selection of the groups. Data from complete years 2005 through 2008 were used for analysis. A semi-annual (for AIP 1 TP) and annual (for AIP 2 MW) comprehensive health assessment, including the MMSE, GDS, SF-12 Health Survey, RUGS III quarterly nursing home MDS, and fall risk assessment, was completed for residents. The MMSE was routinely done on admission, but for subsequent assessments was only done if indicated by a new symptom of cognitive decline detected by the care coordinator because elders were frustrated with repeated use of MMSE. To evaluate the cost effectiveness of AIP, costs of services from Sinclair Home Care beyond the base AIP services that are included in the monthly rent were continuously tracked. Adverse events, including emergency department visits, hospitalizations, and falls, were also tracked. An activities of daily living (ADL) scale<sup>24</sup> and continence rates were computed from the MDS data. The ADL scale is a summary score of seven MDS items (G1Aa-bed mobility, b-transfer, f-locomotion off unit,

g-dressing, h-eating, i-toilet use, and j-personal hygiene) that are scored 0–4, so the score can range from 0–28. Bowel incontinence rates were calculated from MDS item H1a (continent-0; incontinent-1, 2, 3, or 4); bladder incontinence rates were from item H1b (continent-0 or 1; incontinent-2, 3, or 4). In addition, physical (PH) and mental health (MH) subscales were calculated from the SF-12 Health Survey data.<sup>25</sup> Although every effort was made to assess the residents of AIP 1 TP twice per year, sometimes only one assessment was completed, with schedule changes or delays resulting from active resident lives.

To accurately compare costs of care of AIP settings to assisted living and nursing homes, subjects in the cost analysis were limited to those who used *additional care services* from Sinclair Home Care. This excluded residents living in the two AIP settings who were totally independent, who would have skewed the cost of care analysis in favor of AIP. A state of Missouri nursing home eligibility evaluation instrument was used to classify the AIP participants using additional care services into two groups: qualified for nursing home placement (score of 21 or more) and not qualified (score less than 21). Annually, MDS data for each participant was used as proxy information to score the state instrument. Actual care costs were averaged for residents in each setting by those who were nursing home-eligible and those who were not. Average care costs were annualized for both locations. Yearly combined housing and annualized care costs for those eligible for nursing home placement were compared with national average nursing home costs (Table 2). The yearly combined housing and annualized care costs of those receiving additional care services, but who were *not* eligible for nursing home placement, were compared with national average assisted living costs (Table 3).

Both cross-sectional (Tables 4 and 5) and longitudinal analyses (Tables 6 and 7) were created from the clinical data. The longitudinal analysis was done with all subjects who minimally had one fall risk assessment per year from 2005 to 2008. If the subject had more than one assessment of any type (ie, fall risk, MMSE, GDS, SF12, or MDS) in a year, only the data from the first assessment were used in the analyses, and subjects were included only once in the longitudinal analyses.

## Results

### Cost Results

The combined care and housing cost for any resident who was receiving additional care services beyond base services and qualified for nursing home care ( $n = 25$ ) has never approached or exceeded the cost of nursing home care at either location (Table 2). At AIP 2 MW, the average combined housing and annualized care cost is lower than the national average cost for both nursing home (Table 2)

**Table 1 – Sample**

	N	Sex			Age (Median $\pm$ SD)
AIP 1 TP	66	M	18	27%	84.0 $\pm$ 6.2
		F	48	73%	
AIP 2 MW	95	M	24	25%	84.9 $\pm$ 6.6
		F	71	75%	
Total	161	M	42	26%	84.4 $\pm$ 6.4
		F	119	74%	

**Table 2 – Yearly Combined Housing and Care Costs for Residents Who Were Nursing Home Eligible (Residents Used Additional Care Services)**

	N	Average Care Cost	Average Housing Cost	Care Cost + Housing Cost	Average Nursing Home Cost
AIP 1 TP					
2005					
Monthly			\$2871		
Annualized	7	\$2248	\$34,452	\$36,700	\$64,240*
2006					
Monthly			\$3108		
Annualized	2	\$2938	\$37,296	\$40,234	\$66,795 <sup>†</sup>
2007					
Monthly			\$3295		
Annualized	8	\$2945	\$39,540	\$42,485	\$68,985 <sup>‡</sup>
2008					
Monthly			\$3374		
Annualized	3	\$7331	\$40,488	\$47,819	\$69,715 <sup>§</sup>
AIP 2 MW					
2005					
Monthly			\$1526		
Annualized		\$ —	\$18,312	\$18,312	\$64,240*
2006					
Monthly			\$1973		
Annualized	1	\$1590	\$23,676	\$25,266	\$66,795 <sup>†</sup>
2007					
Monthly			\$2278		
Annualized	3	\$867	\$27,336	\$28,203	\$68,985 <sup>‡</sup>
2008					
Monthly			\$2369		
Annualized	1	\$3101	\$28,428	\$31,529	\$69,715 <sup>§</sup>

\* MetLife Mature Market Institute. The MetLife market survey of nursing home and assisted living costs. Westport, CT: MetLife Mature Market Institute; 2005.

<sup>†</sup> MetLife Mature Market Institute. The MetLife market survey of nursing home and assisted living costs. Waltham, MA: LifePlans, Inc.; 2006.

<sup>‡</sup> MetLife Mature Market Institute. The MetLife market survey of nursing home and assisted living costs. Waltham, MA: LifePlans, Inc.; 2007.

<sup>§</sup> MetLife Mature Market Institute. The MetLife market survey of nursing home and assisted living costs. Waltham, MA: LifePlans, Inc.; 2008.

and assisted living (Table 3) for all four years. People who would have qualified for assisted living at AIP 1 TP (n = 37) and AIP 2 MW (n = 9) had low annualized care costs, ranging from \$1137 to \$2591. Those at AIP 2 MW were served for several thousand dollars per year less than the national assisted living cost. The combined housing and annualized care cost at AIP 1 TP is greater than the national average cost for assisted living (Table 3), but the care costs ranged from \$1656 to \$2591 per year, similar to AIP 2 MW. There are reasons for the higher AIP 1 TP costs: (1) the apartments at AIP 1 TP are very large and (2) AIP 1 TP was designed to appeal to residents with long-term care insurance and private pay using high-quality environmental furnishings. The average annualized care costs at AIP 1 TP are higher than AIP 2 MW; this is to be expected because most people remain at AIP 1 TP through the end of life, whereas most at AIP 2 MW move to other locations for higher care on their CCRC campus.

### Length of Stay

For all residents who participated in AIP (n = 161), the average length of stay at both locations is slightly less than the national average for assisted living/

independent living. The average length of stay at AIP 1 TP is 26.3 months and at AIP 2 MW is 25.9 months. The average length of stay for assisted living/independent living is 27.4 months.<sup>26</sup> The range of length of stay for AIP 1 TP was 29 days to 4.5 years, and for AIP 2 MW, it was 16 days to 5.3 years. The maximum length of stay reflects the opening date of each facility, AIP 2 MW the year before AIP 1 TP. Proportionally, three times as many residents at AIP 2 MW move to nursing homes or assisted living than at AIP 1 TP; twice as many residents experience end-of-life care in AIP 1 TP than at AIP 2 MW. These differences reflect the commitment through end of life offered at AIP 1 TP.

### Mental Health Results

The cross-sectional analysis (Table 4) revealed similar MH patterns at both locations. At AIP 2 MW, MH, as measured by the SF-12 MH and the GDS, improved, but cognitive abilities (MMSE) declined. At AIP 1 TP, MH, as measured by the SF-12 MH, improved or remained constant (GDS), and cognitive abilities (MMSE) deteriorated. The declining trends in MMSE are likely influenced by selection bias,

**Table 3 – Yearly Combined Housing and Care Costs for Residents Who Did NOT Qualify for Nursing Home Placement (Residents Used Additional Care Services)**

	N	Average Care Cost	Average Housing Cost	Care Cost + Housing Cost	Average Assisted Living Cost
AIP 1 TP					
2005					
Monthly			\$2871		\$2905
Annualized	8	\$1656	\$34,452	\$36,108	\$34,860*
2006					
Monthly			\$3108		\$2968
Annualized	9	\$1932	\$37,296	\$39,228	\$35,616†
2007					
Monthly			\$3295		\$2969
Annualized	9	\$2244	\$39,540	\$41,784	\$35,628‡
2008					
Monthly			\$3374		\$3031
Annualized	11	\$2591	\$40,488	\$43,079	\$36,372§
AIP 2 MW					
2005					
Monthly			\$1526		\$2905
Annualized	4	\$1137	\$18,312	\$19,449	\$34,860*
2006					
Monthly			\$1973		\$2968
Annualized	0	\$ —	\$23,676	\$23,676	\$35,616†
2007					
Monthly			\$2278		\$2969
Annualized	2	\$2181	\$27,336	\$29,517	\$35,628‡
2008					
Monthly			\$2369		\$3031
Annualized	3	\$1729	\$28,428	\$30,157	\$36,372§

\* MetLife Mature Market Institute. The MetLife market survey of nursing home and assisted living costs. Westport, CT: MetLife Mature Market Institute; 2005.

† MetLife Mature Market Institute. The MetLife market survey of nursing home and assisted living costs. Waltham, MA: LifePlans, Inc.; 2006.

‡ MetLife Mature Market Institute. The MetLife market survey of nursing home and assisted living costs. Waltham, MA: LifePlans, Inc.; 2007.

§ MetLife Mature Market Institute. The MetLife market survey of nursing home and assisted living costs. Waltham, MA: LifePlans, Inc.; 2008.

because the RN care coordinator chose to use it only as indicated by some observed suspected decline in mental status; thus, those with stable or improving MMSE were not captured in the analysis.

The longitudinal analysis (Table 5) also exhibited comparable MH results. At AIP 2 MW, MH (GDS) improved or (SF-12 MH) stayed relatively stable, whereas cognitive function (MMSE) declined. At AIP 1 TP, MH (SF-12 MH) trended better or remained fairly constant (GDS), whereas cognitive abilities (MMSE) trended worse.

Although the MH results revealed similar results at both locations, the PH analyses exposed clinically significant distinctions.

### Physical Health Results

The physical health cross-sectional analysis (Table 4) showed some similarities and some differences between AIP 2 MW and AIP 1 TP. PH, as measured by the SF-12 PH, remained generally constant at both locations. Similarly, the residents' ability to perform ADLs declined during

the first two or three years, and then improved to zero (no deficits) for the third or fourth years. At AIP 2 MW, fall risk scores rose from 2005 to 2007, and then improved in 2008. At AIP 1 TP, fall risk score trended worse, illustrating differences in the populations and commitment through end of life.

The differences between the populations are even more pronounced in the longitudinal analysis (Table 6). At AIP 2 MW, PH (SF-12 PH, ADLs) remained stable. Fall risk rose from 2005 to 2007, then returned to about the 2006 level in 2008. In contrast, PH, as measured by the SF-12 PH, deteriorated at AIP 1 TP, as did fall risk. The residents' ability to perform ADLs worsened during 2005 and 2006, then improved to zero (no deficits). It may be that the sensitivity or annual/semi-annual assessment using the MDS interfered with detecting changes in ADLs.

Continence rates were calculated from the MDS data, and cross-sectional (Table 5) analyses revealed similar results for both locations for bladder continence rates. There was steady decline in bladder continence from 2005 to 2007, and then improvement at both locations for 2008.

**Table 4 – Cross-Sectional Analysis of Subjects Who Had at Least One Assessment Per Year**

	Mental Health Measures									Physical Health Measures								
	MMSE			GDS			SF-12 MH			SF-12 PH			ADL			Fall Risk		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
AIP 1 TP																		
2005	26	26.9	4.1	38	3.7	2.5	40	51.5	8.7	40	39.7	11.9	40	0.1	0.3	43	41.0	15.4
2006	10	23.7	7.1	13	5.7	3.3	37	52.4	9.9	37	42.8	10.2	37	0.3	0.9	38	44.5	16.4
2007	11	23.5	6.4	15	3.6	2.1	37	54.3	8.7	37	41.1	10.1	38	0.7	4.2	32	44.1	14.8
2008	19	22.7	6.7	29	3.5	2.2	31	58.5	5.3	31	38.8	10.9	26	0.0	0.0	30	46.3	15.2
AIP 2 MW																		
2005	31	28.0	2.8	37	4.1	2.9	44	53.0	8.9	44	39.0	12.2	40	0.1	0.3	45	42.4	13.5
2006	10	27.7	3.7	18	3.8	2.9	45	55.7	6.1	45	40.8	11.3	42	0.4	1.8	48	43.1	16.0
2007	17	27.5	2.9	20	3.9	3.0	59	55.9	7.9	59	38.8	10.9	57	0.0	0.0	57	45.8	15.7
2008	13	24.2	6.3	23	2.4	2.0	30	57.0	5.1	30	41.2	11.1	31	0.0	0.0	30	39.0	14.7
Range	0-30			0-15			0-100			0-100			0-28			0-100		
Better score is:	Higher			Lower			Higher			Higher			Lower			Lower		
	Standardized to a mean of 50 & standard deviation of 10																	

Minor differences in bladder continence rates between locations were detected in the longitudinal analysis (Table 7). The continence rate exhibited a sustained decline at AIP 2 MW during all four years. At AIP 1 TP, bladder continence steadily declined from 2005 to 2007, and then the trend flattened out. Bowel incontinence was much less of a problem than bladder incontinence in either location.

**Consumer Satisfaction**

Resident participants of the AIP program consistently gave the program and facilities high marks. Sinclair Home Care rated high in overall patient satisfaction from 2005 to 2008, with scores of 1.27, 1.20, 1.27, and 1.28 on a scale of 1-5, with 1 as best from 2005 to 2008, respectively. In addition, AIP 1 TP's consumer survey for residents revealed that overall resident satisfaction ranked at 94% (excellent or good ratings combined) in 2006 and 2008. AIP 2 MW had similar facility results.

Because AIP 1 TP is licensed as intermediate care with waivers (discussed earlier), the facility is surveyed annually by the Missouri Department of Health and Senior Services, Long-term Care Division. Because the traditional nursing home care regulations are waived in the AIP project, the care services are regulated and surveyed by the Home Health regulators. All state survey processes have been satisfactory since the program's initiation. AIP 2 MW is not licensed but is operated as independent senior housing as a part of the CCRC that is regulated and surveyed by MODHSS. Again, all state survey processes have been satisfactory since the program's initiation.

**Discussion**

When the AIP program was undertaken, our vision was that people could age in place through the end of life at

**Table 5 – Cross-Sectional Analysis of Continence Rates for Subjects Who Had at Least One Assessment Per Year**

	AIP 1 TP			AIP 2 MW		
	N	Continent	Incontinent	N	Continent	Incontinent
Bladder continence						
2005	40	83%	17%	40	80%	20%
2006	37	81%	19%	42	79%	21%
2007	38	61%	39%	57	56%	44%
2008	26	69%	31%	31	74%	26%
Bowel continence						
2005	40	98%	2%	40	98%	2%
2006	37	97%	3%	42	100%	0%
2007	38	92%	8%	57	100%	0%
2008	26	88%	12%	31	94%	6%

Bladder incontinence calculated from MDS item H1b (continent-0 or 1; incontinent-2, 3, or 4). Bowel incontinence calculated from MDS item H1a (continent-0; incontinent-1, 2, 3, or 4).

**Table 6 – Longitudinal Analysis of Subjects Who Had at Least One Fall Risk Assessment Per Year**

	Mental Health Measures									Physical Health Measures								
	MMSE			GDS			SF-12 MH			SF-12 PH			ADL			Fall Risk		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
AIP 1 TP																		
2005	11	27.8	3.7	15	2.7	1.8	15	54.4	5.6	15	44.1	8.6	15	0.1	0.5	15	34.0	15.0
2006	3	22.7	11.0	3	4.3	3.8	15	53.6	8.9	15	43.9	10.8	15	0.2	0.8	15	37.3	17.5
2007	2	14.0	1.4	2	2.0	0.0	15	57.5	4.4	15	43.5	9.0	15	0.0	0.0	15	42.7	16.2
2008	8	20.3	9.0	13	3.5	2.1	15	58.3	7.0	15	38.1	12.1	13	0.0	0.0	15	42.7	13.3
AIP 2 MW																		
2005	7	28.1	1.5	8	4.4	2.0	11	50.1	10.7	11	46.4	9.7	11	0.0	0.0	11	35.5	12.9
2006	0	0.0	0.0	1	2.0	0.0	10	55.1	6.0	10	45.5	9.8	10	0.0	0.0	11	39.1	16.4
2007	3	24.7	2.9	0	0.0	0.0	11	56.2	6.3	11	45.0	7.3	10	0.0	0.0	11	45.5	12.9
2008	6	21.9	6.1	7	1.7	2.2	10	55.1	4.8	10	45.9	7.5	9	0.0	0.0	11	38.2	12.5
Range	0–30			0–15			0–100			0–100			0–28			0–100		
Better score is:	Higher			Lower			Higher			Higher			Lower			Lower		
Standardized to a mean of 50 and standard deviation of 10.																		

AIP 1 TP, so most would not need to move to assisted living or a nursing home unless they made that choice. We were optimistic that costs of care through the end of life would not exceed nursing home care, that in fact the costs might be less. We envisioned wrapping services around a person when they needed services, and removing them as health was restored. The cost analyses were carefully planned to tease apart those people independent in care needs from those who required services and are similar to people living in nursing homes or assisted living. In these analyses, the combined care and housing cost for any resident who was receiving additional care services beyond base services and qualified for nursing home care (n = 24) never approached or exceeded the cost of nursing home care at either location, AIP 1 TP or AIP 2 MW. These results are remarkable, especially for AIP 1 TP, which has higher than national average assisted living costs because of their large apartments and other amenities.

Residents who qualified for assisted living but lived at AIP 2 MW (n = 9) never approached the national average costs for assisted living when considering their combined housing and care costs. Those at AIP 1 TP (n = 37) had higher than national average costs for assisted living because of the higher housing costs, unrelated to care costs, that ranged from \$1656 to \$2591 per year, similar to AIP 2 MW.

Clinically relevant, the similar results from the MH analyses at both locations may be the result of living in independent senior housing with RN assessment and care coordination. Improvement in MH, as measured by SF-12 in the cross-sectional analysis for both locations and at AIP 1 TP in the longitudinal analysis, may be a result of increased socialization and activities that come from living in a senior housing complex or from social work interventions resulting from the RN assessment and subsequent recommendation for social work evaluation. These improvements may be

**Table 7 – Longitudinal Analysis of Continence Rates for Subjects Who Had at Least One Assessment Per Year**

	AIP 1 TP			AIP 2 MW		
	N	Continent	Incontinent	N	Continent	Incontinent
Bladder continence						
2005	15	87%	13%	11	91%	9%
2006	15	80%	20%	10	80%	20%
2007	15	53%	47%	10	60%	40%
2008	13	54%	46%	9	44%	56%
Bowel continence						
2005	15	100%	0%	11	100%	0%
2006	15	100%	0%	10	100%	0%
2007	15	100%	0%	10	100%	0%
2008	13	92%	8%	9	89%	11%
Bladder incontinence calculated from MDS item H1b (continent-0 or 1; incontinent-2, 3, or 4). Bowel incontinence calculated from MDS item H1a (continent-0; incontinent-1, 2, 3, or 4).						

a result of the AIP intervention. There are residents with dementia at both locations, which may account for the decline in cognitive abilities (MMSE) over time in both the cross-sectional and longitudinal analyses. It is also likely that selection bias affected the decline in MMSE scores, because the instrument was not used routinely but only when a cognitive change was noted by the care coordinator; so those with good cognitive function were not included in analyses after they were admitted to AIP.

Residents and family members have different expectations at AIP 1 TP and AIP 2 MW, which may account for some of the differences in PH analyses. The expectation at AIP 1 TP is clearly that everyone who moves there may stay as long as they wish; they may age in place, even through the end of life. At AIP 2 MW, this is not as clear. Given the availability of a variety of facilities on the AIP 2 MW campus (eg, assisted living, special dementia care, nursing home), there is a greater tendency to move to a higher level of care as needs increase. This could account for differences in the fall risk, SF-12 PH, and ADL results. At AIP 2 MW, these measures remained fairly constant (SF-12 PH) or declined then improved (eg, fall risk, ADLs) in the cross-sectional analysis. Because the tendency at AIP 2 MW is to move to a higher level of care, residents with greater needs may have moved to other settings on their campus and thus are not included in this analysis, resulting in detecting a fairly stable (SF-12 PH) or a deteriorating then healthier (fall risk, ADL) population.

This tendency is even more evident in the longitudinal analysis at AIP 2 MW. The ADLs and SF-12 PH remain constant. The one exception is fall risk, which declined during 2005 to 2007 and then improved. This may be a result of rehabilitation or intervention by the RN care coordinator or other care services.

In contrast to the tendency to move to a higher level of care, at AIP 1 TP, residents age in place and exhibit natural physical decline. This decline is especially obvious in the longitudinal analysis of PH, as measured by SF-12 PH.

The ADL and fall risk longitudinal results at AIP 1 TP deserve special attention. The ADL trend declined in 2005 and 2006, and then improved to zero (no deficits). The fall risk scores dropped from 2005 to 2007, and then stabilized. These changes (improvements or stabilizations) were likely the result of intensive care coordination and rehabilitation. As mentioned earlier, the goal is to restore residents to their best possible level of health to help them remain independent. This may be through care coordination, better medication management, or assistance with ADLs, which results in improved function. Sometimes, intensive rehabilitation is needed to restore a resident to optimal health. This is usually done either through a short stay at a rehabilitation hospital, skilled nursing home, or in

their apartment through private pay therapy services or home health care. This intense rehabilitation appears to be working, because, despite higher care costs at AIP 1 TP compared with AL, even costlier nursing home use and hospitalizations have been constrained.

The clinical and cost findings of the AIP evaluation for AIP 1 TP and AIP 2 MW are similar to the AIP community evaluation completed by Marek et al.<sup>15,17</sup> Clinical outcomes improved compared with nursing home and community cohorts; Medicare and Medicaid costs were lower, too.

The AIP model of care in the two settings—AIP 1 TP and AIP 2 MW—which combines home health services with RN care coordination, improved or stabilized clinical assessment measures, reduced nursing home use, and was cost effective. However, to make AIP possible around the country, long-term care regulations need to change to allow residents to remain in independent housing with services or assisted living facilities as their health deteriorates, without forced relocation. Residents need to know that they can stay as long as they wish and receive services as their health care needs increase, and regain independence and self-sufficiency as their health is restored and services are withdrawn. The AIP model could be a viable option for long-term care, while saving money and allowing older adults to remain in a private apartment or home, where they want to be.

It is the role of nursing leaders, researchers, and clinicians to develop solutions that address the needs of our nation's growing aging population. The AIP project at the University of Missouri is one such solution. It is a new approach to a persistent problem of long-term care for elders. Not only have the older adults who have experienced living at AIP 1 TP and AIP 2 MW had better clinical and cost outcomes, they have enjoyed AIP with independence.

From the perspective of the SSON, the AIP project has provided a cutting edge care delivery site for students to have clinical experiences with elders; many nursing students are hired to work as home health aides so they have experience working in nursing practice as their education progresses. The lead RN care coordinator is an alumnus of the SSON. In the past year, 183 nursing students had clinical experiences in the settings (3 RN to BSN, 30 graduate, 37 accelerated, and 113 traditional). In addition to many nursing students, this past year, more than 20 students, from computer and electrical engineering, social work, and health informatics, attended weekly research meetings at AIP 1 TP; many of them have Masters theses and doctoral dissertations focused on the research in progress at the site. Faculty from the SSON and Computer and Electrical Engineering have generated more than \$7.5 million in research grants for work at AIP 1 TP and have more grants pending. The business enterprise of Sinclair Home Care generates

some funds for faculty practice and student scholarships while covering costs of the business.

The results of the cost effectiveness and health restoration and independence effectiveness of the AIP model of care are shared with the hope to see this model of care disseminate across our country. The positive results for the SSON are also shared to encourage other schools of nursing to consider such endeavors. For more details and consultations assisting other schools of nursing, health care providers, or state agencies to pursue implementation of the AIP model of long-term care, please visit [www.agingmo.com](http://www.agingmo.com).

#### REFERENCES

1. Marek KD, Rantz MJ. Aging in place: a new model of long-term care. *Nurs Admin Q* 2000;24:1-11.
2. Rantz MJ, Marek KD, Zwiygart-Stauffacher M. The future of long-term care for the chronically ill. *Nurs Admin Q* 2000;25:51-8.
3. Rantz MJ, Marek KD, Aud MA, Johnson RA, Otto D, Porter R. TigerPlace: a new future of older adults. *J Nurs Care Qual* 2005;20:1-4.
4. Rantz MJ, Marek KD, Aud M, Tyrer HW, Skubic M, Demiris G, et al. A technology and nursing collaboration to help older adults age in place. *Nurs Outlook* 2005;53:40-5.
5. AARP. Fixing to stay: a national survey of housing and home modification issues. Washington, DC: AARP Independent Living Program. Available at: [http://assets.aarp.org/rgcenter/il/home\\_mod.pdf](http://assets.aarp.org/rgcenter/il/home_mod.pdf); 2000. Accessed October 8, 2009.
6. Rantz MJ, Porter R, Cheshier D, Otto D, Servey CH, Johnson RA, et al. TigerPlace, a state-academic-private project to revolutionize traditional long term care. *J Hous Elderly* 2008;22:66-85.
7. Chapin R, Dobbs-Kepper D. Aging in place in assisted living: philosophy versus policy. *Gerontologist* 2001; 41:43-50.
8. Kemper P. Case management agency systems of administering long-term care: evidence form the channeling demonstration. *Gerontologist* 1990;30:817-24.
9. Hughes SL. Apples and oranges? A review of evaluation of community-based long-term care. *Health Serv Res* 1985;20:461-88.
10. Abt Associates Inc. Evaluation of the Community Nursing Organization Demonstration Final Report. Cambridge, MA; 2000.
11. Collins C, Butler FR, Gueldner SH, Palmer MH. Models for Community-base long-term care for the elderly in a changing health system. *Nurs Outlook* 1997;45: 59-63.
12. Elkan R, Kendrick D, Dewey M, Hewitt M, Robinson J, Blair M, et al. Effectiveness of home based support for older people: systematic review and meta-analysis. *BMJ* 2001;323:1-9.
13. Naylor M, Brooten D, Campbell R, Jacobsen BS, Mezey M, Pauley MV, et al. Comprehensive discharge planning and home follow-up of hospitalized elders: a randomized controlled trial. *JAMA* 1999;281:613-20.
14. Marek KD, Rantz MJ, Porter RT. Senior care: making a difference in long-term care of older adults. *Nurs Educ* 2004;43:81-3.
15. Marek KD, Popejoy L, Petroski G, Mehr D, Rantz M, Lin W-C. Clinical outcomes of aging in place. *Nurs Res* 2005;54:202-11.
16. Marek KD, Popejoy L, Petroski G, Rantz M. Nurse care coordination in community-based long-term care. *J Nurs Sch* 2006;38:80-6.
17. Marek KD, Adams SJ, Stetzer F, Popejoy L, Petroski G, Rantz MJ. The influence of community-based nurse care coordination on costs to the Medicare and Medicaid programs. *Res Nurs Health* 2010;33:235-42.
18. Brink TL, Yesavage JA, Lum O, Heersema P, Adey MB, Rose TL. Screening tests for geriatric depression. *Clin Gerontol* 1982;1:37-44.
19. Sheikh JL, Yesavage JA. Geriatric depression scale (GDS): recent evidence and development of a shorter version. In: *Clinical gerontology: a guide to assessment and intervention*. New York: The Haworth Press; 1986.
20. Yesavage JA, Brink TL, Lum O, Huang V, Adey MB, et al. Development and validation of a geriatric depression screening scale: a preliminary report. *J Psychiatr Res* 1983;17:37-49.
21. Folstein MF, Folstein SE, McHugh PR. Mini-mental state: a practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res* 1975; 12:189-98.
22. Resnick B, Nahm ES. Reliability and validity testing of the revised 12-item short-form health survey in older adults. *J Nurs Meas* 2001;9:151-61.
23. CHRSA. Quality Indicators for MDS 2.0, Version 6.3, Optional RUGs III Quarterly; Center for Health System Research and Analysis. University of Wisconsin; 1997.
24. Morris JN, Fries BE, Morris SA. Scaling ADLs within the MDS. *J Gerontol Med Sci* 1999;54A:M546-53.
25. Ware JE. SF-12: how to score the SF-12 physical and mental health summary scales. Hanover, NH: Health Assessment Lab; 2002.
26. American Association of Homes and Services for the Aging (AAHSA). American Seniors Housing Association (ASHA), Assisted Living Foundation of America (ALFA), National Center for Assisted Living (NCAL), and National Investment Center for the Senior Housing & Care Industry (NIC). 2006 overview of assisted living. Washington, DC: AAHSA; 2006.