Available online at www.sciencedirect.com
ScienceDirect
Nurs Outlook 62 (2014) 237–246
Nursing Outlook
www.nursingoutlook.org

The continued success of registered nurse care coordination in a state evaluation of aging in place in senior housing

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ARTICLE INFO

Article history:
Received 4 November 2013
Revised 31 January 2014
Accepted 7 February 2014
Available online 22 February 2014

Keywords:
Aging in place
Nurse care coordination
Assisted living
Nursing home
Elderly

ABSTRACT

Older adults prefer to age in place, remaining in their home as their health care needs intensify. In a state evaluation of aging in place (AIP), the University of Missouri Sinclair School of Nursing and Americare System Inc, Sikeston, MO, developed an elder housing facility to be an ideal housing environment for older adults to test the AIP care delivery model. An evaluation of the first 4 years (2005–2008) of the AIP program at TigerPlace ($n = 66$) revealed that the program was effective in restoring health and maintaining independence while being cost-effective. Similar results evaluating the subsequent 4 years (2009–2012) of the program ($N = 128$) revealed positive health outcomes (fall risk, gait velocity, Functional Ambulation Profile, handgrips, Short-Form 12 Physical Health, Short-Form 12 Mental Health, and Geriatric Depression Scale); slightly negative activities of daily living, independent activities of daily living, and Mini-Mental State Examination; and positive cost-effectiveness results. Combined care and housing costs for any resident who was receiving additional care services and qualified for nursing home care ($n = 44$) was about $20,000 less per year per person than nursing home care. Importantly, residents continued to live in private apartments and were encouraged to be as independent as possible through the end of life.

Supported in part by a grant from the Centers for Medicare and Medicaid Services: Aging in Place: A New Model for Long-term Care, Grant #18-C-91036.
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http://dx.doi.org/10.1016/j.outlook.2014.02.005

Cite this article: Rantz, M., Popejoy, L. L., Galambos, C., Phillips, L. J., Lane, K. R., Marek, K. D., Hicks, L., Musterman, K., Back, J., Miller, S. J., & Ge, B. (2014, AUGUST). The continued success of registered nurse care coordination in a state evaluation of aging in place in senior housing. Nursing Outlook, 62(4), 237-246. http://dx.doi.org/10.1016/j.outlook.2014.02.005.

Introduction

Older adults want to age in place. According to a 2010 American Association of Retired Persons survey, 88% of people age 65 years and over want to stay at home as long as possible (AARP, 2010), retaining as much independence and health as possible (Marek and Rantz, 2000; Rantz, Marek, & Zwygart-Stauffacher, 2000; Rantz et al., 2005a). The aim of aging in place (AIP) is to help people remain in their home as their health care needs intensify (Marek & Rantz, 2000). Legislation was passed in Missouri in 1999 and 2001 to test an AIP model. In response, the University of Missouri (MU) Sinclair School of Nursing (SSON) partnered with Americare Systems, Inc, Sikeston, MO, to build TigerPlace, a senior housing facility. An evaluation of the first 4 years (2005–2008) of the AIP program at TigerPlace revealed that the program was effective in restoring health and maintaining independence while being cost-effective (Rantz et al., 2011). The purpose of this study was to evaluate the second 4 years of the AIP model. Ongoing evaluation of the AIP program is important to ensure it remains an effective alternative to nursing home and other long-term care options.

Background

MU SSON faculty envisioned an AIP model of care delivery that incorporated ongoing registered nurse (RN) care coordination with home health services. The model was envisioned to provide the right care services at the right time to enable maximum restoration of function and independence so people can live in the environment of their choice. The MU SSON received a $2 million grant from the Centers for Medicare and Medicaid (CMS) services to begin a home health agency and evaluate the AIP. In 1999, Sinclair Home Care, a Medicare- and Medicaid-certified home health agency, was established (Marek & Rantz, 2000; Marek, Rantz, & Porter, 2004) and operated by a department within the MU SSON. Sinclair Home Care provided home care services to six counties in the mid-Missouri region. The AIP model was tested in the Missouri Care Options (MCO) program, which offers home and community long-term care services to adults who are Medicaid eligible and in need of assistance. Sinclair Home Care sold the Medicare and Medicaid lines of business in 2009 but retained the private pay business so care services could continue at TigerPlace.

The results of an evaluation of AIP in the community indicated that RN care coordination improved outcomes for older people in the MCO program when compared with those in the MCO program without RN care coordination (Marek, Popejoy, Petroski, & Rantz, 2006) and individuals of a similar case mix in nursing homes (Marek et al., 2005). The total Medicare and Medicaid costs were significantly lower ($1,591.61 per month) in the AIP group compared with nursing home care (Marek, Stetzer, Adams, Popejoy, & Rantz, 2012). Also, the cost to Medicare was lower ($686 per month) in the group with RN care coordination compared with those without RN care coordination (Marek, Adams, Stetzer, Popejoy, & Rantz, 2010). Based on positive results of the CMS evaluation, MU SSON faculty began working with Americare Systems to build TigerPlace, which was designed as an ideal senior housing environment for older adults to age in place and in which the AIP model could be further refined and tested.

TigerPlace

TigerPlace is built to nursing home standards, licensed as an intermediate care facility (ICF) with some regulatory exceptions, and operates as independent housing with services available, allowing people to maximize independence and live in their apartments through the end of life (Rantz et al., 2005a). TigerPlace consists of 54 independent apartments and common areas, including two dining rooms, two sports bars, a gym with exercise equipment, an exercise room, a beauty shop, a classroom, a common living room area, a library, a theater, and a veterinary clinic. Residents are encouraged to have pets for companionship (Johnson, Rantz, McKenney, & Cline, 2008), and on-site pet care and support is provided by the MU Research Center for Human-Animal Interaction. Residents furnish their own apartment and are able to make environmental changes to best suit their individual needs. Two meals per day, housekeeping, and transportation services are included in the rent. Americare manages the housing component, and Sinclair Home Care provides the health care services.

Since opening in 2004, TigerPlace has been very successful as a student educational and research site for many of the schools and colleges at MU. All nursing students have clinical experiences in the facility. Social work students complete semester-long field internship experiences. Physical therapy students work with residents routinely along with students from medicine and health management. Engineering students assist with technology research underway in the facility. Researchers from many schools and colleges participate in interdisciplinary research teams focused on developing new technologies and other ways to help older adults age in place. Faculty members from the School of Nursing and College of Engineering have generated nearly $11 million in grant-funded research.

This success has helped promote interdisciplinary research and education at MU as well as faculty recruitment.

Sinclair Home Care AIP

The care model at TigerPlace includes ongoing RN care coordination and routine health assessment. The base health service package is included in the rent and includes comprehensive health assessment, care coordination services by an RN and a licensed social worker (MSW), access to a wellness center, exercise and strength training classes, and health promotion activities to encourage a healthy lifestyle. All residents are routinely assessed every 6 months, every 3 months if they qualify for intermediate (ICF) level of care, and when there is any significant change in condition. Sinclair Home Care operates a wellness center 5 days per week, which is also included in the base care package. At the wellness center, residents may have their vital signs checked, discuss health problems with an RN, or schedule home health aide or skilled nursing services (Rantz et al., 2011). Residents pay privately for home care services such as medication management, wound care, and such personal care services as dressing and bathing. In the AIP model, the residents do not need to move to get the care they need. Services are brought to the residents, allowing them to age in place. The nurse care coordinator manages the residents' health care across disciplines arranging physician visits and rehabilitation services, such as physical and occupational therapy. A social worker, working with the nurse care coordinator, provides counseling, family support, and arranges community psychosocial services as needed.

The routine health assessment for TigerPlace residents consists of a series of standard assessment $132#instruments including the Mini-Mental State Examination (MMSE) (Folstein, Flostein, & McHugh, 1975), Geriatric Depression Scale (GDS) (Brink et al., 1982; Sheikh & Yesavage, 1986; Yesavage et al., 1983), Short-Form 12 (SF-12) Health Survey (Resnick & Nahm, 2001), minimum data set (MDS) (CMS, 2013a), fall risk assessment (Farmer, 2000), activities of daily living (ADLs), and independent activities of daily living (IADLs) from the CMS Outcomes and Assessment Information Set (OASIS) (CMS, 2013b), handgrip strengths using a dynamometer, and the GAITRite (CIR Systems Inc./GAITRite, Sparta, NJ) analysis mat (www.gaitrite.com). The MDS was chosen to enable comparisons of outcomes with similar nursing home residents. The handgrip strengths have been linked to frailty, disability, and mortality (Ali et al., 2008; Ling et al., 2010). The GAITRite mat measures a variety of temporal and spatial gait parameters as the participant walks across it. The Functional Ambulation Profile (FAP) (Nelson, 1974), a summary score of the overall gait, and gait velocity from the GAITRite analysis mat are used as measures of health status and fall risk (Nelson et al., 1999). Gait velocity has been linked to survival rates (Studenski et al., 2011), functional ability, and balance confidence (Fritz & Lusardi, 2009). The other instruments were chosen because they are established research instruments with good validity and reliability.

The routine health assessments are completed by the RN and MSW care coordinators and recorded in an electronic health record that has been a key part of the Sinclair Home Care infrastructure and has also supported the evaluation of AIP from its beginning. These health assessments are used clinically to guide decision making for interventions that will promote independence and health of the participants. However, their established use as research instruments enables their use in longitudinal evaluation of the care model. Routine audits of the data facilitate data fidelity. Building clinical use of the information from the instruments into routine work and decision making of the clinical staff facilitates its usefulness and accuracy as well and reduces the burden of data collection useful only for evaluation purposes.

Operationalization of AIP

TigerPlace is built to nursing home standards, licensed as an ICF with regulatory exceptions, and operates as independent housing with direct care services available (Rantz et al., 2005a). Therefore, residents are not forced to move to a higher level of care as their care needs increase. Instead, residents' health is managed at TigerPlace, and services are brought to the resident as needed.

Unlike traditional home health services, Sinclair Home Care provides continuous care management. This is done through routine assessment and regular contact with the residents. Special attention is paid when the resident is ill or suffering from an exacerbation of a chronic condition. Those who do not use the wellness center are carefully monitored. This ongoing assessment facilitates early detection of problems, which enables early intervention when treatment is most effective (Ridley, 2005; Rantz et al., 2013a). When problems are identified, the RN care coordinator arranges for the appropriate treatment. The goal is to restore the resident to optimum health and independence. When rehabilitation services are required, they may be provided in the resident's apartment through Medicare home health, a rehabilitation facility, or a short stay in a skilled nursing home. Residents may also receive services from family members, friends, community agencies, or other home health agencies. Nursing and aide services, such as medication management or personal care, are offered through Sinclair Home Care. If an assistive device will allow the resident to remain independent, the RN care coordination arranges for the client to obtain the device and receive any necessary training. When the client is again able to function independently, the services are removed, saving the resident additional care costs. Thus, most direct care services are time limited (Rantz et al., 2011).

Sample

Since the opening of TigerPlace in June 2004 through December 2012, all residents ($N = 162$) of TigerPlace participated in the AIP program. The median age at admission was 84 ± 6.40 years. There were 108 women (66.67%) and 54 men (33.33%); 98 people have been discharged.

The analyses presented in this article are from January 2009 through December 2012, the second 4-year evaluation of the program. All residents ($N = 128$) living at TigerPlace at some time during this 4-year period are included in the analyses. The median age at admission was 84 ± 6.27 years. The sex breakdown was 84 (65.6%) women and 44 (34.4%) men. During the 4 years, half of the people (64/128) were discharged; 25 (20%) moved to a nursing home, 24 (19%) died, 7 (5%) went home or to live with another family member, and 8 (6%) went to an assisted living or residential care facility. One participant was Asian, and another was Hispanic; the remaining participants were white. About 30% of all TigerPlace residents used private insurances to pay for care and/or housing costs; the balance payed privately.

Participation in the aging in place program is voluntary; all residents are informed of the ongoing state evaluation of the AIP program upon admission. Residents agree to participate as stipulated in the admission agreement. All participants complete informed consent approved by the university institutional review board for the use of their health records for this evaluation.

Methods

Descriptive statistics were used to analyze the data from the residents at TigerPlace as a complete population; therefore, inferential statistics were not used. Data from the complete years of 2009 through 2012 were used for analysis. Data were from the routine health assessments of TigerPlace residents that consist of a series of standard assessment instruments, which were explained in Sinclair Home Care AIP services previously. Summary scores of the standardized instruments were used to monitor for changes or trends in the function of the residents over time to interpret the effectiveness of the services to help residents maintain health and function through the end of life. An ADL scale and continence rates were computed from the MDS data. The ADL scale is a summary score of seven MDS items (bed mobility, transfer, locomotion off unit, dressing, eating, toilet use, and personal hygiene) that are scored 0 to 4, resulting in a score range from 0 to 28; this summary score has a long history of use in MDS analyses (Morris & Morris, 1997). Incontinence rates were calculated from two MDS items (i.e., bowel and bladder continence) that were scored from 0 to 3 with higher scores being incontinent. Physical health (PH) and mental health (MH) subscales were calculated from SF-12 Health Survey data.

To evaluate the cost-effectiveness of AIP, costs of services from TigerPlace beyond the base AIP services that are included in the monthly rent were continuously tracked and tabulated for the cost analysis. We recognize there are costs related to adverse events, including emergency department visits, hospitalizations, and falls, and these are not included in the costs of services in this analysis. People who are independent and do not receive services were excluded so that the results would not be skewed toward AIP. A State of Missouri nursing home eligibility evaluation instrument was used to classify the AIP participants using additional care services beyond the base package into two groups: qualified for nursing home placement (score of 21 more) and not qualified for placement (score less than 21). Comparisons of the groups were with the traditional settings for each—nursing homes for those qualified for nursing home and assisted living for those receiving additional care services but not qualified for nursing home. Annually, MDS data for each participant were used as a proxy to score the state nursing home eligibility instrument. The MDS was chosen because it covers the nine areas assessed on the eligibility instrument (mobility, dietary, restorative services, monitoring, medication, behavior/mental condition, treatments, personal care, and rehabilitation services). The MDS provided an objective way to proxy the state assessment instrument. Actual costs for health care service provided on-site at TigerPlace were averaged for residents who were nursing home eligible and those who were not. This provided a robust comparison of national costs of care in nursing homes and assisted living.

Both cross-sectional and longitudinal analyses were performed on the data. The longitudinal analysis was completed using all subjects who, minimally, had lived in TigerPlace from 2009 to 2012. Therefore, subjects were included only once in the longitudinal analysis; the same subjects were included in the cross-sectional analysis for each of the years they lived at TigerPlace. Because most subjects had more than one assessment of any type (i.e., fall risk, MMSE, GDS, SF-12, MDS, OASIS, handgrip, or GaitRite) in a year, only the data from the first assessment in that year were used in the analyses. In a few cases, subjects had a missing assessment for one particular instrument, so they were included in analyses for those instruments completed rather than excluded from the analysis. This approach duplicates the approach used in the first 4-year analysis (Rantz et al., 2011), so the data are comparable.

Residents of TigerPlace complete a yearly anonymized consumer satisfaction survey conducted by an independent consulting service that includes questions about the housing and care components. Consumer satisfaction is an important part of the AIP program, so we can adjust services to better meet needs and desires.

Results

Cost

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 = 6–20 per year) did not approach or exceed the cost of nursing home care (Table 1). The costs for people who used services beyond the base package but were not qualified for nursing home (n = 17–38 per year) were higher than the national average for assisted living (Table 2).

Length of Stay

From the opening of the building in 2004 through the end of 2012, the average length of stay (LOS) for all of the residents (N = 162) was 28.3 months. Since 2009 (N = 128), the average LOS has increased to 31.2 months. Several of the original residents who moved into the facility in 2004 remain, with the maximum LOS slightly over 8.25 years. Intermittent time away from one's apartment and return (without actually "moving" out of the apartment) is not interpreted as beginning a new episode for LOS calculation purposes.

Another perspective on LOS is that of the 128 residents who lived there from 2009 to 2012, 50% continue to live there. Of those who were discharged (n = 64), about 40% died while living at TigerPlace; 40% decided to move to a nursing home; and the remainder (20%) went home or to live with another family member, an assisted living facility, or a residential care facility.

Cognitive and MH

The cognitive and MH results are mixed in both the cross-sectional (Table 3) and longitudinal (Table 4) analyses. The MMSEs fluctuated slightly over time; however, they did trend a small amount lower, indicating a slight decline in the cognitive abilities of the residents. The SF-12 MH declined in 2010 and then improved above baseline. The GDS depression score peaked in 2010 and then declined (improved) for the next 2 years in the cross-sectional analysis. The longitudinal analysis followed the same pattern; it declined slightly in 2012 but still remained well under the 2009 level.

PH

Cross-sectional Analyses

The SF-12 PH cross-sectional analysis revealed improvements in 2010 and 2011 and then a slight decline in 2012 but remained above baseline levels for all residents living at TigerPlace from 2009 to 2012 (Table 3). The left and right handgrip strengths declined a little in 2011 and then improved considerably in 2012. The fall risk scores consistently improved. Gait velocity as measured by the GAITRite improved from 2010 to 2012; however, the FAP improved and then returned to baseline. OASIS ADL scores improved in 2010 and then declined back to baseline. OASIS IADL scores trended worse in 2010 and then returned to slightly below baseline in 2012. In summary, eight of the nine PH measures in the cross-sectional analysis improved (fall risk scores, left and right handgrip, gait velocity, SF-12 PH) or remained fairly constant (OASIS ADLs, OASIS IADLs, and GAITRite FAP) from 2009 to 2012. Only the MDS ADLs consistently declined.

Table 1 – Yearly Combined Housing and Care Costs for Residents Who Were Nursing Home Eligible

	n	Average Care Cost	Average Housing Cost	Care Cost + Housing Cost	Average Nursing Home Cost: Semiprivate Room
2009					
Monthly	8	392	3,894	4,286	
Annualized		4,704	46,725	51,429	72,270*
2010					
Monthly	10	505	4,050	4,554	
Annualized		6,060	48,594	54,654	74,825†
2011					
Monthly	6	691	4,197	4,888	
Annualized		8,292	50,368	58,660	78,110‡
2012					
Monthly	20	758	4,408	5,166	
Annualized		9,096	52,892	61,988	81,030§

* MetLife Mature Market Institute. (2009) Market Survey of Long–Term Care Costs: The 2009 MetLife Market Survey of Nursing Home, Assisted Living, Adult Day Services, and Home Care Costs. Waltham, MA: LifePlans, Inc.
† MetLife Mature Market Institute. (2010) Market Survey of Long–Term Care Costs: The 2010 MetLife Market Survey of Nursing Home, Assisted Living, Adult Day Services, and Home Care Costs. Waltham, MA: LifePlans, Inc.
‡ MetLife Mature Market Institute. (2011) Market Survey of Long–Term Care Costs: The 2011 MetLife Market Survey of Nursing Home, Assisted Living, Adult Day Services, and Home Care Costs. Waltham, MA: LifePlans, Inc.
§ MetLife Mature Market Institute. (2012) Market Survey of Long–Term Care Costs: The 2012 MetLife Market Survey of Nursing Home, Assisted Living, Adult Day Services, and Home Care Costs. Waltham, MA: LifePlans, Inc.

Table 2 – Yearly Combined Housing and Care Costs for Residents Who Were Not Nursing Home Eligible

	n	Average Care Cost	Average Housing Cost	Care Cost + Housing Cost	Average Assisted Living Costs
2009					
Monthly	17	206	3,894	4,100	
Annualized		2,472	46,725	49,197	37,572*
2010					
Monthly	27	300	4,049	4,349	
Annualized		3,600	48.594	52,194	39,516†
2011					
Monthly	38	334	4,197	4,531	
Annualized		4,008	50,368	54,376	41,724‡
2012					
Monthly	17	330	4,408	4,738	
Annualized		3,960	52,892	56,852	42,600§

* MetLife Mature Market Institute. (2009) Market Survey of Long–Term Care Costs: The 2009 MetLife Market Survey of Nursing Home, Assisted Living, Adult Day Services, and Home Care Costs. Waltham, MA: LifePlans, Inc.
† MetLife Mature Market Institute. (2010) Market Survey of Long–Term Care Costs: The 2010 MetLife Market Survey of Nursing Home, Assisted Living, Adult Day Services, and Home Care Costs. Waltham, MA: LifePlans, Inc.
‡ MetLife Mature Market Institute. (2011) Market Survey of Long–Term Care Costs: The 2011 MetLife Market Survey of Nursing Home, Assisted Living, Adult Day Services, and Home Care Costs. Waltham, MA: LifePlans, Inc.
§ MetLife Mature Market Institute. (2012) Market Survey of Long–Term Care Costs: The 2012 MetLife Market Survey of Nursing Home, Assisted Living, Adult Day Services, and Home Care Costs. Waltham, MA: LifePlans, Inc.

Longitudinal Analysis

Longitudinally, the scores for the majority of the measures improved or remained constant (Table 4). The SF-12 PH score trended better in 2010 and 2011 and dipped slightly in 2012 but remained slightly above the 2009 level. The fall risk scores steadily improved. The FAP improved overall. The GAITRite velocity and handgrip strengths worsened a little in 2011 and then dramatically improved in 2012. The OASIS ADL score improved from 2009 to 2010 and then deteriorated in 2011 and 2012, whereas the MDS ADL score steadily declined. The OASIS IADL scores improved in 2010 and 2011 and then were worse than baseline in 2012. In summary, for the longitudinal analysis, scores on six of the nine PH measures (SF-12 PH, fall risk, left and right handgrip strengths, GAITRite FAP, and velocity) were better in 2012 than in 2009. Three measures had poorer scores: MDS ADL, OASIS ADL, and OASIS IADL.

Continence Analysis

Continence rates were calculated from the MDS data. Bowel continence decreased slightly in cross-sectional

Table 3 – Cross-sectional Analysis of Subjects Who Had at Least One Assessment per Year

	MMSE			GDS			SF-12 MH			SF-12 PH			MDS ADL			Fall Risk		
	n	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
2009	84	26.2	4.7	51	4.2	3.4	46	52.7	11.7	46	38.8	10.5	53	0.4	1.0	23	28.9	13.6
2010	71	24.1	6.1	70	6.8	3.5	68	47.0	13.3	68	39.0	8.8	65	1.2	3.9	71	26.3	13.5
2011	81	25.3	5.5	81	2.9	2.8	77	54.2	8.0	77	40.1	10.5	72	1.8	4.3	70	24.6	13.4
2012	74	25.2	5.9	74	2.6	2.2	72	55.1	8.6	72	39.8	11.7	66	2.6	4.7	57	21.5	13.2
Range	0–30				0–15			0–100			0–100			0–28			0–80	
Better score is:	Higher				Lower			Higher			Higher			Lower			Lower	

Standardized to a mean of 50 and a standard deviation of 10

	OASIS ADL			OASIS IADL			Lt Hand Grip			Rt Hand Grip			GAITRite FAP			GAITRite Velocity		
	n	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
2009	21	5.6	6.5	17	8.6	5.0	–	–	–	–	–	–	–	–	–	–	–	–
2010	68	4.4	5.8	63	9.4	6.2	42	18.3	8.1	42	19.7	9.1	46	68.8	15.9	46	62.5	23.9
2011	80	4.7	6.7	79	7.8	6.1	39	15.9	8.1	39	17.1	8.4	50	72.1	16.2	50	61.7	28.2
2012	74	5.7	6.9	74	8.1	6.1	53	22.9	16.0	53	27.2	15.3	52	69.0	25.7	52	66.8	31.6
Range	0–36				0–32									0–100				
Better score is:	Lower				Lower			Higher			Higher			Higher			Higher	

ADL, activities of daily living; GDS, Geriatric Depression Scale; IADLs, independent activities of daily living; Lt, left; MDS, minimum data set; MMSE, Mini-Mental State Examination; OASIS, Outcomes and Assessment Information Set; Rt, right; SD, standard deviation; SF-12 MH, Short-Form 12 Mental Health Subscale; SF-12 PH, Short-Form 12 Physical Health Subscale.

Table 4 – Longitudinal Analysis of Subjects Who Had at Least One Assessment per Year

	MMSE			GDS			SF-12 MH			SF-12 PH			MDS ADLs			Fall Risk		
	n	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
2009	24	26.4	3.9	23	4.1	3.4	21	54.7	11.1	21	38.7	10.4	25	0.2	0.7	10	27.0	11.6
2010	28	25.4	4.5	28	7.8	2.9	28	46.0	14.2	28	39.0	9.1	27	0.7	2.8	28	23.9	13.6
2011	28	26.1	4.9	28	2.5	2.0	27	55.1	8.2	27	42.1	9.9	27	0.9	2.6	26	22.1	11.6
2012	28	25.0	5.9	28	2.7	1.9	28	56.4	6.4	28	39.0	10.9	27	3.1	5.3	22	20.9	14.8
Range 0–30					0–15			0–100			0–100			0–28			0–80	
Better score is: Higher				Lower				Higher			Higher			Lower			Lower	
								Standardized to a mean of 50 and a standard deviation of 10										

	OASIS ADL			OASIS IADLs			Lt Hand Grip			Rt Hand Grip			GAITRite FAP			GAITRite Velocity		
	n	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
2009	10	4.6	7.7	8	8.0	6.7	–	–	–	–	–	–	–	–	–	–	–	–
2010	27	2.6	4.2	25	6.9	5.6	22	17.4	6.8	22	19.3	7.2	23	72.9	15.7	23	66.5	24.6
2011	27	4.4	5.9	28	6.8	5.8	22	16.8	6.3	22	18.5	6.8	28	74.5	16.8	28	65.9	29.2
2012	28	6.7	7.6	28	8.7	6.5	25	19.9	14.4	25	24.0	11.9	22	74.4	23.8	22	74.5	33.6
Range 0–36					0-32									0–100				
Better score is: Lower					Lower			Higher			Higher			Higher			Higher	

ADL, activities of daily living; GDS, Geriatric Depression Scale; IADLs, independent activities of daily living; Lt, left; MDS, minimum data set; MMSE, Mini-Mental State Examination; OASIS, Outcomes and Assessment Information Set; Rt, right; SD, standard deviation; SF-12 MH, Short-Form 12 Mental Health Subscale; SF-12 PH, Short-Form 12 Physical Health Subscale.

analysis (98.1% to 95.5%) and more in the longitudinal analysis (100% to 92.9%). The percent of bladder continent people in 2009 was 84.9% in the cross-sectional (Table 5) and 88.0% in the longitudinal analyses (Table 6). The rates dipped in 2010 and 2011 and then returned to an improvement over baseline in cross-sectional analyses (87.7%) and worse than baseline in the longitudinal analyses (85.2%). Overall, both bladder and bowel incontinence has slightly increased in the longitudinal analysis.

Consumer Satisfaction

Resident participants of the AIP program consistently gave the program and facilities high marks. Overall satisfaction ranged from 98% excellent/good in 2012 to 93% in 2010 and 86% in 2009. Recommendation to others has also been consistently high (i.e., 97% in 2012 and 98% in 2010 and in 2009 with ratings of excellent/good). The provision of health care services (provided by Sinclair Home Care) were rated high (i.e., 98% in 2012, 97% in 2010, and 91% in 2009 with ratings of excellent/good).

Because TigerPlace is licensed as intermediate care with exceptions (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.

Discussion

The primary goal of AIP is to help older adults to live in the environment of their choice for as long as possible, retaining as much MH and PH as possible through the end of life. That goal is operationalized by helping residents avoid moving to a higher-level long-term care setting unless it is their choice. This is accomplished through on-going assessment of function, early interventions, and supportive direct care services and staff who encourage maximum restoration of function and independence so people can age in place and not be forced to move from setting to setting as care needs increase (Rantz et al., 2005a). This goal has been achieved for the vast majority of residents who continue to live at TigerPlace. Additionally, 40% of those discharged during this 4-year evaluation died while living in their apartment—the ultimate goal of AIP.

It is important to note that since the opening of AIP at TigerPlace, LOS has been increasing, supporting the idea that residents are aging in place. The first 4-year evaluation (2004–2008) revealed an average LOS of 26.3 months for all of the residents who had lived there ($n = 66$) (Rantz et al., 2011). Since 2009 ($N = 128$), the average LOS at TigerPlace has increased to 31.2 months. These results are greater than the national average of 28.3 months in assisted living (NCAL, 2013) as well as the national average of 27.5 months in nursing homes (CDC, 2013). Although other factors could account for the longer LOS TigerPlace residents enjoy, through regular assessments, prompt intervention, and long-term support, our AIP care model promotes health and functioning.

Table 5 – Cross-sectional Analysis of Continence Rates for Subjects Who Had at Least One Assessment per Year

	n	Continent (%)	Incontinent (%)
Bowel continence			
2009	53	98	2
2010	65	99	1
2011	72	94	6
2012	66	95	5
Bladder continence			
2009	53	85	15
2010	65	77	23
2011	72	72	28
2012	65	88	12

Table 6 – Longitudinal Sectional Analysis of Subjects Who Had at Least One Assessment per Year

	n	Continent (%)	Incontinent (%)
Bowel continence			
2009	25	100	0
2010	27	100	0
2011	27	93	7
2012	28	93	7
Bladder continence			
2009	25	88	12
2010	27	85	15
2011	27	74	26
2012	27	85	15

Although clinical MH and PH outcome measures fluctuated over time, most of the cross-sectional and longitudinal measures actually remained stable or improved. The GDS (depression) and SF-12 MH trended better in both analyses. Eight of the nine cross-sectional PH measures improved (fall risk scores, left and right hand grip, velocity, and SF-12 PH) or remained fairly constant (OASIS ADLs, OASIS IADLs, and GAITRite FAP) from 2009 to 2012. Six of nine longitudinal PH measures were better in 2012 than in 2009 including SF-12 PH, fall risk, left and right handgrip strengths, GAITRite velocity, and FAP. These trends in clinical health outcomes validate the effectiveness of the AIP care delivery model. Key improvements in depression and MH as well as fall risk, gait velocity, and handgrips all point to the model effectively reducing overall frailty as people age in place (Ali et al., 2008; Fritz & Lusardi, 2009; Ling et al., 2010; Studenski et al., 2011; Syddall, Cooper, Martin, Briggs, & Sayer, 2003). Gait velocity and the FAP are both associated with fall risk (Nelson et al., 1999; Fritz & Lusardi, 2009), and the trends of velocity improvement and FAP stability support this finding. It is important to point out that the health promotion activities and exercise classes are highly encouraged by staff and well attended by residents. The social worker routinely intervenes with guidance and counseling to help residents with life transitions, mental health concerns, and locating resources in the community. The effects of these social work interventions may be seen in the improvement in the MH measures. These fundamental interventions are key aspects of the AIP model of care, as is care coordination and early illness detection to stabilize health problems in an early stage when interventions can be most effective (Rantz et al., 2013a; Rantz et al., 2013b).

The MDS ADLs, OASIS ADLs, and IADLs trended worse in the longitudinal analyses. The MDS ADLs steadily decline in the cross-sectional analysis. There was also a slight decline in cognitive function as measured by the MMSE cross-sectional (score 26.2 in 2009 and 25.0 in 2012) and longitudinal (score 26.4 in 2009 and 24.8 in 2013) analyses. There may be some instrument insensitivity with these measures or perhaps these are trends that could potentially be improved by adding other interventions to the AIP model. There is always the possibility that there may be unavoidable changes caused in part by aging. The average age on admission is 84 years. The AIP model was designed to improve the typical trajectory of functional decline (Rantz et al., 2005b); however, it cannot prevent all declines in function and cognition indefinitely.

From a consumer and public policy perspective, one of the key findings in these analyses is the cost of the AIP care delivery model. As in the analysis of the first 4 years (2004–2008) (Rantz et al., 2011), the subsequent 4 years (2009–2012) had the same 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 ($n = 6–20$ per year) never approached or exceeded the cost of nursing home care (MetLife, 2009, 2010, 2011, 2012). Each year of the analysis, the annual cost of the AIP model was about $20,000 less per person than nursing home care. Importantly, each resident continued to live in his or her private apartment and was encouraged to be as independent as possible through the end of life.

However, the cost comparison of TigerPlace residents who were similar to those in other assisted living facilities (people who used services beyond the base package but were not qualified for nursing home [$n = 17–38$]) were higher than the national averages each year (2009–2012) for assisted living (MetLife Mature Market Institute, 2009, 2010, 2011, 2012). Although the average annual care costs were less than $5,000 per year, the care plus housing annual costs were about $12,000 to $15,000 more per person. These higher costs are related to the large apartments and common spaces that were designed to appeal to residents with long-term care insurance and private pay and not the care costs.

The AIP project at MU was undertaken to develop and test the AIP model of care delivery in community settings (Marek et al., 2005, 2006, 2010, 2012) including private homes, public housing, and private congregate housing and the ideal housing setting of TigerPlace (Rantz et al., 2005a, 2011). The evaluations have revealed the clinical and cost-effectiveness of the model across all these settings. It was envisioned that results would be shared to encourage providers of

long-term care services to adopt a model of care that consumers would embrace. There has been much interest from various providers across the country, and Americare is considering adding other aging in place facilities in the Midwest.

The best success of all has been expressed by the residents who live at TigerPlace. They can articulate the support of the AIP model of care delivery. In one resident's words explaining to news reporters why he likes living at TigerPlace, "You just never know when you will need help from the nurse care coordinator or other care staff. I like to be independent, but it really helps to know they are there to help when I need it, and they will help me get strong again and take care of myself. The staff is great, especially when you need them. But, I like having my own apartment to come and go as I please and be as independent as I can be."

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