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Polypharmacy in Assisted Living and Impact on Clinical Outcomes

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Abstract

Objective: The purpose of this study was to describe medication use and polypharmacy in assisted living settings. We hypothesized that: (1) age, gender, race, setting, multimorbidity and cognitive status would influence polypharmacy; and (2) polypharmacy would be associated with falls, emergency room visits and hospitalizations.

Design: This was a descriptive study using data from a larger study testing the Dissemination and Implementation of Function Focused Care for Assisted Living (FFC-AL-EIT).

Setting: Participants were recruited from 26 assisted living settings.

Participants: A total of 242 individuals for cohort one consented and completed baseline data collection.

Interventions: Data were obtained from participant medical records, observations and input from staff.

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Main Outcome Measure(s): Age, gender, race, ethnicity, comorbidities, cognitive status, medications, falls, emergency room visits, hospitalizations, function based on the Barthel Index and physical activity using the Motionwatch 8.

Results: Participants had a mean age of 86.86 (SD=7.0), the majority were women 179 (74%) and white (N=232, 96%) with 5 (SD=2) diagnoses. The mean number of drugs was 7 (SD=3.56) and 51% were exposed to polypharmacy. The mean Barthel Index score was 63.06 (SD=20.20) and they engaged in 111,353 (SD=87262) counts of activity daily. Fifty-eight residents fell at least once (24%), 22 were sent to the hospital (9%) and 32 (13%) to the emergency room. Neither hypothesis was supported.

Conclusion: Continued research is needed to explore the factors that influence polypharmacy. Identification of these factors will help guide deprescribing so that medication management does not harm older adults physically or cause unnecessary financial burden.

Introduction

There continues to be an increase in the number of medications prescribed for older adults and polypharmacy has been described as America's second drug problem[1]. There are many definitions for polypharmacy used within clinical practice and research. These vary from the definition being based on the number of medications the older adult is taking[2] to a more qualitative evaluation of the appropriateness of medication based on the benefit of the drug for a specific clinical problem or preventive intervention[3]. Others have used a more general description of polypharmacy as 'taking more drugs than is clinically indicated'. For clinical practice the Department of Health in the United Kingdom has defined polypharmacy as taking four or more medications[4]. For research purposes the definition is more commonly conceptualized as being equivalent to taking five or more medicines [5,6].

With increased age there is an increase in the number of chronic illnesses experienced by older adults. There are also an increasing number of medications available to prevent and treat these diseases such as anticoagulants and medications for bone health and cardiovascular health. Consequently, the high rate of polypharmacy among older adults is not surprising.

Although findings have not been consistent there is some evidence that older age, less education, being female and having a recent hospitalization are associated with polypharmacy[7–9]. Conversely, in a comprehensive systematic review of polypharmacy in long-term care facilities it was noted that older age, activities of daily living disability, cognitive impairment and longer length of stay were inversely associated with polypharmacy[10]. Provider factors likewise influence polypharmacy such as inappropriate use of guidelines (i.e., use of guidelines not developed for older adults, particularly those older than 90 years of age), starting drugs to treat adverse effects from another medication, and fear of stopping a medication despite lack of strong clinical indications to continue the treatment.

The implications of polypharmacy have been considered with regard to patient outcomes as well as cost of care. From the patient perspective, polypharmacy has been associated with

increased risk of falls, drug interactions and adverse side effects, a decrease in adherence, increased risk of hospitalization, functional impairment and cognitive decline[11–15]. The costs associated with polypharmacy account for over 177 billion dollars annually and are due to excessive number of visits to health care providers, the emergency room or required hospitalizations[16].

In the United States, based on National Health and Nutrition Examination Survey (NHANES) data, approximately 40% of older adults in the United States report polypharmacy, using the polypharmacy definition of taking five or more medications daily[17,18]. These findings, however, are based on community dwelling older adults. It is anticipated that the rates are even higher among those in long-term care settings such as assisted living and nursing homes[10,19,20]. Limited research has focused on polypharmacy in assisted living settings as direct chart review for medications is more difficult in these settings compared to nursing homes[21]. The purpose of this study, therefore, was to describe medication use and polypharmacy in assisted living settings and the factors that influence polypharmacy. We hypothesized that age, gender, race, setting, diagnoses, and cognition would influence polypharmacy. In addition, we tested the impact of polypharmacy on clinical outcomes. Specifically, we hypothesized that controlling for age, gender, race, setting, diagnoses, cognition, function, and physical activity, polypharmacy would be associated with falls, emergency room visits and hospitalizations.

Methods

Design

This study used baseline data from the first cohort of a 12 month study entitled, Dissemination and Implementation of Function Focused Care for Assisted Living Using the Evidence Integration Triangle (FFC-AL-EIT). Participants were recruited from 26 assisted living settings in Maryland, Pennsylvania and Massachusetts. Settings were invited to participate if they: (1) had at least 25 beds; and (2) identified a nurse (a direct care worker, licensed practical nurse or registered nurse) to be the champion and work with the study team in the implementation of FFC-AL-EIT; and (3) were able to access email and websites via a phone, tablet or computer. The study was approved by the Institutional Review Board at the University of Maryland, Baltimore.

Study Participants

Residents were eligible to participate in this study if they were 65 years of age or older, able to speak English, lived in a participating assisted living setting at the time of recruitment, and were able to recall at least one out of three words as per the Minicog [22]. Residents were excluded from the study if they were enrolled in hospice. All participants were given the Evaluation to Sign Consent, a five-item questionnaire evaluating the individual's understanding of participation in the research project [23]. Potentially eligible participants were identified by the staff in the assisted living setting and were randomly approached until ten residents per setting were recruited. A total of 381 residents were approached, 110 (29%) refused to participate (6 of these were refusals from the legally authorized representative), 7 (2%) individuals were excluded/ineligible as they were either too young or enrolled in

Hospice and 15 (4%) were unable to assent or the evaluator was unable to reach the legally authorized representative to obtain consent. A total of 249 individuals consented, five of whom were ineligible due to cognitive status, leaving a baseline enrolled sample of 244 residents. Of the 244 residents, one individual withdrew prior to baseline data being collected and there was missing baseline data on one enrolled resident. Data analysis was therefore done on 242 enrolled participants with data.

Procedures

Following consent, demographic and descriptive information was obtained from resident charts to include: age, gender, race, ethnicity, comorbidities, and cognitive status based on the Mini Cog [22]. The number of falls, emergency room visits and hospitalizations that occurred in the 4 months prior to recruitment was obtained based on chart review or from the appropriate designated individual within settings.

The Barthel Index[24] was completed by asking the direct care worker providing care for the resident on the day of testing how the resident performed with regard to activities of daily living. The Barthel Index is a 10-item measure of activities of daily living (e.g., bathing, dressing). Items are weighted to account for the amount of assistance required. A score of 100 indicates complete independence. Estimates of internal consistency ranged from alpha coefficients of 0.62 to 0.80, inter-rater reliability was supported based on an intra-class correlation of 0.89 between two observers; and validity was based on correlations with the Functional Inventory Measure ($r=0.97$, $p<.05$)[24].

The MotionWatch 8 was placed on each participant for a five day period. Prior research has shown that daily activity for older adults in this type of setting is consistent on a day to day basis [25]. Therefore for this analysis we used the daily mean across three full days of evaluation (days 2, 3, and 4) for counts of activity and time in moderate level physical activity, with moderate activity levels based on previously establish cutpoints [26]. Participants wore the MotionWatch 8 at all times during the five day period including showering, bathing, and when sleeping. Prior evidence of reliability of the Motionwatch 8 was based on consistency between recordings across three days of wear. Validity was based on a consistent match between activity counts and recorded activity performed and a statistically significant difference in Borg Rating of Perceived Exercise Scale (RPE) between the sedentary group (Borg RPE = 8.6, SD=3.0) and those with some level of activity (Borg RPE = 9.9, SD= 2.3; $F=5.72$, $p=.02$)[25].

Medications were obtained based on chart review and included all regularly prescribed medications with the exception of ophthalmic medications or supplements (e.g.,cranberry, vitamins A, C, E, enzyme Q-10, melatonin, niacin, fish oil, omega-3). Medication groups are shown in Table 1. Miscellaneous medications included oral chemotherapeutic agents such as tamoxifen, anti-gout medications such as allopurinol or replacement minerals such as potassium. Polypharmacy was defined as being prescribed five or more medications daily.

Data Analysis

Descriptive statistics were used to describe the sample and medication use among these individuals. Intraclass correlations of the null model were calculated and there was no

evidence showing clustering of residents within each setting. Binary logistic regression analyses were done to test the factors that influence polypharmacy and the impact of polypharmacy on falls, emergency room visits and hospitalizations. The Wald statistic was used to determine the statistical significance of the variables that were entered into the single model testing the factors that influence polypharmacy. The Omnibus Tests of Model Coefficients was used to check if the second model was an improvement over the baseline model based on chi-square for the analyses testing the impact of polypharmacy on falls, emergency room visits and hospitalizations. Lastly, a $p<.05$ level of significance was used for all analyses.

Results

As shown in Table 1, the cohort one sample included 242 residents with a mean age of 86.86 (SD=7.0), the majority of whom were women (179, 74%) and white (N=233, 96%). These individuals had a mean of approximately 5 (SD=2) diagnoses and a mean score of 2.44 (SD=.77) on the 3 out of 3 recall question from the MiniCog. The participants needed help with some activities of daily living as noted by a mean Barthel Index score of 63.06 (SD=20.20). Overall they engaged in 111,353 (SD=87262) counts of activity daily and an average of 43.76 (SD=64.31) minutes of moderate level physical activity daily. Approximately a quarter of the participants experienced a fall in the four months prior to recruitment (N=58, 24%), 32 (13%) were sent to the emergency room, and 22 were sent to the hospital (9%). Fourteen of the 22 (64%) transfers to the hospital were related to falls and fractures and the remaining were associated with acute medical problems such as pneumonia or congestive heart failure.

The frequency of medication use by disease state or drug category and the total number of drugs and frequency of polypharmacy are shown in Table 2. Total number of drugs taken daily ranged from 0 (6 individuals, 2%) to 18 (1 individual, 1%) with the mean number of drugs being 7 (SD=3.56). The most prevalent group of drugs used were cardiovascular medications, the next most prevalent were medications for gastrointestinal problems, then anticoagulants, then antilipids, pain medications and antidepressants. Less than twenty percent of the participants were receiving medications from each of the other drug groups. All medications were administered to the residents by facility staff and over half of the participants (N=124, 51%) were exposed to polypharmacy.

Based on a binary logistic regression analysis, none of the predicted variables (age, gender, race, setting, diagnoses, and cognition) were associated with polypharmacy (Wald = .207, p=.65). Similarly, controlling for age, gender, race, setting, diagnoses, cognition, function, and physical activity, polypharmacy was not associated with falls (control variables block 1 Omnibus Test Chi-Square = 6.68, df =8 and p=.57; polypharmacy block 2 chi-square = 1.73, df=1, p=.19), emergency room visits (control variables block 1 Omnibus Test Chi-square = 10.29, df=8, p=.25; polypharmacy block 2 chi-square=.31, df=1, p=58) or hospitalizations (control variables block 1 Omnibus Test Chi-Square = 12.95, df=8, p=.11; polypharmacy block 2 Chi-square =.01, df=1, p=.92) in the four months prior to recruitment.

Discussion

From a descriptive perspective the findings from this study indicate that older adults in assisted living settings are experiencing polypharmacy at rates slightly higher than what is seen in the community[17,18] or in some nursing home settings[27,28]. Contributing to the high rate of polypharmacy in assisted living settings is the inability to prescribe drugs on an as-needed-basis. These settings do not generally have full time registered nursing oversight and thus the staff providing care can't make ongoing clinical decisions about whether or not a resident needs, for example, a pain medication, or something for gastro-intestinal symptoms. Further, unlike the nursing home setting, there is not any regulatory oversight to encourage a decrease in medications. Skilled nursing facilities (SNF) are mandated by the Centers for Medicare and Medicaid Services to avoid unnecessary drug use[29]. There are penalties for SNFs that demonstrate unnecessary drug use. Surveyors assess the appropriateness of medications used in SNFs and have a list of "medications of particular relevance" that should not be used, which includes medications listed in the Beers criteria. The surveyors also possess a list of medications subject to "gradual dose reductions" which include such things as the psychotropic medications. Conversely in assisted living there is variability across the United States in terms of whether or not the settings are required to complete a medication review as well as the type of review needed[30].

The hypotheses that age, gender, race, setting, diagnoses and cognition would influence polypharmacy and that after controlling for age, gender, race, setting, diagnoses, cognition, function, and physical activity, polypharmacy would be associated with falls, emergency room visits and hospitalizations were not supported in this study. With regard to polypharmacy, other factors such as provider preferences and practices (e.g., routine use of vitamin D and calcium; rigid control of blood pressures) and resident or family requests may have a greater impact on prescribing and medication use than resident related factors. Factors other than medications may likewise contribute to falls, emergency room visits and hospitalizations. Further it is possible that there are only certain drugs or drug combinations, such as the use of more than three central nervous system medications[31], that contribute to falls. With regard to transfers to the hospital it may be resident and family requests that result in these transfers versus demographic or clinical factors related to residents or provider factors.

There may be factors other than polypharmacy that have a greater influence on residents' function and physical activity, which then contribute to falls and hospitalizations. These include such things as: (1) the philosophy of care in the settings (e.g., a care philosophy that does not encourage independence and physical activity); (2) residents refusal to engage in functional tasks and physical activity; and (3) limitations to physical activity due barriers in the environment or policies within the setting. These factors should be considered in future research. Despite a lack of association of polypharmacy with adverse outcomes, ongoing work should continue to focus on deprescribing and decreasing the rate of polypharmacy in assisted living by utilizing input from consultant pharmacists as available and based on recommended approaches for how to best initiate the deprescribing process [32].

Similar to prior research[20,27,28] the most commonly prescribed medications were cardiovascular drugs including all types of antihypertensives, diuretics and nitrates, lipid lowering medications; medications used for gastrointestinal disease and symptoms such as proton pump inhibitors; anticoagulants; and antidepressants. The high rates of some of the cardiovascular medications and anticoagulants may be consistent with preventive guidelines. Future research needs to continue to explore the value of the use of these medications among older adults, particularly since the mean age of these individuals was 86.86 (SD=7.0) and the cost/benefit of these medications is not well known. For example, over treatment of hypertension may increase the risk of mortality among older adults in long-term care settings[33].

The high rate of antidepressant use in this study, albeit consistent with the rate of antidepressant use seen in nursing home settings [28], may be indicative of increased diagnoses of depression among individuals in assisted living settings. Alternatively, this high rate may be due to more expanded use of the antidepressants beyond treating depression, particularly the use of selective serotonin reuptake inhibitors to treat symptoms such as pain or anxiety.

In this sample of residents there was a higher rate of osteoporosis medications (31% versus 3–11%) than was seen in prior research [27,34]. This may be due to the inclusion of Vitamin D within this group of medications and the increased emphasis on use of vitamin D for a variety of clinical problems (e.g., falls). In fact the majority of the participants in this study that were getting medications for osteoporosis were getting vitamin D [35 out of 78 (45%) individuals given drugs for osteoporosis were prescribed Vitamin D]. The rate of use of anticholinesterase inhibitors and memantine in this study was similar to what was recently reported in Canada[28] and what has been reported in the United States[35] but higher than what was seen in Israel[27]. The rate of antipsychotics prescribed (10% of residents received these drugs) and sedative hypnotics (2% of residents received these drugs) was lower than typically seen in nursing home settings with rates nationally for antipsychotics of 15.5% and of sedative-hypnotics as high as 47%[27,28,36–38]. The low rates in our sample are likely due to the participants having less cognitive impairment and thus fewer behavioral symptoms than might be noted in other samples of long-term care residents either in the nursing home or dementia specific assisted living settings.

Only 21% of the residents were treated with a non-narcotic pain treatment and only 6% were receiving narcotics. The rate of pain medications used in long-term care settings has varied with rates being as high as 46% of nursing home residents having “as needed” orders for some type of pain medication[39] to only 18% receiving some type of pharmacologic pain treatment [40]. The low rate in our sample may be appropriate to the needs of the resident, particularly since the participants were all able to communicate and report pain. We do not know, however, if pain was present and untreated among these individuals. Ongoing work is needed to continue to establish the most appropriate methods for evaluating pain and treating pain in this population.

Study Limitations and Conclusion

This study was limited by virtue of being a relatively small sample of residents in assisted living settings all of whom had consented to participate in a study focused on optimizing function and physical activity and generally had no more than mild dementia. The sample, therefore may have been biased and not reflect the general assisted living population. This is particularly a concern given the low rate of psychotropic medication use. In addition, since the sample was drawn from only three states the findings can't be generalized to all residents in assisted living settings. Although we considered the potential impact of setting on polypharmacy and other outcomes we did not specifically focus on aspects of the setting such as staffing, ownership, or location, which may be useful to consider in future work. This was a secondary data analysis and the primary outcomes were obtained based on report from the staff rather than objectively obtaining functional data or falls data or using Medicare claims data to obtain information about hospitalizations and emergency room visits. Further we assumed that all medications ordered were given and taken by the resident. We did not gather data on if and when a resident refused a medication. Despite these limitations, the study provides useful descriptive information on medication use in assisted living settings and the factors that influence use and impact polypharmacy among older individuals. Continued research is needed to explore the factors that influence polypharmacy to help guide deprescribing so that medication management does not harm older adults physically or cause unnecessary financial burden.

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Table 1

Sample Description (N=242)

Variable	Measure Range	Sample Range	Mean	Standard Deviation
Age	–	67–103	86.85	7.00
Mini-Cog (3 out of 3 recall)	0–1	1–3	2.44	.77
Diagnoses	1–12	1–12	4.92	2.12
Total number of medications	–	0–18	7.01	3.56
Barthel Index	0–100	3–80	63.06	20.20
Total Daily Counts of Activity	–	50–451690	111353	87262
Total Daily Minutes in Moderate Activity	–	0–327	43.76	64.31
Variable	N	Percent		
Gender				
Male	63	26		
Female	179	74		
Race				
White	233	96		
Black	9	4		
Emergency Room Visit				
No	209	87		
Yes	32	13		
Hospital Admission				
No	219	91		
Yes	22	9		
Fall				
No	183	76		
Yes	58	24		

Table 2

Frequency of Medications Prescribed By Drug Group (total N = 242)

Drug Group	Mean (SD)	Median	Range	N	%
Total Number of Medications	7.01 (3.56)	7.00	0–18		
0				6	2
1–5				78	32
6–10				117	48
11–15				38	16
16–18				3	1
Cardiovascular Medications	1.45(1.24)	1.00	0–5		
0				71	30
1–5				171	70
Narcotics	.07(.30)	0	0–3		
0				227	94
1–3				15	6
Dementia Medications	.25(.53)	0	0–2		
0				193	80
1–2				49	20
Urinary Incontinence Medications	.12(.33)	0	0–2		
0				215	89
1–2				27	11
Steroids	.38(.63)	0	0–3		
0				166	69
1–3				76	31
Medications for Parkinson’s Disease	.10(.36)	0	0–3		
0				222	91
1–3				20	9
Prostate Medications	.13(.38)	0	0–2		
0				215	89
1–2				27	11
Osteoporosis Medications	.44(.72)	0	0–3		
0				164	68
1–3				78	32
Diabetes Medications	.24(.55)	0	0–3		
0				198	82
1–3				44	18
Antilipid Medications	.40(24)	0	0–3		

Drug Group	Mean (SD)	Median	Range	N	%
0				151	62
1–3				91	38
Pain Medications	.26(.56)	0	0–3		
0				191	79
1–3				51	21
Antiseizure Medications	.20(.51)	0	0–3		
0				204	84
1–3				38	16
Gastro-intestinal Medications	.91(.99)	1.00	0–5		
0				98	40
1–5				144	60
Anxiolytic Medications	.09(.26)	0	0–2		
0				223	92
1–2				19	8
Antidepression Medications	.53(.72)	0	0–3		
0				144	60
1–3				98	40
Antipsychotic Medications	.11(.36)	0	0–3		
0				218	90
1–3				24	10
Anemia Medications	.15(.36)	0	0–1		
0				206	85
1				36	15
Sedative Hypnotic Medications	.02(.14)	0	0–1		
0				237	98
1				5	2
Allergy Medications	.30(.74)	0	0–4		
0				198	82
1–4				44	18
Anticoagulant Medications	.61(.62)	0	0–2		
0				111	46
1–2				131	54