

A Cross-Sectional Comparison of Prevalent Diagnoses and Medication Profiles for Residents in an Assisted Living Facility at Two Time Periods

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Objectives: Describe the prevalence of diagnoses and prescribed medications in an assisted living facility for one month in 2001 and 2004.

Design: A descriptive, cross-sectional report.

Setting: An assisted living facility in Seattle, Washington.

Participants: Assisted living facility residents.

Interventions: In March 2001 and January 2004, charts of all the assisted living facility residents were reviewed. Cross-sectional comparisons of demographics, total and average numbers of charted diagnoses, and prescribed medications were conducted. Prevalent diagnoses and medications used were identified. Among the residents present in both periods, longitudinal comparisons of treatment outcomes for hypertension (HTN) and diabetes mellitus (DM) were assessed.

Main Outcome Measures: Changes in demographics, diagnoses, medications, and blood pressure and blood glucose readings.

Results: Charts of 52 (2001) and 54 (2004) residents were reviewed. HTN, DM, and gastrointestinal (GI) disease were the most prevalent diagnoses during both time periods, although the prescribed medications for these conditions were different in 2001 and 2004. The per-resident numbers of diagnoses and medications averaged 7.2 ± 3.3 and 9.1 ± 4.7 , respectively, in 2004, compared with 5.1 ± 1.9 and 6.4 ± 3.6 in 2001. Among 11 residents who lived in the assisted living facility during both data-collection months, the per-resident averages were 5.2 ± 2.2 diagnoses and 8 ± 3.9 medications in 2001, compared with 7.9 ± 2.9 and 11.1 ± 5.1 , respectively, in 2004. The average blood pressure readings among these residents improved in 2004 over those in 2001, though no improvement was seen in the average blood glucose readings.

Conclusion: To address the changing needs of assisted living facility residents over time, active ongoing monitoring and assessment of residents' medication therapies by pharmacists are indicated.

Key words: Assisted living facility, Cross-sectional comparisons, Prescribed medications, Prevalent diagnoses.

Abbreviations: ACEI = ACE inhibitor, ARB = Angiotensin-2 receptor blocker, BP = Blood pressure, BG = Blood glucose, CCB = Calcium channel blockers, DM = Diabetes mellitus, GI = Gastrointestinal, HTN = Hypertension, MAR = Medication administration records, PPI = Proton-pump inhibitor.

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Introduction

The number of U.S. citizens living beyond 65 years of age is projected to surpass 86 million by 2050.¹ Senior adults are affected by age-related physiological changes that lead to declines in health and functional ability, and many of them are opting for assisted living facilities as an alternative residential option where they can "age in place."² Assisted living facilities are rapidly growing residential communities that provide housing, health care, and other services to residents and delay or prevent their placement into nursing facilities.^{2,3} Beyond providing basic assistance in activities of daily living (grooming, dressing, bathing, toileting, etc.) and instrumental activities of daily living (meal planning, cooking, shopping, etc.), most assisted living facilities promote resident autonomy, independence, quality of life, and maintenance of function.^{2,4-6} The facilities generally negotiate customized care and service plans with each resident to cater to the resident's changing needs.² Medication management is one of the services offered by assisted living facilities. A 2004 AARP Public Policy Institute Research report listed "need help with medications" as the most prevalent need among assisted living residents in the United States.⁷ Previously, there have been reports on resident profiles and the use of medications in assisted living facilities,⁸⁻¹² although few investigators have studied the changes over time in disease profiles and treatment medications used in this rapidly growing health care setting. Assessments of the changes in disease prevalence and medications used by the resi-

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dents over time will assist the multidisciplinary health care providers in these settings to address not only this changing medical, functional, and safety needs of the vulnerable population, but also to determine whether or not new and changing treatment guidelines are being implemented for their assisted living facility residents.

The primary objectives of this report are to describe the changes in the prevalence of specific diagnoses and the medication therapies used between two resident populations in an assisted living facility at two time periods, 35 months apart. Secondary objectives are to report the changes over time in the numbers of diagnoses, medications used, and treatment outcomes of the most prevalent health conditions among the residents who resided in the facility at both time periods.

Design and Setting

This is a retrospective, descriptive, cross-sectional study comparing the disease state prevalence and medications used by the residents in an assisted living facility in March 2001 and January 2004. The study was conducted in a 54-unit, assisted living facility located in the International District in Seattle, Washington. This assisted living facility is subsidized by the Department of Social and Health Services. The majority of the residents are of Asian ethnicities. The indigent older adults seek medical care from different medical providers within the community. An independent, off-site pharmacy supplies medications and pharmaceuticals to the facility via daily deliveries. Changes in routinely prescribed medications are faxed directly from the residents' medical providers to the pharmacy and the facility. All routinely used and as-needed prescribed medications, including over-the-counter (OTC) products and dietary supplements used by the residents, are listed in the residents' medication administration records (MARs).

This facility has established collaboration with the University of Washington (UW) School of Pharmacy. A UW faculty member is on-site to precept pharmacy school students in their senior care clerkships. The UW faculty and students conducted this study, which was approved by the University's Institutional Review Board and the facility administrators. All study activities were conducted in accordance with the Health Information Privacy and Portability Act, and all residents consented to review of their medical charts.

Method

Retrospective reviews of residents' charts and MARs were conducted during two distinct months, in March 2001 and January 2004, to extract data on age, gender, ethnicity, diagnoses, and prescribed medications. Collected medication data included all routinely administered chronic medications, "as-needed" medications that had been used at least once during the data collection months, and OTC products/dietary supplements listed in the MARs. For the residents who lived in the facility during both months, the blood pressure (BP) and blood glucose (BG) readings recorded in the residents' charts during three months prior to each of the two data collection months were recorded.

Since the data collected represented the entire population in the assisted living facility during the two data collection months, descriptive analyses of the data and comparisons with the mean values were conducted to reflect the changes in disease prevalence and medication usage in this population. Cross-sectional analyses of the charted diagnoses and prescribed medications were performed to identify the most prevalent diagnoses (disease states) and the medications used for these diseases in each of the two months.

All medications were grouped into their specific therapeutic classes. The average numbers of diagnoses and medications used per resident were calculated using descriptive statistics (Microsoft Excel Data Analysis ToolPak 2003). To assess the control of hypertension (HTN) and diabetes mellitus (DM) over the two periods among the subset of residents living in the assisted living facility during both data collection months, the mean BP and BG readings charted in their records during the three months before the data collection months were compared. The prescribed medications for these two health conditions at the data collection months were also assessed for differences.

Main Outcome Measures

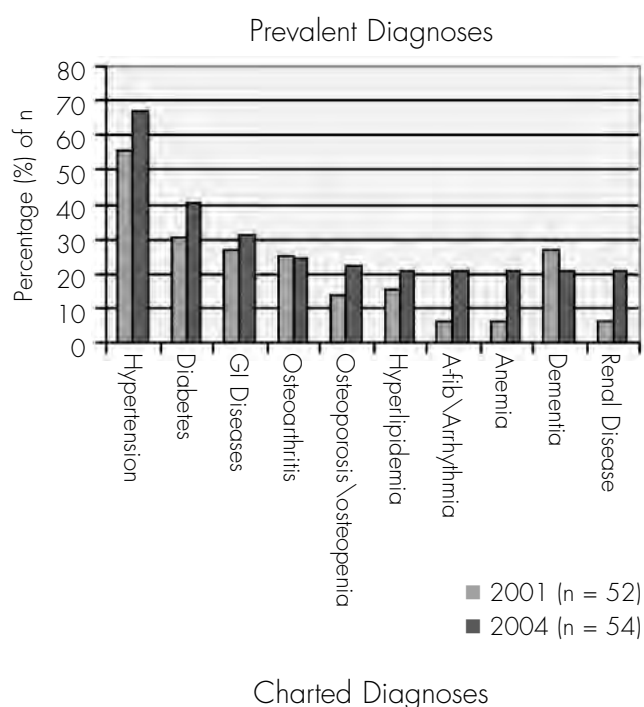
The main outcome measures included the differences in 2001 and 2004 in: 1) the resident demographics, 2) the total and per-resident average numbers of diagnoses and prescribed medications, 3) the 10 most frequently charted diagnoses by order of prevalence based on 2004 data, 4) the medications (grouped into therapeutic classes) for the top three prevalent diagnoses, and 5) the mean

Table 1. Resident Demographics of Study Facility, 2001 and 2004

Description	March 2001	January 2004
Total number of residents	52	54
Percent female	57	67
Average age (years) ± SD	85.5 ± 7.6	83.5 ± 7.8
Average number of diagnoses/resident ± SD	5.1 ± 1.9	7.2 ± 3.3
Average number of medications/resident ± SD	6.4 ± 3.6	9.1 ± 4.7

Abbreviation: SD = Standard deviation.

Figure 1. Percent of Residents with Selected Diagnoses By Year



Abbreviation: GI = Gastrointestinal.

BP and BG readings recorded and the average numbers of medications used to treat HTN and DM among the residents who were present during the two data collection months.

Results

A total of 52 and 54 charts were reviewed in 2001 and 2004, respectively. Demographic data in 2004 (Table 1) showed an increase in the percentage of female residents from 57% in 2001 to 67% in 2004, and a slight decrease in the average age, in years, of the residents (85.5 ± 7.6 in 2001 vs. 83.5 ± 7.8 in 2004). The ethnicities of the resident population were similar during these two time periods, with Chinese, Vietnamese, Filipinos, and Koreans as the major ethnic groups. The 2004 data, when compared with 2001, showed increases in the total number of diagnoses (388 vs. 265) and in the average number of diagnoses per resident (7.2 ± 3.3 vs. 5.1 ± 1.9). The total number of prescribed medications increased from 332 to 491, with a corresponding increase in the average number of medications per resident, from 6.4 ± 3.6 in 2001 to 9.1 ± 4.7 in 2004.

Figure 1 shows hypertension, DM, and gastrointestinal (GI) diseases were the three most prevalent diagnoses, or disease states, during both periods. GI diseases included gastroesophageal reflux disorder, dyspepsia, GI erosion/ulceration, and gastritis. The prevalence of atrial fibrillation, anemia, and renal diseases increased from 5.8% in 2001 to 20.3% in 2004 for each of these three conditions. The prevalence of osteoarthritis (24.1%) and dementia (20.3%) in 2004 decreased when compared with 25% and 26.9%, respectively, in 2001.

The number of residents with HTN, DM, and GI diseases increased in 2004 when compared with 2001. Changes in the medications prescribed for these three prevalent diseases were observed (Table 2). In 2001, 29 (55.8%) residents had HTN, compared with 36 (66.7%) in 2004. Comparing the 2004 to 2001 data, the number and percent of residents prescribed beta-blockers, ACE inhibitors (ACEIs), diuretics, and angiotensin-2 receptor blockers (ARBs) increased, and those using alpha-1 antagonists decreased. Although the use of calcium channel blockers (CCBs) during both months remained unchanged, there was a decrease in the use of dihydropyridine CCBs (nine prescriptions in 2001 versus six prescriptions in 2004).

Table 2. Prevalence of Prescribed Medications for Hypertension, Diabetes, and Gastrointestinal Diseases in 2001 and 2004*

	2001 Number (%)	2004 Number (%)
Hypertension		
Number of residents with diagnosis	29	36
Beta-blocker prescriptions	12 (41.3)	21 (58.3)
ACE-inhibitor prescriptions	8 (27.6)	16 (44.4)
Diuretic prescriptions	10 (34.4)	12 (33.3)
Calcium channel-blocker prescriptions	11 (37.9)	10 (27.8)
Angiotensin-receptor blocker prescriptions	3 (10.3)	7 (19.4)
Alpha-1 antagonist prescriptions	5 (17.2)	3 (8.3)
Alpha-adrenergic inhibitors prescriptions	1 (3.4)	1 (2.8)
Diabetes		
Number of residents with diagnosis	16	22
Sulfonylurea prescriptions	8 (50)	12 (54.5)
Biguanide prescriptions	6 (37.5)	4 (18.2)
Insulin prescriptions	4 (25)	6 (27.3)
Meglitinide prescriptions	0	2 (9.1)
Thiazolidinediones prescriptions	0	2 (9.1)
Gastrointestinal Diseases		
Number of residents with diagnosis	14	17
Proton-pump inhibitor prescriptions	12 (85.7)	20 (117.6)
H ₂ antagonist prescriptions	6 (42.9)	2 (11.9)
Antiemetic/antacid prescriptions	3 (21.4)	3 (17.6)

* March 2001, January 2004.

For DM, 16 (30.8%) residents had this diagnosis, compared with 22 (40.7%) in 2004. Sulfonylureas were the most commonly prescribed DM medication in both periods. Compared with 2001, the 2004 data showed changes in the use of insulins, with small increases in long-acting insulin glargine (2.3%). The use of other medications such as thiazolidinediones (TZD, 9.1%) and meglitinides (9.1%) also increased in 2004, whereas the use of biguanides decreased. The number of residents with GI diagnoses increased in 2004 (17/54, 31.5%) versus 2001 (14 /52, 26.9%). The use of proton-pump

inhibitors (PPIs) for GI conditions or risk of GI bleeding increased in 2004, with three residents receiving PPI prescriptions without charted diagnoses or reasons of use, which resulted in a calculated 118% prevalence of use among the 17 residents with GI diagnoses, compared with 86% use among 14 residents with GI diseases in 2001.

Table 3 shows that among the 11 residents who were present in 2001 and 2004, there were increases in the average numbers of diagnoses per resident (5.2 ± 2.2 in 2001, 7.9 ± 2.9 in 2004), and the average numbers of

Table 3. Differences in Average Numbers of Diagnoses and Medications, Mean Blood Pressure, and Blood Glucose Among 11 Residents Present in Both 2001 and 2004*

Description	2001	2004
Average number of diagnoses/resident \pm SD (n = 11)	5.2 \pm 2.2	7.9 \pm 2.9
Average number of medications used/resident \pm SD (n = 11)	8.0 \pm 3.9	11.1 \pm 5.1
Mean systolic blood pressure in mm Hg (n = 7)	143.6 \pm 7.9	126.1 \pm 2.7
Mean diastolic blood pressure in mm Hg (n = 7)	77.7 \pm 2.2	69.0 \pm 2.2
Mean blood glucose in mg/dL (n = 3)	143.7 \pm 26.0	168.7 \pm 32.3

*March 2001, January 2004.

prescribed medications per resident (8 ± 3.9 in 2001, 11.1 ± 5.1 in 2004). The mean BP among the seven residents with this diagnosis in 2004 ($126.1/69.0$ mm Hg) showed improvement over the 2001 mean readings ($143.6/77.7$ mm Hg), whereas the mean BG readings showed an increase in the 2004 value (168.7 mg/dL) when compared with the 2001 value (143.7 mg/dL).

Table 4 shows the prescribed medications and control of HTN and DM among residents present during 2001 and 2004 with these health problems. The prevalence of HTN in 2004 among this group of residents was 72.7% (8/11), and the average number of medications used per diagnosed resident was 1.63 (range 1-3). These figures were higher than the respective 54.5% (6/11) and 1.33 found in 2001. BP assessment showed 87.5% (7/8) residents in 2004 versus 50% (3/6) residents in 2001 achieved the treatment goals recommended by the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC-7).¹³ For DM, 36.4% (4/11) of the residents were diagnosed with this disease, with each resident using an average of 1.75 medications in 2004, compared with 27.2% (3/11) and 1.67 medications used in 2001. In 2004, 2/3 residents showed improvements in the mean BG readings versus those in 2001, and one resident showed worsened control.

Discussion

This report is the first to review the changes in disease prevalence and medications used in an assisted living

facility at two different time periods. The results showed that over time, the numbers of diagnoses and medications used to treat the health problems among assisted living facility residents increased. As seen in the diagnoses and treatment of HTN and DM among the group of residents who were present in both 2001 and 2004, more residents were diagnosed with these conditions over time, and more medications were needed to treat each condition to achieve the desired outcome. For the treatment of hypertension, we observed increased use of beta-blockers, ACEIs, diuretics, and ARBs among the residents diagnosed with HTN in 2004. These are all effective BP-lowering medications, and the selection of the most appropriate medication or combination of medications often depends on each individual's medical history, concomitant health problems or compelling indications, tolerability of medication side effects, and cost.¹⁴ To accurately assess the appropriateness of HTN therapies and provide individualized recommendations on medication selections for assisted living facility residents, pharmacists providing services should maintain frequent communications with the assisted living facility staff and the residents' providers to stay current on the residents' BP measurements, blood test results, and updated diagnoses or changes in health status.

We found increased use of insulin glargine, TZD, and meglitinides in 2004. Relative to sulfonylureas and regular or isophane insulins, these medications are newer treatment options for DM. This observation supports previous reports that suggested that changing prescrip-

Table 4. Medications and Control of Hypertension and Diabetes Among Diagnosed Residents Present During Both Data Collection Months In 2001 and 2004

Resident with HTN and/or DM	2001 BP Meds	2001 Avg BP	2004 BP Meds	2004 Avg BP	2001 DM Meds	2001 Avg Fasting BG	2004 DM Meds	2004 Avg Fasting BG
1	Doxazosin	145/83	Candesartan Lisinopril	124/72	No DM	N/A	No DM	N/A
2	No HTN	N/A	Lisinopril	124/71	No DM	N/A	Glipizide	127
3	Diltiazem Quinapril	165/81	Diltiazem Valsartan	134/66	Glyburide	192	Insulin Glipizide	168
4	Verapamil	147/77	Enalapril Valsartan	134/69	No DM	N/A	No DM	N/A
5	HCTZ Losartan	173/82	HCTZ Losartan Amlodipine	128/64	Glipizide	136	Glipizide Metformin	113
6	No HTN	127/72	Valsartan	126/63	Metformin NPH and regular Insulin	103	NPH insulin Rosiglitazone	225
7	Benazepril	135/81	Lisinopril	124/69	No DM	N/A	No DM	N/A
8	Metoprolol	113/68	Metoprolol	113/80	No DM	N/A	No DM	N/A

Abbreviations: Avg = Average, BG = Blood glucose, BP = Blood pressure, DM = Diabetes, HCTZ = Hydrochlorothiazide, HTN = Hypertension, Meds = Medications, N/A = Not available.

tion patterns of DM medications are related to the introduction of new medications to the marketplace.¹⁵ Our results also show a decreased use of metformin in 2004. The use of metformin in the elderly has been cautioned because of the potential for lactic acidosis and related adverse reactions in patients with reduced renal function, though recent reports have argued that the risk of metformin-induced lactic acidosis is rare.¹⁶⁻¹⁸ However, in view of the prevalence of renal insufficiency among older adults, the use of metformin in this population warrants close monitoring of dosing and renal function. It is important for pharmacists to monitor dosing adjustments

based on changes in renal function and educate medical providers about the importance of creatinine clearance-based estimation of renal function¹⁷ instead of solely relying on serum creatinine values.

Since dementia is a progressive disease, relocation of assisted living facility residents to nursing homes can be a possible explanation for the decreased prevalence of dementia in 2004 found in this study. Also, dementia can potentially be underdetected and underdiagnosed among this population. For residents using anticholinesterase inhibitors for dementia, pharmacists should assess the need for chronic use of medications with anticholinergic

side effects. When appropriate, recommendations to reduce the use of anticholinergic medications may be necessary to minimize potential drug-drug and drug-disease interactions and to maximize the efficacy of dementia medication therapy.

In Washington State, as in many other states, assisted living pharmacy providers are not required to provide on-site visits and consulting. It is important that pharmacists serving the residents in this setting maintain frequent communications with the medical providers and facility staff to stay abreast of:

- Changes in the residents' health status
- New diagnoses, laboratory, and other treatment-monitoring targets to ensure accurate assessment of medication pharmacodynamic and pharmacokinetic parameters
- Timely identification of potential drug-drug and/or drug-disease interactions

This will allow them to provide recommendations to optimize drug therapy.

In assisted living facilities that contract with specific pharmacies to provide medication and pharmaceutical supplies for the residents, such as the one in this study, the pharmacists often are the providers with the residents' most updated medication lists since all new medication orders are faxed to the pharmacy. Pharmacists not only can closely monitor the residents' chronic and new medication prescriptions, but they should also communicate important changes (additions, discontinuations, and changes) of prescribed medications to each resident's primary medical provider. Many assisted living facility residents receive care and medication prescriptions from more than one provider, and often prescription changes made by different providers are not well communicated among the providers.

The results of this study showed that the comorbidities and complexities of medication therapies of assisted living facility residents increase over time. The pharmacy providers in this setting play a pivotal role in providing clinical consultation and coordination of the changing medication needs of the residents to the multidisciplinary team of assisted living facility staff, residents, their families, and their providers.

The most obvious limitation of this study is the small number of residents in the population and the fact that the data were collected from only one assisted living

facility for only two distinct months. Another limitation is the demographics of our population. The ethnic and gender composition are not typical for an assisted living facility in that our population was comprised mostly of Asian residents and a lower percentage of female residents than usual. These limitations prevent generalization of the results, but can be regarded as an example or a glimpse into a much greater and more complex situation.

Another limitation is the lack of documentation or records of treatment outcomes besides BP and BG readings in the residents' charts, which limits our ability to track and assess medication treatment efficacy of diseases such as hyperlipidemia and anemia. We also did not assess the appropriateness of medication choices, monitor for potential medication-related problems, track pharmacist interventions, or assess the changes in the cost of treatment therapies. Such assessments are all worthwhile efforts that are performed routinely by geriatric consultant pharmacists and are outside the scope of this report. There is a need for further research focusing on the longitudinal evaluations of ongoing clinical interventions provided by consultant pharmacists in identifying, preventing, managing, and/or resolving medication-related issues among the residents in the assisted living facility setting.

Conclusion

With the changing profile of residents in assisted living facilities, corresponding changes in the prevalence of diseases and medication therapies are expected. The results of this study shows that over time, residents in assisted living facilities can develop more health problems and be treated with more medications, and that treatment outcomes can be affected by changes in medication therapy. Even when the prevalent disease states remain similar, the medication therapies can be different, likely as a result of changes in residents' comorbidities, prescribing guidelines, recommended treatment protocols, and the availability of newer medications.

The changes over time in the medication therapies among assisted living facility residents observed in this study indicate the need for ongoing close monitoring and assessment of assisted living facility residents' medication therapies. Pharmacists with special training in geriatric pharmacotherapy have the expertise to oversee and ensure proper medication management to optimize treatment outcomes.

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