

Spring | 2013

Psychotropic Medication Utilization in Care Home Residents Age 65 or Older Compared with the Equivalent General Population in Scotland

Tyler P. Stewart

Table of Contents

ABSTRACT	3
BACKGROUND	5
PRESCRIBING INFORMATION SYSTEM	7
METHODS	7
POPULATION ESTIMATES	9
RESULTS	9
DISCUSSION	16
LIMITATIONS	19
FURTHER ANALYSIS	21
CONCLUSION	21
ACKNOWLEDGEMENTS	22
REFERENCES	23
APPENDICES	25
APPENDIX A	25
APPENDIX B	27

ABSTRACT

Purpose: In Scotland, care homes provide assisted living and medical services. Psychotropic medications (antipsychotics, anxiolytics, and hypnotics) may be over utilized in these facilities. This study compared psychotropic medication utilization in elderly care home residents to the equivalent population of non-care home residents. It is hypothesized that patients in care homes utilize psychotropic medications more than non-care home residents.

Methods: Demographic and prescription information for all patients aged 65 years and older on January 1, 2011 who received at least one prescription for a psychotropic medication during 2011 was retrieved from the national Prescribing Information System (PIS). Patients were grouped into care home and non-care home populations and were stratified by gender and 10-year age band. Estimates of the total non-care home and care home populations were made using National Records of Scotland information and, using PIS, by counting all individuals resident in a care home who had received at least one prescription of any type during 2011. Relative risk of receiving psychotropics, percent of population treated, and other utilization measures were calculated. Statistical significance was determined by $p < 0.05$ utilizing a paired two-sample t-test.

Results: A total of 879,492 patients were included, 32,372 of whom resided in care homes (3.7%). Males comprised 28% and 43% of the care home and non-care home populations, respectively. Age groups 65-74, 75-84, and 85+ made up 12%, 35%, and 53% of the care home population, respectively, while making up 55%, 34%, and 11% of the non-care home population, respectively. More care home patients were treated with psychotropics than non-care home patients (41.6% vs. 12.1%, $p < 0.05$). Men were more likely than women to receive psychotropics in care homes (43.6% vs.

40.9%, $p < 0.05$), but less likely to receive psychotropics in the non-care home setting (9.4% vs. 14.3%, $p < 0.05$). Treatment with psychotropics was more common for every age group living in the care home (65-74 years Relative Risk (RR)=4.6 95% CI=2.93-6.29, 75-84 years RR=3.4 95% CI=2.42-4.54, 85+ years RR=2.4 95% CI=1.31-3.47). The percent of non-care home patients treated with psychotropics increased as patients aged (65-74 years 10.7%, 75-84 years 13.4%, 85+ years 15.9%). Conversely, the percent of care home patients treated with psychotropics decreased as patients aged (65-74 years 49.4%, 75-84 years 46.0%, 85+ years 37.4%).

Conclusion: Residents of care homes have increased use of psychotropic medications compared to individuals not in care homes. There are significant differences in the use of psychotropic medications based on gender and age. Whether this reflects appropriate prescribing warrants further investigation.

Background:

Care homes in Scotland, similar to long term care facilities in the United States, are designed to offer assisted living services, often with medical care, to those who require services beyond what they are capable of providing for themselves. In Scotland, the elderly comprise around 90% of the care home population. The elderly population typically has several comorbidities that influence their care and require multiple medication regimens to manage these comorbidities. It is generally accepted, that in many instances the elderly, both in and out of care homes, are exposed to inappropriate medication regimens¹. This is of great concern given the elderly population is already at an increased risk of experiencing adverse events from medication use and inappropriate use increases these risks unnecessarily.

There is growing evidence that many of the adverse drug events that occur in care homes are preventable and that inappropriate medication use accounts for a significant portion of healthcare expenditures. A study from 2005 in the United States estimated that 42% of adverse drug events in long term care facilities were preventable¹. It was also estimated that between 2000 and 2001, potentially inappropriate medication expenditures reached \$7.2 billion¹. Inappropriate prescribing can therefore have significant medical and financial consequences.

For those patients who are in care homes, there are concerns that psychotropic medications, anxiolytics, hypnotics, and antipsychotics, may be used in inappropriate ways such as a chemical restraint or sedative. Though anxiolytics, hypnotics, and antipsychotics only comprise a subset of the medications that are considered to be used inappropriately in elderly patients in care homes, they are drugs that carry side effect profiles that can be very problematic in this population. A study of nursing home residents in the United States showed that psychotropic medications in

particular, have significant influence on the physical functioning of residents taking psychotropic medications versus those residents who were not including increasing the risk of falls which can be particularly problematic in the elderly population². Also, studies have shown that the use of antipsychotics in patients with dementia may increase risk of death up to one and a half times³. But, not only can the patients physical functioning be affected, psychotropic medications can significantly alter the mental functioning of these patients as well.

Given the nature of these medications and the impact they can have on the given population, recommendations and regulations have been passed both in the U.S. and in Scotland to try to reduce the exposure to these types of medications in the elderly population. The Centers for Medicare and Medicaid Services in the U.S. have regulations and recommendations on the use of High Risk Medications (HRM's), including many psychotropic medications, in elderly patients. In the United Kingdom, there have been national recommendations to reduce the use of a variety of psychotropic medications in elderly patients. With the notion of possible inappropriate use of psychotropic medications in the elderly and care home residents along with the push to reduce or control the use of HRMs, including many psychotropics, in elderly patients, the purpose of this study was to use the Prescribing Information System (PIS) data warehouse to examine the use of anxiolytics, hypnotics, and antipsychotics in those patients 65 years of age or older and to compare this with use in the equivalent population not in care homes. It is hypothesized that patients in care homes utilize psychotropic medications more than non-care home residents.

Prescribing Information System

The PIS data warehouse, housed within the information services division (ISD) of the National Health Service (NHS) National Services Scotland (NSS), is a national database for Scotland which houses community prescription data dating back to 1993. It currently houses nearly 1.3 billion community prescription events. This system tracks all prescription events for patients in the community, including those in care homes. A unique patient identifier (UPI) has been attached to the prescribing data since 2009. This UPI is unique to each patient in Scotland. The inclusion of the UPI number in the data allows for linking of prescription events for an individual as well as linking of prescription events for a population based on patient specific prescription information such as gender, care home residency, and age. Since 2009, nearly 95% of the data captured relating to anxiolytics, hypnotics, and antipsychotics has been captured with a UPI. This recently included identifier was instrumental in the following study, allowing for the capture of nearly all prescription events based on set criteria designed in the database queries.

Methods:

The program Business Object XI WebIntelligence™ was used to retrieve data from the PIS data warehouse. This program was used to query the data warehouse and pull data specific to set parameters outlined in the queries. The queries were designed to retrieve data on those patients who were 65 years of age or older on January 1, 2011 and who had been given a prescription for an anxiolytic, hypnotic, or antipsychotic medication, as defined in the British National Formulary (BNF) under codes 4.1.1, 4.1.2, and 4.2.1 (Appendix A.), during 2011. The BNF groups and codes medications based on therapeutic use or pharmacology and uses an organizational

system of chapters, sections, and sub-sections that provides a unique code for each drug. For each individual who was captured in the above criteria, the following data was extracted: care home residency status, age, gender, NHS board of residency (Appendix B), type of psychotropic medication received, and the number of prescriptions received. Then, from these data, the percent of population treated with a psychotropic medication, number of psychotropic medication prescriptions per treated patient, and number of prescriptions per 1000 population were calculated. Furthermore relative risk (RR), or treatment ratios, (the percent treated in the defined care home population divided by the percent treated in the defined non-care home population) and prescription frequency per treated patient ratios (the prescriptions per treated patient in the defined care home population divided by the prescriptions per treated patient in the defined non-care home population) were calculated for the care home population versus the non-care home population. The treatment ratios, prescription frequency per treated patient ratio, and other measures of utilization were constructed for the nation as well as for the 14 health boards. These calculations were performed using Business Object XI WebIntelligence™ and Microsoft Excel™.

Using Microsoft Excel™ statistical comparisons were made for psychotropic medication utilization, primarily between those patients resident in care homes and those not resident in care homes based on the utilization measures stated above. Comparisons were made based on gender (male and female) and 10 year age group bands (65-74, 75-84, 85+). Using the UPI, patients were counted into these various groups based on the outlined criteria and distinct counts were made for the nation as well as for each health board. The counts and comparisons were made for the whole of Scotland as well as by each individual health board. Analysis was repeated for anxiolytics, hypnotics, and antipsychotics individually as well as collectively as

psychotropics as a whole. Statistical significance was determined by a p value less than 0.05 utilizing a paired two-sample t-test.

Population Estimates

In order to appropriately measure and compare the data, population estimates were constructed for both the care home population and the non-care home population who were age 65 or older. Because there was no readily available census data for the total care home population, the population estimate was made by counting the number of individuals aged 65 or older, in care homes, who received a prescription of any type. This count was made for the whole of Scotland as well as distinct counts by health board, gender, and 10 year age band.

The population estimate for those not in care homes was made using the mid-year population estimate from 2010 by the National Records of Scotland (NRS) for those age 65 or older and again this estimate was made for the whole of Scotland as well as distinct counts by health board, gender, and 10 year age band. From this mid-year estimate the estimated care home population from above was subtracted to yield the estimated population of persons not in care homes. The 2010 NRS estimate was used because it is the most recent estimate available.

Results:

A total of 879,492 patients were included, 32,372 of whom resided in care homes (3.7%). Males comprised 28% and 43% of the care home and non-care home populations, respectively. Age groups 65-74, 75-84, and 85+ made up 12%, 35%, and 53% of the care home population, respectively, while making up 55%, 34%, and 11% of the non-care home population, respectively.

For psychotropic medications as a whole, the percent treated for those patients in a care home for the whole of Scotland was 41.6% while the percent treated for those not in a care home was 12.1% (Table 1). This yields a treatment ratio of 3.4 and a prescription frequency per treated patient ratio of 1.6 for the care home population versus the non-care home population (Table 2). When divided by health board, each board follows a similar pattern (Figure 1).

Population Description	Prescription Type	Percent of Care Home Population Treated	Percent of Non-Care Home Population Treated
Total ^	All*	41.6	12.1
Total ^	Anxiolytic	17.0	5.2
Total^	Hypnotic	16.1	6.8
Total^	Antipsychotic	23.2	1.8
Female	All*	40.9	14.3
Male	All*	43.6	9.4
Age 65-74	All*	49.4	10.7
Age 75-84	All*	46.0	13.4
Age 85+	All*	37.4	15.9

Table 1. Percent treated with a psychotropic medication in the care home and non-care home populations broken down by population description of those over the age of 65 and by type of psychotropic prescription

*Prescription type of 'All' is defined as a prescription for any type of psychotropic medication (anxiolytic, hypnotic, or antipsychotic)

^Population description of 'Total' is defined as all those age 65 years or older within the given population regardless of age or gender.

Care Home Population Description	Prescription Type	Treatment Ratio (Relative Risk)	Prescription Frequency per Treated Patient Ratio
Total ^	All*	3.4	1.6
Total ^	Anxiolytic	3.3	1.4
Total^	Hypnotic	2.4	1.3
Total^	Antipsychotic	12.9	1.3
Female	All*	2.9	1.5
Male	All*	4.6	1.8
Age 65-74	All*	4.6	2.0
Age 75-84	All*	3.4	1.7
Age 85+	All*	2.4	1.3

Table 2. Treatment and prescription frequency per treated patient ratios for specific psychotropic medications for the distinct care home populations versus the distinct non-care home population

*Prescription type of 'All' is defined as a prescription for any type of psychotropic medication (anxiolytic, hypnotic, or antipsychotic)

^Population description of 'Total' is defined as all those age 65 years or older within the given population regardless of age or gender.

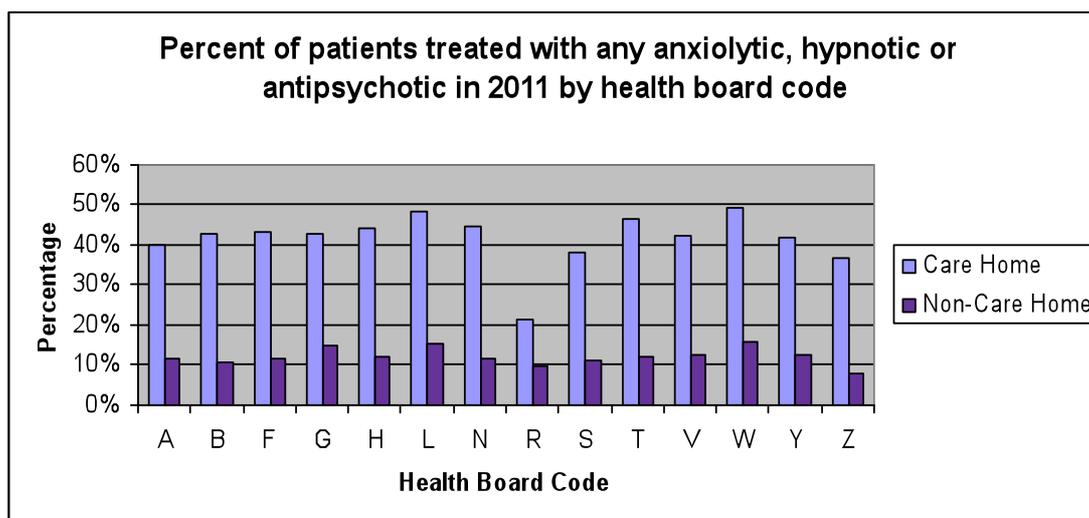


Figure 1. Percent of patients treated with any anxiolytic, hypnotic, or antipsychotic in 2011 delineated by health board and compared across the care home population and the care home population.

Similar patterns are observed with the anxiolytic medication class. The percent treated for those patients in a care home for the whole of Scotland was 17.0% while the percent treated for those not in a care home was 5.2% (Table 1). This yields a treatment ratio of 3.3 and the prescription frequency per treated patient ratio of 1.4 for the care home population versus the non-care home population (Table 2). When divided by health board, each board follows a similar pattern (Figure 2).

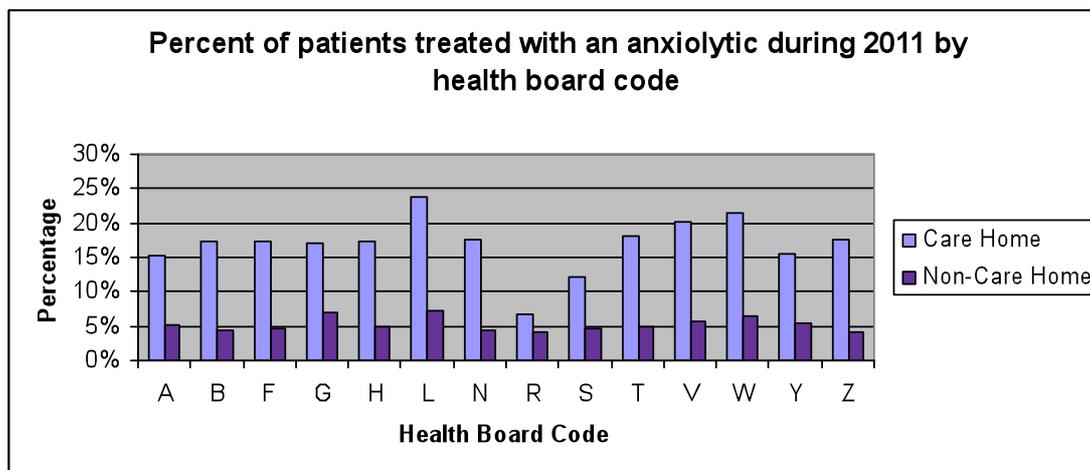


Figure 2. Percent of patients treated with an anxiolytic in 2011 delineated by health board and compared across the care home population and non-care home population.

Similar patterns are observed with the hypnotic medication class. The percent treated for those patients in a care home for the whole of Scotland was 16.1% while the percent treated for those not in a care home was 6.8% (Table 1). This yields a treatment ratio of 2.4 and the prescription frequency per treated patient ratio of 1.3 for the care home population versus the non-care home population (Table 2). When divided by health board, each board follows a similar pattern (Figure 3).

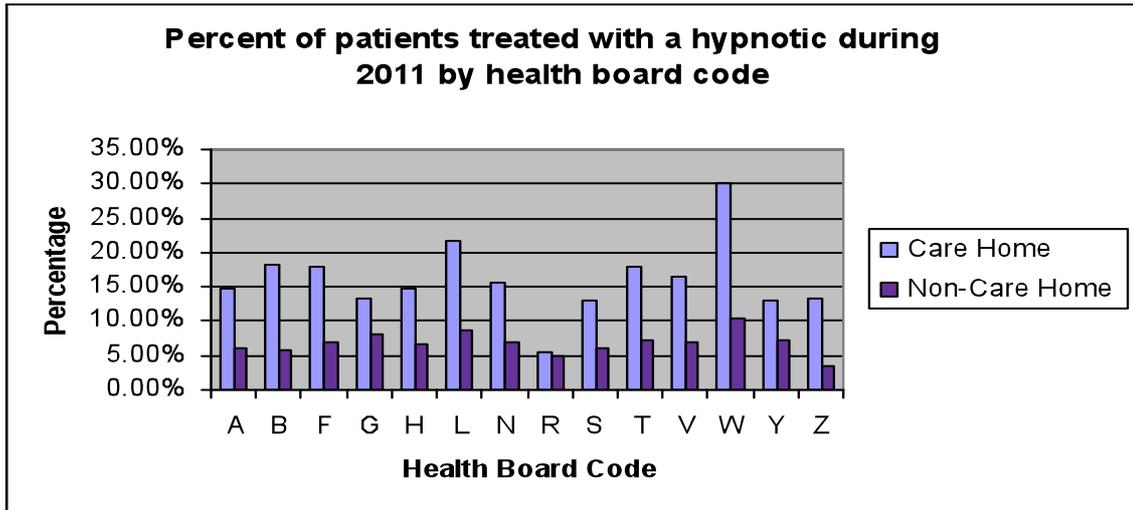


Figure 3. Percent of patients treated with a hypnotic in 2011 delineated by health board and compared across the care home population and non-care home population.

Similar patterns are observed with the antipsychotic medication class. The percent treated for those patients in a care home for the whole of Scotland was 23.2% while the percent treated for those not in a care home was 1.8% (Table 1). This yields a treatment ratio of 12.9 and the prescription frequency per treated patient ratio of 1.3 for the care home population versus the non-care home population (Table 2). When divided by health board, each board follows a similar pattern (Figure 4).

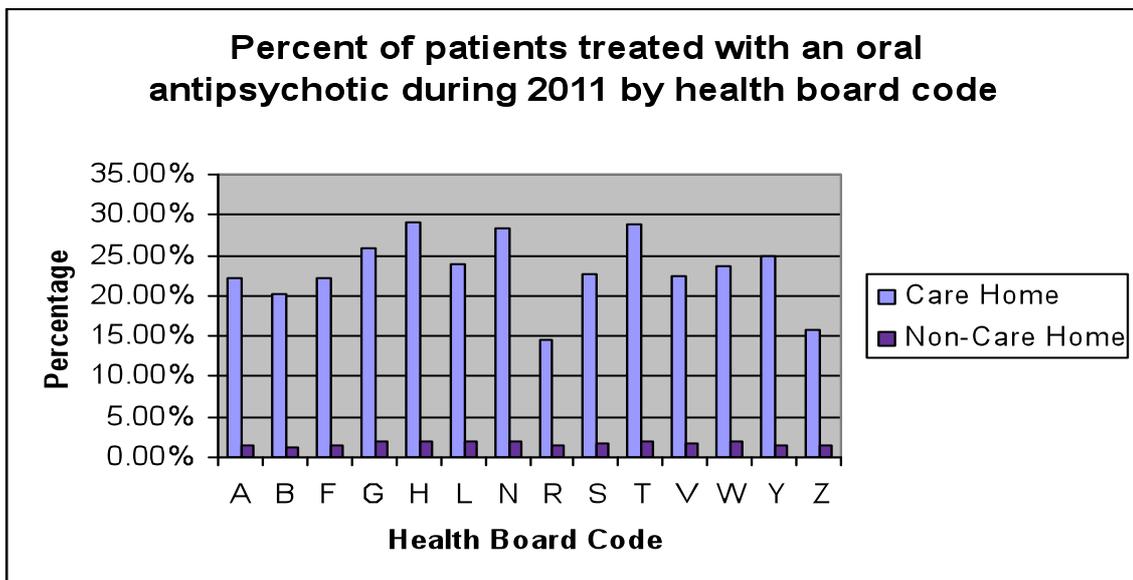


Figure 4. Percent of patients treated with an antipsychotic in 2011 delineated by health board and compared across the care home population and non-care home population.

When examining the utilization measures of prescriptions per treated patient and prescriptions per 1000 population, similar patterns are observed as those seen in the percent of population treated. These data are displayed in Table 3.

Population Description	Prescription Type	Prescriptions per treated patient in care home	Prescriptions per treated patient non-care home	Prescriptions per 1000 care home population	Prescriptions per 1000 non-care home population
Total^	All*	11	6.9	4605	1043
Total^	Anxiolytic	6.0	4.4	1008	237
Total^	Hypnotic	8.6	6.6	1370	467
Total^	Antipsychotic	9.2	6.9	2332	128
Female	All*	11	7.1	4492	1028
Male	All*	11.3	6.3	4925	604
65-74	All*	13.5	6.6	6852	718
75-84	All*	11.	7.0	5296	942
85+	All*	9.9	7.4	3706	1188

Table 3. Prescriptions per treated patient and prescriptions per 1000 population for specific psychotropic medications for the distinct care home populations and the distinct non-care home population

*Prescription type of 'All' is defined as a prescription for any type of psychotropic medication (anxiolytic, hypnotic, or antipsychotic)

^Population description of 'Total' is defined as all those age 65 years or older within the given population regardless of age or gender.

When examining gender and care home residency status for the whole of Scotland and for psychotropic medications combined, females in care homes had a percent treated of 40.9%, men in care homes had a percent treated of 43.6%, females not in care homes had a percent treated of 14.3%, and males not in care homes had a

percent treated of 9.4% (Figure 5) (Table 1). This yields a treatment ratio of 2.9 and a prescription frequency per treated patient ratio of 1.5 for females in the care home population versus the non-care home population. This yields a treatment ratio of 4.6 and a prescription frequency per treated patient ratio of 1.8 for males in the care home population versus the non-care home population (Table 2).

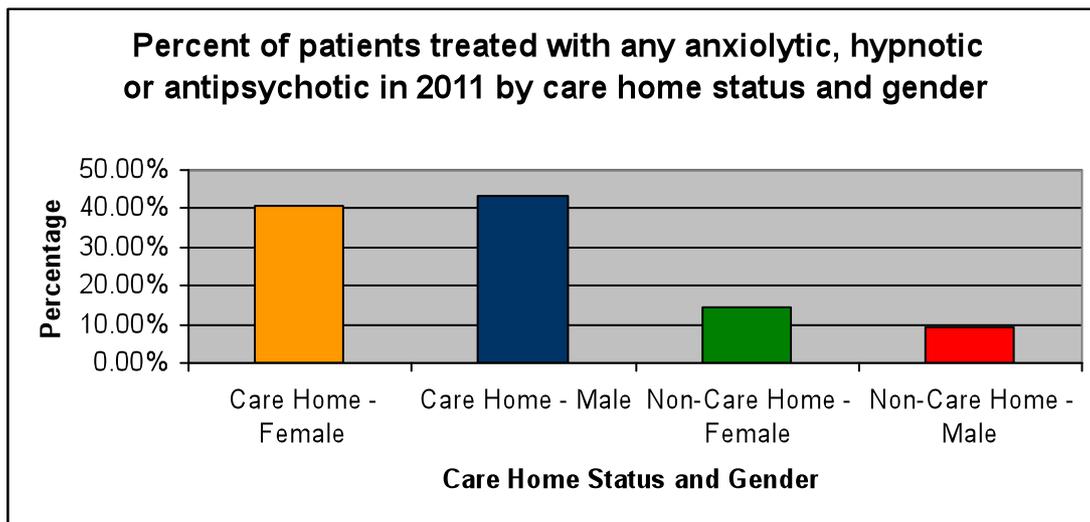


Figure 5. Percent of patients treated with any anxiolytic, hypnotic, or antipsychotic in 2011 delineated by care home status and gender

When looking at age band and care home residency status for the whole of Scotland and for psychotropic medications combined, those ages 65-74 in a care home had a percent treated of 49.4%, those ages 75-84 in a care homes had a percent treated of 46.0%, those ages 85+ in a care home had a percent treated of 37.4%, those ages 65-74 not in a care home had a percent treated of 10.7%, those ages 75-84 not in a care homes had a percent treated of 13.4%, and those ages 85+ not in a care home had a percent treated of 15.9% (Figure 6) (Table 1). This yields a treatment ratio of 4.6 and a prescription frequency per treated patient ratio of 2.0 for those ages 65-74 in the care home population versus the non-care home population. This yields a

treatment ratio of 3.4 and a prescription frequency per treated patient ratio of 1.7 for those ages 75-84 in the care home population versus the non-care home population. This yields a treatment ratio of 2.4 and a prescription frequency per treated patient ratio of 1.3 for those age 85+ in the care home population versus the non-care home population (Table 2).

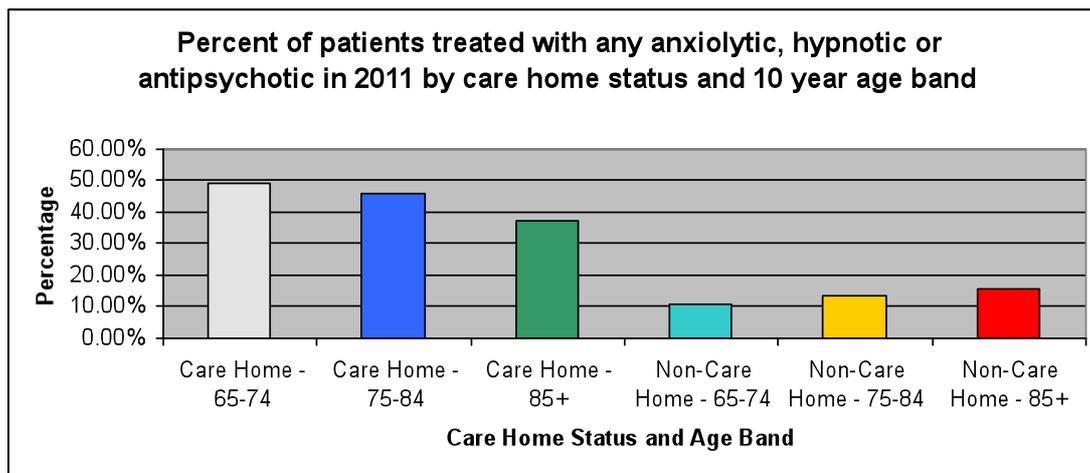


Figure 6. Percent of patients treated with any anxiolytic, hypnotic or antipsychotic medication in 2001 by care home status and 10 year age band.

Discussion:

For psychotropic medications as a whole one can see there is a tremendous amount more prescription utilization in the care home population than in the non-care home population. Statistically significant differences were found in the percent of patients treated with any anxiolytic, hypnotic or antipsychotic between the care home population and the non-care home population ($p\text{-value} < 0.05$). This difference is seen across all health boards as depicted in Figure 1. Combining all health boards, the treatment ratio, seen in Table 2, for the care home population versus the non-care home population is 3.4, meaning that holding all else constant a patient in a care home has a 3.4 fold increase in their percent chance of being treated with a psychotropic

medication than a patient not in a care home. The prescription frequency per treated patient ratio for all of Scotland shows that patients in a care home treated with a psychotropic medication receive 1.6 times as many medications as those treated who are not in a care home.

When analyzing the data based on specific drug class, anxiolytic, hypnotic, or antipsychotic, in the total care home population, similar results are seen as those derived when looking at the psychotropic medications as a whole. The percent treated for each drug class is higher in the care home population and in all three cases the difference is statistically significant ($p\text{-value}<0.05$).

Similarly, the prescriptions per treated patient and prescriptions per 1000 population for all population descriptions analyzed were significantly higher in the care home population than in the non-care home population ($p\text{-value}<0.05$). Again, these utilization measures display increased use of psychotropics in the care home population that may be due to variety of factors included in the limitations of this study or due to overuse in the care homes.

When examining gender in the care home and non-care home populations, similar patterns as above in regard to percent treated, prescriptions per treated patient, and prescriptions per 1000 population are seen between the care home and non-care home population for like genders. Analysis of males versus females and percent treated in the care home population and percent treated in the non-care home population reveals more intriguing details. Females in the care home had less percentage treated than did males in the care home but had more percentage treated than males in the non-care home population. The difference in percent treated between males and females in the care home population was statistically significant ($p\text{-value}<0.05$) as well as the difference between males and females not in care

homes. Though it may be considered that males are more prone to be diagnosed with disease states requiring psychotropic medications, there is no available diagnosis data for the population. If this were the case and was part of the reason males were admitted to care homes then one would expect to see the differences seen between males and females in the care home and non-care home population. But, again, without diagnosis data the differences between males and females is hard to fully analyze.

When comparing the age bands in the care home and non-care home, the same patterns as above in regards to percent treated, prescriptions per treated patient, and prescriptions per 1000 population are seen between the care home and non-care home population for like age bands. Treatment with psychotropics was more common for every age group living in the care home with relative risk as follows, 65-74 years RR=4.6 95% confidence interval (CI)=2.93-6.29, 75-84 years RR=3.4 95% CI=2.42-4.54, 85+ years RR=2.4 95% CI=1.31-3.47. Those patients in a care home ages 65-74 and those ages 75-84 had a significantly higher percent of patients treated with any psychotropic medication than those in a care home age 85+ (p-value<0.05). Though the percent of patients treated with any psychotropic medication was higher in the care home population age 65-74 than in the care home population age 75-84, this difference was not statistically significant (p-value>0.05). When looking at the non-care home population by age band, the age band 75-84 and age band 85+ populations had significantly higher percent of patients treated with any anxiolytic, hypnotic, or antipsychotic medications than the age 65-74 population (p-value<0.05). Also, the age 85+ population had a significantly higher percent of patients treated than the age 75-84 population for the non-care home population (p-value<0.05) (Figure 6.) (Table 1).

Some interesting trends are found when comparing age band to age band within the care home population and then in the non-care home population. One would expect utilization of psychotropic medications to increase as age increases due to the notion of increased disposition to disease states requiring psychotropic medications such as antipsychotics as an individual gets older⁴. This trend is confirmed in the non-care home population, but the care home population shows the opposite. In the care home population, as the age band age increases the utilization of psychotropic medications decrease. These differences may be explained by changes in the population demographics as patients age. As one moves from one age band to another in increasing order, based on the NRS census, the proportion of males who make up that particular age band decreases. This is seen both in and out of the care homes. Therefore, with decreasing proportion of male representation in increasing age bands and evidence that a higher percentage of males are treated with a psychotropic medication in care homes, one would expect to see the decreasing percent of over all percent of patients treated in the care home population as age band increases. And, since the percent treated of females not in the care home is higher than the percent treated of males not in the care home and there is a decreasing proportion of males in the increasing age bands, one would expect to see the increasing percent of over all percent of patients treated in the non-care home population as age band increases.

Limitations

Though the presented data provides evidence suggestive of increased utilization of psychotropic medications in the elderly care home populations, there are still several limitations that must be noted. The primary limitation with this study is the inherent differences in the care home and non-care home populations that may

dictate the necessity for use of a psychotropic medication. Differences may be present between those patients in care homes and those not in care homes such that those patients in care homes have a higher diagnosis rate of disease states that require these medications, such as dementia, agitation, anxiety, etc. This data is not linked with the prescribing data used in this study and thus this influence could not be described. The days of treatment per prescription were not standardized. In this study, one prescription of a psychotropic medication is equal to another prescription of a psychotropic medication regardless of days supply or strength of the medication.

The method by which the care home population was calculated makes the assumption that there is an insignificant amount of individuals who were resident in a care home who received zero prescriptions during their stay. Given that prescriptions in care homes not only include standard medications but also a vast array of medical supplies, this was believed to be reasonable assumption. Using the 2010 NRS census estimate assumes an insignificant change in population from 2010 to 2011 with regards to psychotropic medication utilization. Due to the UPI capture rate, the data presented only represents approximately 95% of all data available and we cannot account for the influence of the remaining 5% of the data. Prescribing habits of prescribers may differ from region to region or NHS board to NHS board and influence the levels of psychotropic medications prescribed. Medication availability may differ from board to board, due to accessibility of rural health boards throughout the country, and dictate utilization of one medication over another out of necessity. Males and females may have a different diagnosis rate for disease states that require psychotropic medications that would dictate utilization of these medications. These limitations must be considered when drawing conclusions about the data.

Further Analysis

With this analysis as a foundation, additional analysis can be undertaken to further compare the care home population to the non-care home population. Further analysis of individual health boards may provide insight into the variations within each board and allow for comparison against national data. The data could be examined based on deprivation categories, which are based on socio-economic factors, providing information on patients socioeconomic statuses and psychotropic medication utilization. Further analysis on multiple psychotropic medication utilization could be done (e.g. concomitant use of anxiolytic and hypnotic, hypnotic and antipsychotic, etc.). This methodology could be undertaken with a variety of other drug classes to analyze utilization in the care homes. Other medication classes that may be of interest are antibiotics, medications for pain management, or medications for chronic conditions to explore the prevalence of comorbidities in the care home population.

Conclusion:

Care homes are designed to assist the elderly and provide skilled medical treatments to their patients. For those patients who are in care homes, there are concerns that psychotropic medications, anxiolytics, hypnotics, and antipsychotics, are over utilized and/or used in inappropriate ways. Though this study presented does not indicate causality, the data presented shows an increase in psychotropic medication use in those patients in care homes over those not in care homes. There are significant differences in the use of psychotropic medications based on gender and age as well. With the rapidly growing elderly population, it is prudent that appropriate medication utilization be on the forefront of patient care.

Acknowledgements:

I would like to thank Dr. Joseph Fink, University of Kentucky College of Pharmacy, for his assistance and guidance as my capstone advisor. I would like to also thank Stuart McTaggart, Information Services Division, National Health Services Scotland, for his guidance, collaboration, and preceptorship in developing and implementing this project. Finally, I would like to thank Dr. Melody Ryan, University of Kentucky College of Pharmacy, for her assistance and guidance in advancing this project into a poster for presentation as well as in the completion of this manuscript.

References:

- 1.) The American Geriatrics Society 2012 Beers Criteria Update Expert Panel. American Geriatrics Society Updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults. JAGS New York, New York; 2012
- 2.) Galik E, Resnick B. (2012), Psychotropic medication use and association with physical and psychosocial outcomes in nursing home residents. *Journal of Psychiatric and Mental Health Nursing*. Doi 10.1111/j.13652850.2012.01911.x
- 3.) McCowan C, Magin P, Clark S, Guthrie B. An observational study of psychotropic drug use and initiation in older patients resident in their own home or in care. 2012; *Age and Ageing* 2012; 0: 1-6. Doi: 10.1093/ageing/afs117
- 4.) Hartikainen S, Rahkonen T, Kautiainen H, Sulkava R. Kuopio 75+ study: does advanced age predict more common use of psychotropics among the elderly? *International Clinical Psychopharmacology*. 2003 May;18(3):163-7
- 5.) Furniss L. Use of Medications in Nursing Homes for Older People. *Advances in Psychiatric Treatment*. APT 2002;8:198-204
- 6.) Nishtala PS, McLachlan AJ, Bell JS, Chen TF. Psychotropic prescribing in long-term care facilities: impact of medication reviews and educational interventions. *The American Journal of Geriatric Psychiatry*. 2008 Aug;16(8):621-32. Web. August 2012
- 7.) Dhall J, Larrat EP, Lapane KL. Use of potentially inappropriate drugs in nursing homes. *Pharmacotherapy*: 2002 vol. 22 (1): 88-96. Web. August 2012
- 8.) Richter T, Mann E, Meyer G, Haastert B, Köpke S. Prevalence of psychotropic medication use among German and Austrian nursing home residents: a comparison of 3 cohorts. *Journal of the American Medical Directors Association*. 2012 Feb;13(2):187e.7-187e.13. Web. August 2012.
- 9.) Molinari VA, Chiriboga DA, Branch LG, Schinka J, Schonfeld L, Kos L, Mills WL, Krok J, Hyer K. Reasons for psychiatric medication prescriptions for new nursing home residents. *Aging Ment Health*, 2011 Sep;15(7):904-12.
- 10.) British National Formulary (online): London: BMJ Group and Pharmaceutical Press. www.bnf.org. Accessed June 2012.
- 11.) Shah SM, Carey IM, Harris T, DeWilde S, Cook DG. Quality of prescribing in care homes and the community in England and Wales. *The British Journal of General Practice*. 2012 May;62(598):e329-36. Web. August 2012

- 12.) Ohayon MM, Lader MH. Use of psychotropic medication in the general population of France, Germany, Italy, and the United Kingdom. *J of Clin Psychiatry*. 2012; 63(9):817-825. Web. September 2012
- 13.) Paulose-Ram R, Safran MA, Jonas BS, Gu Q, Orwig D. Trends in psychotropic medication use among U.S. adults. *Pharmacoepidemiology and Drug Safety*. 2007 Feb; 16(5):560-570
- 14.) Pittrow D, Krappweis J, Rentsch A, Achindler C, Hach I, Bramlage P, Kirch W. Pattern of prescriptions issued by nursing home-based physicians versus office-based physicians for frail elderly patients in German nursing homes. *Pharmacoepidemiol Drug Saf*. 2003 Oct-Nov; 12(7):595-9
- 15.) World Health Organization Collaborating Centre for Drug Statistics Methodology. <http://www.whooc.no>. Updated 2009. Accessed June, 2012.
- 16.) Schneider LS, Dagerman KS, Insel P. Risk of death with atypical antipsychotic drug treatment for Dementia. *J Am Med Assoc*. 2005; 294: 1934–43.

Appendix A.

List of drugs included under BNF codes 4.1.1 (hypnotics), 4.1.2 (anxiolytics), and 4.2.1 (oral antipsychotics)

HYPNOTICS: (BNF 4.1.1)

- BENZODIAZEPINES
 - NITRAZEPAM
 - FLURAZEPAM
 - LOPRAZOLAM
 - LORMETAZEPAM
 - TEMAZEPAM
- ZALEPLON, ZOLPIDEM, AND ZOPICLONE
 - ZALEPLON
 - ZOLPIDEM TARTRATE
 - ZOPICLONE
- CHLORAL AND DERIVATIVES
 - CHLORAL HYDRATE
- CLOMETHIAZOLE
- ANTIHISTAMINES
 - PROMETHAZINE HYDROCHLORIDE
- ALCOHOL
- SODIUM OXYBATE
- MELATONIN

ANXIOLYTICS: (BNF 4.1.2)

- BENZODIAZEPINES
 - DIAZEPAM
 - ALPRAZOLAM
 - CHLORDIAZEPOXIDE HYDROCHLORIDE
 - LORAZEPAM
 - OXAZEPAM
- BUSPIRONE
- MEPROBAMATE

ANTIPSYCHOTICS: (BNF 4.2.1)

- FIRST-GENERATION ANTIPSYCHOTIC DRUGS
 - BENPERIDOL
 - CHLORPROMAZINE HYDROCHLORIDE
 - FLUPENTIXOL
 - HALOPERIDOL
 - LEVOMEPROMAZINE
 - PERICYAZINE
 - PERPHENAZINE
 - PIMOZIDE
 - PROCHLORPERAZINE
 - PROMAZINE HYDROCHLORIDE
 - SULPIRIDE
 - TRIFLUOPERAZINE
 - ZUCLOPENTHIXOL

- ZUCLOPENTHIXOL ACETATE
- SECOND-GENERATION ANTIPSYCHOTIC DRUGS
 - AMISULPRIDE
 - ARIPIRAZOLE
 - CLOZAPINE
 - OLANZAPINE
 - PALIPERIDONE
 - QUETIAPINE
 - RISPERIDONE

Appendix B.

The 14, regionally defined, health boards of Scotland and corresponding health board code

Health Board	Health Board Code
NHS Ayrshire and Arran	A
NHS Borders	B
NHS Dumfries and Galloway	Y
NHS Fife	F
NHS Forth Valley	V
NHS Grampian	N
NHS Greater Glasgow and Clyde	G
NHS Highland	H
NHS Lanarkshire	L
NHS Lothian	S
NHS Orkney	R
NHS Shetland	Z
NHS Tayside	T
NHS Western Isles	W