Polypharmacy in elderly women after myocardial infarction.

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Abstract:

The aims of the study were to: (a) examine the number, absolute volume, and type of daily medications older women were taking 6 to 12 months post-myocardial infarction (MI); (b) describe the financial burden of cardiac medications; and (c) examine the relationship of age, education, and income to the number of medications. An analysis of a cross-sectional descriptive study of women >65 years of age who were post-MI was used. Most (89%; N = 83) were taking at least one cardiac medication, costs per day varied ($0.13–$6.75), and total number of pills taken per day was 1 to 19. Age, education, and income did not explain the number of medications. Consideration of the financial burden of medications is important to increase compliance and foster secondary prevention in older women.

Keywords: polypharmacy | older women | myocardial infarction | nursing | women | aging | post-myocardial infection medications

Article:

INTRODUCTION

Over the past decade, research has illuminated the unique issues related to women and cardiovascular disease. Cardiovascular disease is the single leading cause of death and disability in women over 50, and 75% of women, ages 60 to 79, have coronary heart disease, a type of cardiovascular disease (American Heart Association [AHA], 2006). The average age for a woman having her first myocardial infarction (MI) is 70.4 years compared to 65.8 years for men, (AHA, 2007). Women experience higher rates of mortality after MI and poorer outcomes, such as angina and heart failure, after invasive interventions such as angioplasty and coronary artery bypass grafting (Vaccarino et al., 2003, 2005). Poor clinical outcomes in women post-MI in conjunction with increased age with MI may require multiple medications to manage the symptoms. Subsequently, women with cardiovascular disease have an increased prevalence of polypharmacy (Senik & Kadir, 2006). The prefix poly- means more than one (Neufeldt & Guralnik, 1988). Thus, the definition of polypharmacy is two or more drugs taken for a period of 240 days or more (Veehof, Stewart, Haaijer-Ruskamp, & Meyboom-de Jong, 2000).

“Polypharmacy in the elderly complicates therapy, increases cost, and is a challenge for healthcare agencies” (Rollason & Vogt, 2003, p. 817). Although individuals over 65 years of age comprise 12% of the population, they account for 33% of prescriptions that are filled by pharmacists (Patel, 2003). Pharmacological therapy in the elderly is difficult due to physiological changes associated with aging, such as poor absorption and decreased metabolism, and these changes may contribute to adverse drug reactions (Trotter, 2001). Because of the effects of one medication potentiating or inhibiting the action of another medication (Fulton & Allen, 2005), polypharmacy in the older adult contributes to a further decline in renal and hepatic function (Denneboom, Dautzenberg, Grol, & DeSmet, 2006), increased fall rates (Reddy, 2006), and decreased cognition (Starr et al., 2004) and complicates health care.

In addition to cardiovascular disease, the elderly often have other comorbid conditions, like arthritis and diabetes (Robinson, 2007; Rollason & Vogt, 2003), which may also require medications for disease management or prevent the use of some cardiac medications. Elderly women are prescribed more cardiac medications, specifically beta-blockers. In fact, women significantly used antihypertensive combinations, beta-blockers, diuretics, and angiotensen converting enzyme (ACE) inhibitors more than men (Correa-De-Araujo, Miller, Banthin,, & Trinh, 2004). Because women have an MI later in life and consume more cardiac medications than men, it is important to examine if age is related to the number of medications taken by women post-MI.

In 2003, adults ages 65 and older had the lowest quantitative literacy level of all adult age groups (National Center for Education Statistics, 2007). Lack of understanding due to low literacy levels may also result in medication noncompliance. A reported variance of 11 to 29% of noncompliance is noted in the literature (Claxton, Cramer, & Pierce, 2001; Dunbar-Jacob, Bohachick, Mortimer, Sereika, & Foley, 2003), and noncompliance can significantly influence health outcomes after MI. If the physiological symptoms persist and there is no communication of noncompliance with medications, health-care providers may prescribe additional medications, contributing to polypharmacy. Further, nonadherence may also be related to the number of medications taken daily. Rudd, Ramesh, Bryant-Kosling, and Guerrero (1993) suggested that adherence rates could improve by using fewer medications and longer-acting medications. Exploring the relationships of education level to polypharmacy and the number of medications post-MI is important, especially for those with low literacy levels.

Due to the relationship between an individual's literacy level and revenue, income is also an important variable to examine in elderly women post-MI. Forty-three percent of individuals with low literacy levels live in poverty (Minnesota Literacy Council, n.d). Older women also have fewer sources of retirement income than men, and these women's income is only approximately $2300 above poverty level (Wu, 2007). The median income of women is slightly more than one-half that of men, and more importantly, these women's income is only $3,000 above poverty level (Beedon & Wu, 2005). An individual is considered to be living in poverty if their yearly income is below $10, 210 (Health and Human Services, 2007). In February 2007, Social Security payments for elderly individuals averaged $465.60 monthly or $5587.20 annually (Social Security Administration, 2007). Therefore, many women with only Social Security income are considered within the poverty level.

Guidelines from the American College of Cardiology and the AHA Task Force on Practice Guidelines (Antman et al., 2004) recommend individuals presenting with an MI are treated, unless contraindicated, with nitrates, beta-blockers, aspirin, calcium channel blockers, and ACE inhibitors. However, the costs of these medications may be unaffordable or place a significant burden on elderly women with a fixed income. Although many older adults have enrolled in Medicare Part D since the implementation in 2006, a cost savings in the standard Medicare Part D occurs only when a person has an annual medication cost of $800 (Moczygemba, 2006). The average cost of a Medicare Part D prescription coverage plan is $28.20 per month. Further, participants are expected to pay a yearly deductible of $265 for prescriptions (Centers for Medicare and Medicaid Services, 2007). These costs, coupled with the increase in costs of food, heat, and gas for daily living, poses a substantial financial burden on elderly women. Therefore, understanding the associations of income to the number of medications women are taking post-MI would be important in evaluating the influence of income on polypharmacy.

AIMS

The primary aims of this study were to examine the number, absolute volume (total number of pills), and type of medications older women were taking daily 6 to 12 months post-MI and to describe the actual or potential financial burden of cardiac medications. A secondary aim was to examine the relationship of age, education, and income to the number and absolute volume of medications taken.

METHOD

This descriptive correlation study was an analysis of data collected to examine correlates to fatigue in older women 6 to 12 months after MI (Crane, 2005). Eighty-six women from two area hospital systems and one cardiovascular clinic in the central southeast region of the United States participated in this study.

PROCEDURE

Data collection occurred in the home or at a location chosen by the participants. All women completed an informed consent and answered questions related to demographics, such as age and income. Those individuals with a medical diagnosis of dementia or who could not answer the questions were excluded from the study. The principal investigator (PI) or research assistant (RA) visually examined all the daily medications the women were taking and verified that the women were taking the medications as prescribed on each prescription bottle. Medications that were taken periodically for symptom management, for example, a headache, were not included.

This information was recorded on a form designed by the PI. All data were then entered into SPSS 11.5.

All of the medication information was categorized by classification of the medications, name of medications, number of daily doses, and number of pills taken daily. To specifically examine cardiac medications, categories were identified based on the AHA's guidelines for treating MIs: ACE inhibitors, beta-blockers, and medications to control blood pressure, specifically diuretics (Antman et al., 2004). Another category was developed for other cardiac medications not specifically recommended by the AHA such as antiarhythmics, calcium channel blockers, and nitrates. There were 11 medications in this category. Only 10% or less of the women took these medications except for digoxin, which was taken by 13%. This categorization allowed for the examination of all cardiac medications while focusing on those medications used most frequently. The total number of cardiac medications taken, based on the four categories, and the total of all medications taken for each participant in a 24-hour period were calculated. Costs of cardiac medications taken in a 24-hour period were also calculated for each participant. Estimated costs were based on the lowest prices received from Wal-Mart and Costco pharmacies. These pharmacies offer low-cost generics to all Medicare and private prescription-coverage individuals (L. D. Moss personal communication with Wal-Mart and Costco pharmacies, February 20, 2007).

Age, education, and income information were derived from the original questionnaire completed by the PI or RA. Age was the actual age reported by each participant based on their last birthday at the time of data collection. Education was classified into nine categories: (a) 8 years or less, (b) 9 to 11 years, (c) high school graduate or General Educational Development (GED), (d) some technical school, (e) technical school, (f) some college, (g) baccalaureate degree, (h) some graduate education, or (i) graduate degree or higher. Income was divided into categories based on increments of $10,000. The lowest income was less than or equal to $10,000, and the top income was over $100,000. There was a category for those who did not know their income or those who refused to disclose the information. Of the 86 participants, one had an income of greater than $100,000, and two did not know their income. Because the one participant with an income greater than $100,000 was an outlier and could skew the results, this participant and the two who did not know their income were excluded from analysis. Therefore, the final sample for this study was 83, and this number of participants had an 80% power to detect a R2 of 0.15 at a 0.05 significance level with three normally distributed independent variables.

All data were examined to verify that the assumptions for multiple regressions were met. Because the data were normally distributed, no transformations were applied.

RESULTS

The age of the individuals in this study ranged from 65 to 91 years of age. Over half of those were 75 years or younger. They took an average of seven medications per day and eight pills in a

24-hour period (see Table 1 and 2). The majority (66%) of the women reported annual household incomes above $10,000, indicating they were not in the poverty level. When comparing those women with annual incomes $10,000 or below to women whose income was above $10,000, women $10,000 or below had fewer years of education, took a greater number of pills in 24 hours, and took fewer cardiac drugs.

TABLE 1 Age and Educational Levels by Income (N = 83)

Variables	≤ $10,000	> $10,000
Age	Mean 74.78 (SD 5.301)	Mean 75.35 (SD 6.385)
Educational Level		
8 years or less	44.4%	7%
9–11 years	29.6%	21.1%
High school graduate or GED	14.8%	28.1%
Some technical school	3.7%	8.8%
Some college	7.4%	17.5%
Baccalaureate degree	0%	5.3%
Graduate degree or higher	0%	7%

Table 2 is omitted from this formatted document.

Income was categorized into two groups: those who reported annual household incomes less or equal to $10,000 or more than $10,000. A Mann-Whitney U-test was used to test differences in education and the two income levels (less than or equal to $10,000 and more than $10,000). A significant difference was noted ($p < 0.001$) between the two groups. The majority (74%) of those with incomes ≤$10,000 had 11 years or less of education compared to 29% for those with higher incomes. There were no significant differences in age, total number of pills taken, or total number of cardiac drugs taken for each group.

When examining cardiac drugs, approximately 89% of all the women were taking cardiac drugs in three categories: ACE inhibitors, beta-blockers, and diuretics. The most common ACE inhibitor was Altace (Ramipril), accounting for 59% of the women, followed by Vasotec (Enalapril) for 10%. All other drugs were less than 7%. The most common beta-blocker was

Lopressor (Metoprolol), with 35% of the women taking this drug. Lasix (Furosemide) was the most frequent diuretic, with 68% of the women taking this drug. Over half (52%) of the women were taking additional cardiac medications. Most took digoxin, accounting for 13%. The other medications in this category had from 1 to 6 women taking each drug; thus, all other medications were taken by 7% or less of the women. Table 3 describes the percent of women taking cardiac medications by income category.

TABLE 3 Cardiac Medications by Income (N = 83)

Cardiac medications	≤$10,000 (n = 27)	>$10,000 (n = 56)
ACE Inhibitors	27 (55.6%)	56 (46.4%)
Beta-Blockers	27 (66.7%)	56 (71.4%)
Diuretics	27 (44.4%)	56 (48.2%)
Other Medications	26 (48.1%)	56 (46.4%)

The financial costs of the cardiac medications ranged from $0.13 to $6.75 per day. Of those with annual incomes ≤ $10,000, at least 52% spent up to $2.66 per day or $79.80 per 30-day month. Those with incomes greater than $10,000 spent up to $2.07 per day. As expected, the costs of cardiac medications were strongly correlated with the number of cardiac pills taken daily ($r = 0.66$; $p < 0.001$). Table 4 details the costs of cardiac medications for each income group based on the most and least expensive drugs for ACE inhibitors, beta-blockers, and diuretics.

TABLE 4 Highest and Lowest Priced Medications by Income (N = 83)

	Trade (Generic)	≤ $10,000 (n = 27)	> $10,000 (n = 56)
ACE Inhibitors	Altace (Ramipril) ($1.60–$2.01/dose)	37%	25%
	Vasotec (Enalapril) ($0.13/dose)	3.7%	5.4%
Beta-Blockers	Coreg (Carvediolol) ($2.02/dose)	18.5%	3.6%
	Tenormin (Atenolol) ($0.13/dose)	18.5%	14.3%
Diuretics	Maxzide (Triamterene & HCTZ) ($1.44/dose)	0%	1.8%
	Lasix (Furosemide) ($0.13/dose)	44.4%	32.1%

A standard multiple regression was conducted to examine the relationship of the three independent variables—age, education, and income (all categories)—to the number of all medications, which included cardiac medications and other medications. Although income and age were moderately correlated ($r = 0.49$; $p < 0.001$), the model was not significant ($F = 0.295$ (3, 79); $p = 0.829$). A second regression analysis was conducted with the total number of only cardiac medications as the dependent variable. This model was also nonsignificant ($F = 1.171$ (3, 79); $p = 0.326$).

DISCUSSION

Women reported taking an average of seven medications a day. Based on the definitions that polypharmacy is two or more drugs taken for a period of 240 days or more (Veehof et al., 2000) or five or more drugs taken at the same time (Werden & Preskorn, 2003), polypharmacy was prevalent in this sample. Surprisingly, this study did not find that aging was related to polypharmacy. Women over the age of 75 years took on average fewer daily medications than those 65 to 75 years of age. These results may be related to women not having their prescriptions filled. A large study of community-dwelling elders (N = 6,535) noted that adults ages 65 to 80 were most likely to delay their medications due to costs (Klein, Turvey, & Wallace, 2004) when they only had Medicare as insurance or had large personal costs with low personal incomes. It is imperative that health-care providers be aware of the potential for polypharmacy in elderly women and issues associated with polypharmacy such as delay in filling medication prescriptions or taking less medication than prescribed related to financial burden, especially those post-MI. Future studies should not only examine the medication but also inquire if older adults have had their prescriptions filled.

Polypharmacy can be concerning for elderly women with lower educational levels. Approximately half of the women in this study who had an income in the poverty level had 8 years or less of education. Another study (Day & Newburger, 2002) that noted that women with higher levels of education, on average, have higher earnings than those with lower educational levels. Although there was not a significant difference in the educational level and the absolute number of medications taken, lower educational levels are concerning in the presence of polypharmacy.

Low education levels are associated with medication nonadherence. In a systematic review, Claxton, Cramer, and Pierce (Claxton et al., 2001) documented a 29% noncompliance rate for medications among elderly women especially when taking more than two medications. Conversely, Dunbar-Jacob et al. (2003) noted medication nonadherence rates between 11–12% in those with cardiovascular disease. These varying results may be related to the educational level of the participants. Over 80% of the sample in the Dunbar-Jacob et al. study had a high school or more education. Elderly women with low educational levels may rely on health-care professionals to be their advocate and to provide the necessary education they need to knowledgeably discuss medication issues. Therefore, health-care providers must: (a) articulate the need to reduce polypharmacy in older women, (b) ensure there is no redundancy by exploring the options of using combination drugs or extended release drugs, and (c) work with other health-care providers to reduce the number of medications taken daily.

Physician prescribing habits could potentially impose a financial burden associated with polypharmacy in elderly women post-MI. In 2003, the out-of-pocket payments for personal health care paid by women was $2,445 and $1,272 for Medicare payments (Robinson, 2007). While in this study the difference in the number of medications between the two income groups was not statistically significant, the results are clinically significant: There was no difference in medication-prescribing practices in those with low or high incomes. Prescribing choices were not influenced by income. The majority of the women took at least two cardiac medications daily, and the price of the medications did not impact which medications they were taking. This is worrisome for women whose income is at or below the poverty level. Although Medicare Part D covers a percentage of the expenses, there is a point when the women are financially responsible for the medication costs, known as the “donut hole.” Once the women have reached the yearly deductible of $265 and the initial coverage limit of $2400, they must pay the full cost of the medication until their out of pocket expense reaches $3850. At that point the catastrophic insurance is available, where the prices are reduced to the minimum co-pay of $2.15 to $5.35 per prescription. This is based on yearly expenses, and they must start over with the deductible the first of every January (Centers for Medicare and Medicaid Services, 2007). Those with lower incomes may have to make choices or sacrifices related to food, heat, and gas for daily living to ensure they can purchase their medications. Because women are more likely to have another MI in 6 years after their first MI compared to men (35% to 18% respectively) (AHA, 2006), medications are important in older women post-MI. Taking into consideration the income of women and the financial burden of medications is an important measure to foster compliance to medications and thus, enhance secondary prevention in this vulnerable population.

LIMITATIONS

When measuring income, we did not reflect the cost a spouse may spend for medications. This would be important to consider in future research to determine household financial burden related to family polypharmacy. Comprehension levels were also not addressed when examining educational levels. Completing a certain level of formal education does not necessarily reflect the ability of an individual to comprehend information either through verbal or written communication. The level of comprehension could not only affect the women's ability to question their health-care provider's prescribing habits, but may also affect compliance with medication regimes. While women who had a diagnosis of dementia or who were unable to answer the questions requiring recall were excluded, a lack of a cognitive screen is a limitation of this study. Finally, the costs associated with the cardiac medications were based on two pharmacies, one in which the individual must be able to afford a membership to use the pharmacy services. In future studies it would be important to determine which pharmacies the women were using and calculate daily costs based on the prices from the actual pharmacies. The women, especially those at the poverty level, may be using a local pharmacy because of issues with transportation. The costs associated with local pharmacies could be higher, thus affecting the true financial burden of polypharmacy on elderly women post-MI.

CONCLUSION

Although the results of this study were not statistically significant when examining age, educational levels, and income in relation to the number of medications, it is important to heighten awareness of health-care providers to the potential problems associated with polypharmacy in elderly women post-MI. Increasing the awareness of the benefits of Medicare Part D may assist in counseling elderly women in the application process of Medicare and how to evaluate the various available plans. Health-care providers should assess comprehension levels and potential financial burdens of these women to ensure compliance with medications. Furthermore, evaluating the costs and use of sustained-released medications or combination medications to improve adherence and reduce the potential financial burden associated with polypharmacy in elderly women post-MI is warranted.

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