International Journal of Applied Engineering Research
ISSN 0973-4562 Volume 10, Number 4 (2015) pp. 10149-10162

http://www.ripublication.com

Vulnerable Older Adults with Hypertension Demonstrate Age-and Gender Specific Presentations of Hypertension Management Problems

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Funding source: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

No conflicts of interest to declare.

Abstract

This study examined age-gender specific problem presentation among vulnerable older persons with hypertension who live with low income. As part of a larger community-based home visiting project, 26,622 participants completed face-to-face interviews (younger old 65-74 years, 36%; oldest old ≥75 years, 64%; women, 83%). Knowledge deficit (86%) was the most common, followed by uncontrolled blood pressure (67%), poor nutritional management (65%), and medication noncompliance (40%). Age-gender specific presentation was evident: uncontrolled blood pressure was substantially difficult in younger older men; medication noncompliance in oldest old men; overweight in younger older women; and knowledge deficit in oldest old women. This information can be helpful to health professionals in assisting vulnerable subgroups with problems having greater priority. Such a problem-based approach is likely to improve hypertension management among vulnerable elderly persons.

Key words: Hypertension; elderly; vulnerable; healthcare problem; hypertension management

Hypertension today represents a worldwide epidemic, and it is the second most prevalent chronic illness and a major public health concern in Korea (Ministry of Health and Welfare [MHW]/ Korea Centers for Disease Control & Prevention [KCDC], 2012). This chronic condition affects nearly one in three Korean adults with age-adjusted prevalence of 29.0% (MHW/ KCDC, 2012) with an associated death rate of 10.1 (per 100,000 individuals) (Ministry of Health & Welfare Statistics Portal, 2011). Hypertension increases substantially with advanced age for both men and women (MHW/ KCDC, 2012; Nelson et al., 2012). Those who were previously normotensive are also likely to develop hypertension, and after middle age and older, hypertension becomes more prevalent among women, with their incidence similar to and exceeding that of men associated with alterations in hemodynamics and hormonal metabolism (Ferrario, Jessup, & Smith, 2013; Franklin & Wong, 2013; Go et al., 2014).

Silent but longstanding livelihood with hypertension has resulted in adverse health outcomes which include cardiovascular morbidity, mortality, and associated financial burdens on both individuals and society (Go et al., 2014; Stamler, 2013). Hypertension and its control are critical for public health because it increases the likelihood of developing cardiovascular disease (CVD) (Go et al., 2014; Wong, Dede, Chow, Wong, & Franklin, 2012). In an effort to prevent cardiovascular events, a goal of hypertensive care was mainly approached for control of blood pressure. As an adjunct to pharmacologic therapy, self-management with lifestyle modification is often promoted for blood pressure control and cardiovascular risk reduction (Go et al., 2014). However, poor hypertension management is a chronic concern, which is associated in part with lifelong commitment to therapeutic regimens (Dolor et al., 2009; Lehane & McCarthy, 2007; Wong et al., 2012). In addition, due to the asymptomatic nature of hypertension in progress until acute organ injury and associated signs and symptoms occur, hypertensive individuals are often unaware of their disease severity (Kessler & Joudeh, 2010; Wolf et al., 2013). This is likely to challenge hypertension management in public health practice. In hypertension management, Korean adults with hypertension showed worse outcomes with regard to rates of awareness (66.2% vs. 81.5%), optimal treatment (60.7% vs. 74.9%), and control of blood pressure (42.5% vs. 52.5%), compared with the US adults (Go et al., 2014; MHW/ KCDC, 2012).

Such poor hypertension management and subsequently adverse health outcomes occurred more often in persons with hypertension who are older and have lower income than their counter parts (Berenson, Doty, Abrams, & Shih, 2012; Centers for Disease Control and Prevention [CDC], 2011). This community-dwelling, vulnerable population may also have difficulty engaging in intricate therapeutic regimens of hypertensive care, associated in part with their lifelong habits, knowledge deficit, or poor literacy while having lack of available aid and resources or poor healthcare access (Berkman et al., 2011; Halladay et al., 2013; Shi & Stevens, 2005). This vulnerability raises attention to the priority in public health with efforts driven toward

a population or problem-based and systematic approach to hypertensive care (CDC, 2011; Clark, Smith, Taylor, & Campbell, 2010).

Research Question

Therefore, understanding of specific problems associated with hypertensive care of this vulnerable population to is important to enhance the efficacy of hypertension management. However, few studies have investigated healthcare problems or concerns associated with hypertension management which possibly present age and gender differential characteristics in this community-dwelling vulnerable population. The purpose of this study was to address the question of whether vulnerable older adults with hypertension with low income in the community demonstrate age-gender specific presentations of healthcare problems. Specific aims were to 1) explore healthcare problems of hypertensive care among these vulnerable persons, and 2) examine age-gender specific presentation of healthcare problems of hypertensive care according to age (65 to 74 years of age vs. 75 years of age and over) and gender (male vs. female).

Methods

Design and Sample

As part of a larger community-based home visiting project across the nation, secondary data analysis was performed in this study. Data were obtained from the Korean Ministry of Health and Welfare, which provides home visiting services annually for vulnerable persons with low economic status, particularly designed for community-dwelling, older adults with hypertension. Members of this vulnerable population who were enrolled in the public healthcare system across the nation in 2012 participated in this study. Specific eligibility criteria included 1) age 65 years or older at the time of informed consent statements, 2) income households with the minimum living expenses of 120% or less or the bottom quintile in payment of health insurance, 3) having a medical diagnosis of hypertension AND high blood pressure (systolic blood pressure [SBP] $\geq$ 140 mmHg or diastolic blood pressure [DBP] $\geq$ 90 mmHg).

A goal of this home visiting service for hypertension management was to enhance the self-management skills of vulnerable elderly persons with hypertension in both rural and urban regions of Korea. The study was approved by the institutional review boards of the university and all participants completed a written informed consent statement prior to participating in home visiting services. Face-to-face interviews were conducted during the home visits by trained registered nurses. Visiting nurses collected part of the data for this study on demographics, health status, and healthcare problems associated with hypertensive care, using a standardized training manual (Ministry of Health & Welfare, 2012a).

Measures

Healthcare problems. Based on evidence from empirical and theoretical research, the project investigators generated a set of healthcare problems in hypertension management. Definition and determination of each healthcare problem was published elsewhere (Ministry of Health & Welfare, 2012a). These 10 common problems were those that hypertensive persons might encounter during their self-management of hypertension, including 1) uncontrolled blood pressure, 2) knowledge deficit, 3) medication noncompliance, 4) smoking, 5) alcohol drinking, 6) lack of physical activity, 7) poor nutritional management, primarily restriction of dietary sodium intake, 8) overweight, 9) poor stress management, and 10) lack of community resource utilization.

Statistical Analysis

In order to describe the sample, descriptive statistics were computed, including frequency and percentage. Descriptive statistics were also performed in order to identify and prioritize healthcare problems of hypertension management among vulnerable elders with hypertension (aim one). For differential characteristics of healthcare problems according to age and gender, chi-square statistics were computed (aim two). The level of significance was set at $p < .05$ for all analyses. Analyses were performed, using Statistical Analysis Software (SAS) (Version 9.3).

Results

A total of 26,622 community-dwelling older adults with hypertension were included in this study; 36% of participants were aged 65 years to 74 years (younger older adults) and 64% of them were oldest older adults (age ≥ 75 years). Approximately four fifths were women (83.2%). Knowledge deficit (86.4%) was the most common problem associated with hypertension management in this vulnerable population. Other major problems reported by one in four or more hypertensive elderly persons include uncontrolled blood pressure (67.1%), followed by poor nutritional management (64.9%), medication noncompliance (39.9.%), lack of community resource utilization (36.0%), lack of physical activity (33.5%), and poor stress management (25.3%) (Figure 1). Among lifestyle behaviors needing modification as adjunct therapeutic regimens, particular concerns in malpractice were poor nutritional management and lack of physical activity.

Healthcare Problems by Age and Gender

Age and gender specific problems in hypertension management are shown in Table 1. For both age and gender groups, the most common problem was knowledge deficit, followed by uncontrolled blood pressure and poor nutritional management. Other problematic areas reported by approximately one third or more were also found to be similar between the two age groups, respectively, in medication noncompliance (38.1% vs. 40.9%), lack of physical activity (32.3% vs. 34.2%), and lack of community resource utilization (35.5% vs. 36.3%). Common problems reported by approximately one third or more of men and women were respectively medication

noncompliance (43.1% vs. 39.2%), lack of community resource utilization (37.9% vs. 35.7%), and lack of physical activity (29.6% vs. 34.3%).

Among 10 problems, younger older adults reported significantly greater difficulties in smoking, alcohol drinking, overweight, and poor stress management; oldest older adults reported significantly greater difficulty in the following problems: knowledge deficit, medication noncompliance, and lack of physical activity. Gender specific differences were evident in the following problem areas, with men having greater difficulties than women, respectively, in smoking (18.5% vs. 3.3%, chi-square = 1,560.43, $p < .0001$) and alcohol drinking (11.0% vs. 0.7%, chi-square = 1,681.43, $p < .0001$); whereas, women had greater difficulties than men, respectively, in knowledge deficit (86.8% vs. 84.5%, chi-square = 17.88, $p < .0001$), lack of physical activity (34.3% vs. 29.6%, chi-square = 36.71, $p < .0001$), poor nutritional management (65.2% vs. 63.5%, chi-square = 4.98, $p = .03$), and overweight (11.9% vs. 9.0%, chi-square = 31.41, $p < .0001$).

Age-and Gender Specific Healthcare Problems

Significant associations of age by gender were found in most problems of hypertension management, except for stress management (Table 2). Across four subgroups according to age by gender, younger older men had greater problems of uncontrolled blood pressure (71%-66%), smoking (24%-3%), and alcohol drinking (14%-1%); oldest older men reported greater problems of medication noncompliance (44%-37%) and lack of community resource utilization (38%-35%). Younger older women had greater problems of overweight (16%-8%) and poor stress management (27%-24%); oldest older women had greater problems of knowledge deficit (88%-84%) and lack of physical activity (35%-30%). No significant association was observed in poor nutritional management, which was one of the major problems across age by gender subgroups.

Discussion

Disparities associated with hypertensive care and health outcomes are well-documented (Franklin & Wong, 2013; Go et al., 2014; Wong et al., 2012). In particular, hypertensive older adults with low income were more susceptible to adverse outcomes, including hypertensive complications and cardiovascular morbidities and mortalities, compared with hypertensive adults with higher income, when untreated or with lack of optimal treatments (Berenson et al., 2012; Ebrahimi et al., 2010; Halladay et al., 2013). Their specific needs for hypertensive care and problem-based approaches are likely to improve hypertension management and decrease disparities in associated benefits among these vulnerable persons with hypertension.

In this study, healthcare problems associated with hypertension management were investigated among community-dwelling vulnerable elderly persons with low income. The highlights of this study include that knowledge deficit, uncontrolled blood pressure, and poor nutritional management were the most prevalent problems in this large sample of vulnerable hypertensive individuals. Age-and gender specific problem

presentation was evident in that smoking and alcohol drinking were substantially difficult problems in younger older men; medication noncompliance in oldest older men; overweight in younger older women, and knowledge deficit and lack of physical activity in oldest older women. This information may be helpful to public health professionals in prioritizing problems and, accordingly, targeting vulnerable subgroups at greater likelihood of adverse health outcomes for achievement of maximal benefits of public efforts in primary care settings and in the community.

Some of these problems could be modifiable through public education and continuing support and counseling for hypertensive care. The most prevalent concern of knowledge deficit is particularly concerning because of hypertensive persons being often unaware of its severity until cardiovascular symptoms occur (Kessler & Joudeh, 2010; Wolf et al., 2013). The finding suggested that in public health practice, education of this community-dwelling vulnerable population who was mostly asymptomatic with regard to signs or symptoms of severe asymptomatic hypertension or hypertensive complications is important. Education should also highlight the importance of periodic evaluation and follow-up, which helps in determining compliance with the recommended therapeutic regimens, achievement of desired blood pressure control, and, ultimately, prevention of severe asymptomatic hypertension or development of CVD (Kessler & Joudeh, 2010).

Educational interventions were shown to be effective in increasing knowledge for hypertensive care and thus, promoting therapeutic compliance of hypertensive persons with medication and health behaviors for improvement of blood pressure control (Magadza, Radloff, & Srinivas, 2009; Martinez-Valverde et al., 2012; Park, Chang, Kim, & Kwak, 2013). An interprofessional educational initiative for hypertensive care in primary care practice improved rates of blood pressure control from baseline to nine months after the intervention in just around 50% to 70% of hypertensive persons (Tobe et al., 2014). Another form of educational and counseling intervention tailored according to individual needs and concerns regarding hypertensive care was also reported to be effective for blood pressure control and behavior modification (Park et al., 2013). It is suggested that this home visiting service for hypertension management offer education and counseling tailored according to individual problems with repeated follow-up reviews, or an alternative is to adopt periodic telephone monitoring or distant assistance in a timely manner after the intervention. Such an approach may enable community-dwelling vulnerable elderly persons to increase their hypertension knowledge, and correspondingly, better understanding and compliance with therapeutic instructions is likely to improve their skills for hypertension management.

Other prevalent problems reported by more than one third of vulnerable elderly persons were lifestyle behavioral problems, including poor nutritional management, medication noncompliance, and lack of physical activity. Poor nutritional management was not significantly different across age by gender subgroups, with each group similarly reporting this problem concerning. Difficulty following guidelines for healthy dietary intake, primarily sodium restriction is a particular concern due to its strong link with increased hypertensive complications and incident cardiovascular diseases (Du et al., 2014). According to the most recent analysis of the

national survey, amount of daily salt intake of Korean adults is 12 grams (4,800mg of sodium), with salt intake in men surpassing that of women (15.8g vs. 10.7g), which is 2.4 times higher than the World Health Organization recommendation (5-gram salt or 2,000mg of sodium) (Ministry of Health & Welfare, 2012b). The Korean dietary tradition leads to excessive sodium consumption and main sources of dietary sodium include Kimchi (fermented Korean side dishes made of seasoned vegetables, salt, and spices), soups or stews, and nodule soup (Lee, Duffey, & Popkin, 2013; Ministry of Health & Welfare, 2012b). Development of practical guidelines for sodium restriction is warranted, which should be compatible with Korean dining culture while congruently applicable in both clinical practice and in the community.

Despite a well-established benefit of antihypertensive medication for blood pressure control, its non-compliance continues to be a significant healthcare problem (Fahey, Schroeder, Ebrahim, & Glynn, 2009). In our study, approximately one third of vulnerable elderly persons reported medication noncompliance . In order to improve blood pressure control in patients with hypertension, a review of intervention studies suggested a stepped care approach involving an organized system of registration and management which enabled healthcare professionals to provide supportive care and resources necessary for compliance behavior, such as free care, frequent and convenient contact with health care professionals, or regular follow-ups (Fahey et al., 2009). It is also suggested that simultaneous understanding of intentional and unintentional factors for medication noncompliant facilitates effectiveness of interventions aimed at lifelong commitment to pharmacotherapy (Lehane & McCarthy, 2007). This home visiting service may adopt these recommendations in designing an individual hypertension management strategies, particularly understanding of unintentional factors that might highly affect medication compliance, such as demographic characteristics, intricate therapeutic regimens, or physician patient relationship (Lehane & McCarthy, 2007).

Community resource use was also lacking in community-dwelling older adults. Public centers across Korea operate a variety of health promotion programs and provide primary care for those with chronic disease. However, in this study, vulnerable hypertensive elderly persons, who are the primary consumers of these services, reported poor access to such beneficial services. Development of an effective approach or pathway for delivery of the existing services is warranted. Since launching the home visiting services in 2007 and with their successful operations, hypertension management, which is part of the services, has been offered annually to this vulnerable population in Korea (Moon & Lee, 2014). By extending its function to liaison with associated matters of vulnerable elderly, visiting nurses can help them gain access to existent healthcare resources or refer them to a support network (Moon & Lee, 2014).

Age-and gender specific problems also emerged in this vulnerable group of people. Such age and/or gender specific presentation in hypertension management has been documented for healthcare disparities and outcomes. Despite substantial public efforts to narrow the gaps in associated benefits for hypertensive care, its control was poorer in men or young adults (CDC, 2011), while after age 60 years, older women experienced substantially worse control than men (Go et al., 2014). According to the

2007 to 2010 national survey analysis, rates of awareness, treatment, and control were, respectively, 81.5%, 74.9%, and 52.5% of hypertensive adults in the United States (Go et al., 2014). In particular, those with 18 to 39 years of age showed lower rate of awareness, compared with other age counterparts (40 to 59 years of age and those ≥ 60 years of age) (Go et al., 2014). Among those under control of hypertension while on similar treatment rates between men and women, women, particularly older women, showed poorer rates of control than men in age groups of < 60 years (38% vs. 38%), 60 to 79 years (28% vs. 36%), and ≥ 80 years (23% vs. 38%), respectively (Go et al., 2014). Poorer control of hypertension in women associated with hemodynamic and hormonal alterations and sex differential treatment efficacy suggest consideration of gender-specific choices for optimal therapeutic regimens (Ferrario et al., 2013).

In this study, overweight and poor stress management were more prevalent in younger older women, while knowledge deficit and lack of physical activity were more prevalent in oldest older women, compared with those in other groups. The vulnerable hypertensive women (≥ 65 years of age) showed over representation (83.2%) in this sample, compared with overall prevalence of hypertensive elderly women in the same age group (68.5% vs. male hypertensives, 59.3%) (MHW/ KCDC, 2012). Community-dwelling elderly women are likely to be exposed to healthcare inequalities and poor health outcomes associated in part with poor economic status and subsequently high risk for poor access to medical services. Older women with chronic illness should be a priority of public health practice and they should be provided access to available public resources for healthcare, including hypertension management services in ccontinuing and coordinated support.

On the other hand, younger older men had a higher rate of uncontrolled blood pressure control. Smoking and alcohol drinking were also more prevalent in younger older men across four age-by-gender subgroups. Consistent with and expanding the vulnerability of poor control in men or young adults (Go et al., 2014), younger age was a risk factor for uncontrolled blood pressure even among older people in the current study, compared to other subgroups. On the contrary to a previous report that younger adults aged 18 to 39 years (46.0%) showed the lowest rates of medication use for blood pressure control, compared with those aged 40 to 59 years (77.1%) and those aged ≥ 60 years (80.7%) (Go et al., 2014), oldest older men had a higher rate of medication noncompliance in this study. This study adds that given those on treatment, oldest older men were at greater risk for noncompliance with the prescribed medication.

In conclusion, age-gender specific problems can be useful information for design of intensive management on a provisional basis for vulnerable individuals with hypertension with integration of their needs and problems in priority. Such a needs and problem-based approach would most likely improve hypertension management with decreases in the disparities in associated benefits. Public health education for hypertension management may also focus on specific problems of each subgroup for prevention or promotion of cardiovascular health. Given longer livelihood with hypertension, younger older men need public healthcare attention to hypertensive care, particularly blood pressure control and retractably challenging behaviors, smoking and alcohol drinking. After 60 years of age, hypertension control in elderly women is

worse than in men. Public efforts should focus on community-dwelling elderly women because of their higher likelihood of healthcare inequalities and poor health outcomes associated with poor economic status and subsequently high risk for poor access to healthcare services.

Several implications for public health practice include, first, as recommended for a population-based approach to hypertensive care because of standard care undertaken following the current guidelines in such an approach (CDC, 2011), a problem based approach is more likely to advance the care of this growing vulnerable population of people worldwide. Second, coordinated efforts are critical in such delivery of public health. Given limited resources of support, periodic monitoring and evaluation enable public health professionals to understand specific self-management needs and preferences associated with hypertensive care and to provide assistance with access to healthcare resources or referrals accordingly during home visits. Third, visiting nurses can also provide ongoing support and assistance with healthcare access as needed in such primary care practice in which continuity of care is accomplished with the promotion of lifelong behavioral modification, including medication compliance in this vulnerable population. Such public efforts may contribute to reducing the incidence of uncontrolled high blood pressure and cardiovascular morbidities and a successful acquisition is expected to eliminate disparities in associated benefits of hypertension management.

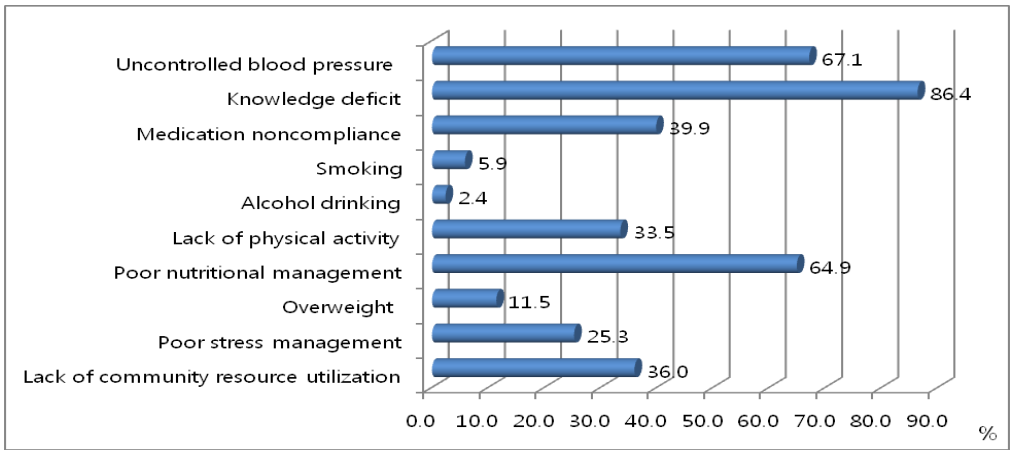

Figure 1: Prevalence of healthcare problems associated with hypertension management in community-dwelling vulnerable older adults with hypertension.

References

[1] Berenson, J., Doty, M. M., Abrams, M. K., & Shih, A. (2012). Achieving better quality of care for low-income populations: the roles of health insurance and the medical home in reducing health inequities. *Issue Brief (Commonw Fund), 11*, 1-18.

[2] Berkman, N. D., Sheridan, S. L., Donahue, K. E., Halpern, D. J., Viera, A., Crotty, K., et al. (2011). Health literacy interventions and outcomes: an updated systematic review. *Evid Rep Technol Assess (Full Rep)*(199), 1-941.

[3] Centers for Disease Contorl and Prevention (2011). *Fact Sheet: Health Disparities in Hypertension and Hypertension Control: U.S. Department of Health and Human Services.* Retrieved from http://www.cdc.gov/minorityhealth/CHDIR/2011/FactSheets/Hypertension.pdf

[4] Clark, C. E., Smith, L. F., Taylor, R. S., & Campbell, J. L. (2010). Nurse led interventions to improve control of blood pressure in people with hypertension: systematic review and meta-analysis. *BMJ, 341*, c3995. doi: 10.1136/bmj.c3995

[5] Dolor, R. J., Yancy, W. S., Owen, W. F., Matchar, D. B., Samsa, G. P., Pollak, K. I., et al. (2009). Hypertension Improvement Project(HIP): study protocol and implementation challenges. *Trials, 10*(13). doi: 10.1186/1745-6215-10-13.

[6] Du, S., Neiman, A., Batis, C., Wang, H., Zhang, B., Zhang, J., & Popkin, B. M. (2014). Understanding the patterns and trends of sodium intake, potassium intake, and sodium to potassium ratio and their effect on hypertension in China. *Am J Clin Nutr, 99*(2), 334-343. doi: 10.3945/ajcn.113.059121

[7] Ebrahimi, M., Mansournia, M. A., Haghdoost, A. A., Abazari, A., Alaeddini, F., Mirzazadeh, A., & Yunesian, M. (2010). Social disparities in prevalence, treatment and control of hypertension in Iran: second National Surveillance of Risk Factors of Noncommunicable Diseases, 2006. *J Hypertens, 28*(8), 1620-1629. doi: 10.1097/HJH.0b013e32833a38f2

[8] Fahey, T., Schroeder, K., Ebrahim, S., & Glynn, L. (2009). Interventions used to improve control of blood pressure in patients with hypertension (Review). *Cochrane Library, Vol. Issue 4.* doi: 10.1002/14651858.CD005182.pub3

[9] Ferrario, C. M., Jessup, J. A., & Smith, R. D. (2013). Hemodynamic and hormonal patterns of untreated essential hypertension in men and women. *Ther Adv Cardiovasc Dis, 7*(6), 293-305. doi: 10.1177/1753944713513221

[10] Fongwa, M. N., Evangelista, L. S., Hays, R. D., Martins, D. S., Elashoff, D., Cowan, M. J., & Morisky, D. E. (2008). Adherence treatment factors in hypertensive African American women. *Vasc Health Risk Manag, 4*(1), 157-166.

[11] Franklin, S. S, Wong. N. D. (2013). Hypertension and cardiovascular disease: Contributions of the Framingham Heart Study. *Global Heart, 8*(1), 49-57.

[12] Go, A. S., Mozaffarian, D., Roger, V. L., Benjamin, E. J., Berry, J. D., Blaha, M. J., et al. (2014). Heart disease and stroke statistics--2014 update:

a report from the American Heart Association. *Circulation, 129*(3), e28-e292. doi: 10.1161/01.cir.0000441139.02102.80

[13] Halladay, J. R., Donahue, K. E., Hinderliter, A. L., Cummings, D. M., Cene, C. W., Miller, C. L., et al. (2013). The Heart Healthy Lenoir project--an intervention to reduce disparities in hypertension control: study protocol. *BMC Health Serv Res, 13*, 441. doi: 10.1186/1472-6963-13-441

[14] Kessler, C. S., & Joudeh, Y. (2010). Evaluation and treatment of severe asymptomatic hypertension. *Am Fam Physician, 81*(4), 470-476.

[15] Lee, H. S., Duffey, K. J., & Popkin, B. M. (2013). Sodium and potassium intake patterns and trends in South Korea. *J Hum Hypertens, 27*(5), 298-303. doi: 10.1038/jhh.2012.43

[16] Lehane, E., & McCarthy, G. (2007). An examination of the intentional and unintentional aspects of medication non-adherence in patients diagnosed with hypertension. *J Clin Nurs, 16*(4), 698–706.

[17] Magadza, C., Radloff, S. E., & Srinivas, S. C. (2009). The effect of an educational intervention on patients' knowledge about hypertension, beliefs about medicines, and adherence. *Res Social Adm Pharm, 5*(4), 363-375. doi: 10.1016/j.sapharm.2009.01.004

[18] Martinez-Valverde, S., Castro-Rios, A., Perez-Cuevas, R., Klunder-Klunder, M., Salinas-Escudero, G., & Reyes-Morales, H. (2012). Effectiveness of a medical education intervention to treat hypertension in primary care. *J Eval Clin Pract, 18*(2), 420-425. doi: 10.1111/j.1365-2753.2010.01595.x

[19] Ministry of Health & Welfare. (2012a). *Guidelines for the tailored home visiting healthcare services* (1-1352000-000591-10). Seoul: Korea Health Promotion Foundation

[20] Ministry of Health & Welfare (2012b). *High salt intake in Korea* (2012-11-19 [final revision: 2012-11-20]). Retrieved from http://www.mw.go.kr/front_new/al/sal0301vw.jsp?PAR_MENU_ID=04&MENU_ID=0403&CONT_SEQ=279051&page=1

[21] Ministry of Health & Welfare Statistics Portal (2011). Mortality associated with chronic diseases. Available from http://stat.mw.go.kr/front/statData/majorIdctView.jsp?menuId=17&guidSeq=113&ctgr=F00001

[22] Ministry of Health & Welfare/ Korea Centers for Disease Control & Prevention. (2012). *Korea Health Statistics 2012: Korean National Health and Nutrition Examniation Survey (KNHANES V-3)* (11-1351159-000027-10). Seoul: Ministry of Health & Welfare.

[23] Moon, H. J, Lee, I. S. (2014). Structural Equation Modeling on Case Management Outcomes and Factors Influencing Outcomes in the Community-dwelling Vulnerable Elders. *J Korean Acad Nurs, 43*(6), 791-800.

[24] Nelson, M. R., Ramsay, E., Ryan, P., Willson, K., Tonkin, A. M., Wing, L., et al. (2012). A score for the prediction of cardiovascular events in the

hypertensive aged. *Am J Hypertens, 25*(2), 190-194. doi: 10.1038/ajh.2011.192

[25] Park, Y. H., Chang, H., Kim, J., & Kwak, J. S. (2013). Patient-tailored self-management intervention for older adults with hypertension in a nursing home. *J Clin Nurs, 22*(5-6), 710-722. doi: 10.1111/j.1365-2702.2012.04236.x

[26] Shi, L., & Stevens, G. D. (2005). Vulnerability and unmet health care needs. The influence of multiple risk factors. *J Gen Intern Med, 20*(2), 148-154. doi: 10.1111/j.1525-1497.2005.40136.x

[27] Stamler, J. (2013). Hypertension, not essential: an epidemic preventable by improved eating patterns. *J Hum Hypertens, 27*(10), 581-582. doi: 10.1038/jhh.2013.25

[28] Statistical Analysis Software (SAS). SAS System for Windows (Version 9.3). Cary, NC: SAS Institute, Inc.

[29] Tobe, S. W., Moy Lum-Kwong, M., Von Sychowski, S., Kandukur, K., Kiss, A., & Flintoft, V. (2014). Hypertension management initiative prospective cohort study: comparison between immediate and delayed intervention groups. *J Hum Hypertens, 28*(1), 44-50. doi: 10.1038/jhh.2013.48

[30] Wolf, S. J., Lo, B., Shih, R. D., Smith, M. D., & Fesmire, F. M.. (2013). Clinical policy: critical issues in the evaluation and management of adult patients in the emergency department with asymptomatic elevated blood pressure. *Ann Emerg Med, 62*(1), 59-68. doi: 10.1016/j.annemergmed.2013.05.012

[31] Wong, N. D., Dede, J., Chow, V. H., Wong, K. S., & Franklin, S. S. (2012). Global cardiovascular risk associated with hypertension and extent of treatment and control according to risk group. *Am J Hypertens, 25*(5), 561-567. doi: 10.1038/ajh.2012.2

Table 1: Healthcare Problems of Vulnerable Older Adults with Hypertension by Age and Gender (N = 26,622)

#	Health Problems	Age			Gender		
		Age 65-74 Years (n=9,593), %	Age ≥ 75 Years (n=17,029), %	Chi-square (p-value)	Male (n=4,469), %	Female (n=22,153), %	Chi-square (p-value)
1.	Uncontrolled blood pressure	67.6	66.8	1.82(.177)	70.2	66.5	22.93(**<.0001**)
2.	Knowledge deficit	85.0	87.2	24.47(**<.0001**)	84.5	86.8	17.88(**<.0001**)
3.	Medication noncompliance	38.1	40.9	20.52(**<.0001**)	43.1	39.2	22.85(**<.0001**)
4.	Smoking	7.6	4.9	83.83(**<.0001**)	18.5	3.3	1,560.43(**<.0001**)
5.	Alcohol drinking	3.5	1.8	83.78**(<.0001**)	11.0	0.7	1,681.43(**<.0001**)
6.	Lack of physical activity	32.3	34.2	10.40(**.001**)	29.6	34.3	36.71(**<.0001**)
7.	Poor nutritional management	65.2	64.7	0.69(.408)	63.5	65.2	4.98(**.026**)
8.	Overweight	15.1	9.4	200.61(**<.0001**)	9.0	11.9	31.41(**<.0001**)
9.	Poor stress management	26.7	24.5	15.01(**<.001**)	26.2	25.1	2.19(.139)
10.	Lack of community resource utilization	35.5	36.3	1.56(.211)	37.9	35.7	8.23(**.0004**)

Table 2: Age-and Gender Specific Healthcare Problems in Vulnerable Hypertensive Older Adults (N = 26,622)

#	Health Problems	Age 65-74 years		Age 75 years and over		Chi-square	p-value
		Male (n=1,862)	Female (n=7,731)	Male (n=2,607)	Female (n=14,422)		
1.	Uncontrolled blood pressure	71.16	66.8	69.51	66.35	24.74	**<.0001**
2.	Knowledge deficit	84	85.29	84.77	87.64	42.15	**<.0001**
3.	Medication noncompliance	42.48	37.01	43.5	40.43	47.94	**<.0001**
4.	Smoking	24.17	3.63	14.5	3.13	1,746.66	**<.0001**
5.	Alcohol drinking	14.39	0.93	8.52	0.53	1,845.00	**<.0001**
6.	Lack of physical activity	27.98	33.29	30.76	34.83	45.80	**<.0001**
7.	Poor nutritional management	63.59	65.63	63.37	64.98	5.95	0.114
8.	Overweight	10.63	16.22	7.86	9.65	253.75	**<.0001**
9.	Poor stress management	26.26	26.75	26.08	24.22	19.26	**<0.001**
10.	Lack of community resource utilization	37.76	35.00	38.01	35.99	10.41	**0.015**