

## Editorial



# Optimal Strategy of Hypertension Screening in a Nationwide Health Examination: Early and Periodic Blood Pressure Measurement

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► See the article “Cost-Effectiveness Analysis of Hypertension Screening in the Korea National Health Screening Program” in volume 51 on page 610.

Hypertension (HTN) occurs in approximately 30% of the adult Korean population; it is the major contributing factor for cardiovascular disease, including myocardial infarction, heart failure, and stroke.<sup>1)</sup> HTN is therefore known as a disease that results in significant medical costs. According to the Korean National Health Insurance Service (KNHIS) statistics, the estimated medical cost of treating HTN in 2020 in Korea was 3,830 billion Korean Won (KRW), accounting for 16% of medical expenses for chronic diseases.<sup>2)</sup> Therefore, early detection of HTN will help reducing future cardiovascular disease, and thus ultimately reduce the medical cost. However, in the Korea Hypertension Fact Sheet 2020, the awareness of HTN among the Korean population was only 67%<sup>2)</sup> and it has plateaued over the past 10 years.<sup>1)</sup> Moreover, its rate in patients aged under 50 years with HTN has remained below 50%.<sup>2)</sup> In comparison, in the United States, the awareness of HTN among adults was quite high, approximately 77%, when assessed in 2017–2018.<sup>3)</sup> Increasing awareness regarding HTN is a significant public health issue.

Generally, blood pressure (BP) measurement is the only method to diagnose HTN because most patients remain asymptomatic. Therefore, routine BP screening during the national health examination (NHE) is one of the effective methods for early detection of HTN. However, the optimal strategy of HTN screening in the NHE is unclear. There is limited data regarding the cost-effectiveness analysis (CEA) of HTN screening in the NHE; especially, there is no relevant data available in the KNHIS.<sup>4)</sup>

In this issue of the *Korean Circulation Journal*, Lee et al.<sup>5)</sup> have excellent suggestions for clinicians and public health providers regarding the evaluation of the CEA of routine HTN screening as a part of the NHE program. They estimated the cost of case-finding that was computed for 5-year interval age groups; moreover, the cost per quality adjusted life years gained was estimated for 12 different scenarios, including varying starting ages, examination patterns, and examination intervals compared with no screening. The major findings are as follows: first, case-based analysis showed that less than 71,000 KRW (approximately \$58) was required to find one new HTN case using the HTN screening examination for a general population over 40 years old, and the costs decreased with an increase in the examinees' age. Second, the optimal HTN screening strategy based on the CEA was the first screening examination; the second confirmatory examination in the adult population over 40 years

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was conducted after 3 years. Third, the main drivers for the incremental cost-effectiveness ratio (ICER) results were the sensitivity of the first screening examination, followed by the detection rate of the second confirmatory examination.

To improve the awareness and early detection of HTN, BP screening might be an important step in the NHE. However, the screening strategies depend on the national HTN prevalence, health care system, socioeconomic status, and CEA. Nguyen et al.<sup>4)</sup> reported that biannual screening of men and female starting at 55 years and 45 years, respectively gave a high probability of being cost-effective in community health station in Vietnam. The KNHIS conducts a free biannual health examination for adults over 40 years of age. Among these, HTN screening has a 2-step approach: if high BP is detected in the first screening examination, the second confirmatory examination is conducted on a separate day. However, according to the KNHIS's 2014 yearbook, the detection rate of the first screening was 74.8%, but the detection rate in the second confirmatory examination was less than 40%.<sup>5)</sup> If this is the case, how can we improve detection rate of HTN? Lee et al.<sup>5)</sup> reported that the cost of finding a new HTN case using NHE program for the adult population over 40 years old was quite low although they did not describe the detailed BP measurement protocol. Therefore, it is possible that the presence of HTN could be diagnosed with accurate BP measurement at the first visit. Accuracy can be affected by the environment in which it is measured, subject behavior, measurement procedures, devices used for measurement, and the observer. Therefore, to minimize errors in BP measurement, standardized measurement with validated devices is needed.<sup>6)</sup> However, there is still a concern of false-positive diagnosis due to white coat HTN. Based on the ICER analysis, Lee et al.<sup>5)</sup> suggest that the primary determinant for a diagnosis of HTN is examinee-related factors, not examiner-related factors. Therefore, ambulatory BP monitoring (ABPM) is an option as it can confirm HTN in the first screening visit, thus reducing misdiagnosis and examination costs. Beyhaghi and Viera<sup>7)</sup> reported that when ABPM was primarily used to screen patients <80 years of age, the cost savings ranged from \$128 to \$2,794. Therefore, ABPM is recommended as the diagnostic strategy of choice for most adults in primary care settings regardless of initial screening results.<sup>7)</sup> Lovibond et al.<sup>8)</sup> suggested that additional costs from ABPM were counterbalanced by cost savings from better targeted treatment. The U.S. Preventive Services Task Force (USPSTF) statement recommends that ABPM should be used to confirm a diagnosis of HTN before starting treatment although it may cause sleep disturbance and discomfort.<sup>9)</sup>

Currently, interest in the screening and management of HTN in young adults is growing, because the prevalence of HTN among young adults has increased, whereas the awareness and treatment rates remain low.<sup>2)</sup> Also, the second confirmatory examination rate is very low in a young population. Therefore, a viable alternative strategy for the young population would be to recommend ABPM in the clinic instead of encouraging a visit for secondary confirmatory examination if high BP is screened at the first visit. However, it will be discussed whether this strategy might be an excellent cost-effective alternative in the KNHIS instead of the second confirmatory examination.

Recently, the USPSTF<sup>9)</sup> continues to recommend screening for HTN in adults 18 years or older in clinical settings. HTN screening is reasonable annual examination in adults 40 years or older and in adults at high risk for HTN such as persons with prehypertension or persons with overweight or obese. In contrast, less frequent screening (i.e., every 3–5 years) is considered appropriate for adults aged 18 to 39 years who are not at increased risk for HTN and who have a prior normal BP reading. Whereas, Lee et al.<sup>5)</sup> suggest HTN screening as a

part of NHEng program was cost-effective for adults aged 40 years or older every 3 years. However, they did not consider the patient's BP levels in the first visit, which can affect the CEA for HTN screening. Moreover, they did not evaluate the impact of other risk factors such as diabetes mellitus, or obesity which might influence the clinical outcomes. Lastly, event rates were derived from the claim data, which were mainly based on the medication prescription. Therefore, it is possible that the event rate is overestimated. The results might overestimate the cost-effectiveness of HTN screening. Therefore, Lee et al.<sup>5)</sup> cautiously suggest that annual examination in adults aged 40 years or older might be more effective if the purpose of the BP examination during the NHE is not to achieve the minimum cost but to reduce the clinical outcomes in the target population, as adequate diagnosis of HTN helps provide early treatment and reduces the associated mortality and morbidity.

In summary, BP measurement is an essential step of the NHE program for early detection of HTN. We need more early and periodic BP screening such as BP measurement in adults aged 40 years or old every 3 years. However, accurate BP measurement with proper techniques and validated devices in first examination is also important point for detection of HTN. Moreover, in the future, it will be discussed whether ABPM is a cost effective alternative to improve diagnosis of HTN in the NHE.

## REFERENCES

1. Kang SH, Kim SH, Cho JH, et al. Prevalence, awareness, treatment, and control of hypertension in Korea. *Sci Rep* 2019;9:10970.  
[PUBMED](#) | [CROSSREF](#)
2. Kim HC, Cho SMJ, Lee H, et al. Korea hypertension fact sheet 2020: analysis of nationwide population-based data. *Clin Hypertens* 2021;27:8-11.  
[PUBMED](#) | [CROSSREF](#)
3. Muntner P, Hardy ST, Fine LJ, et al. Trends in blood pressure control among US adults with hypertension, 1999–2000 to 2017–2018. *JAMA* 2020;324:1190-200.  
[PUBMED](#) | [CROSSREF](#)
4. Nguyen TP, Wright EP, Nguyen TT, et al. Cost-effectiveness analysis of screening for and managing identified hypertension for cardiovascular disease prevention in Vietnam. *PLoS One* 2016;11:e0155699.  
[PUBMED](#) | [CROSSREF](#)
5. Lee HY, Lee SW, Kim HC, Ihm SH, Park SH, Kim TH. Cost-effectiveness analysis of hypertension screening in the Korea national health screening program. *Korean Circ J* 2021;51:610-22.  
[CROSSREF](#)
6. Muntner P, Shimbo D, Carey RM, et al. Measurement of blood pressure in humans: a scientific statement from the American Heart Association. *Hypertension* 2019;73:e35-66.  
[PUBMED](#) | [CROSSREF](#)
7. Beyhaghi H, Viera AJ. Comparative cost-effectiveness of clinic, home, or ambulatory blood pressure measurement for hypertension diagnosis in US adults. *Hypertension* 2019;73:121-31.  
[PUBMED](#) | [CROSSREF](#)
8. Lovibond K, Jowett S, Barton P, et al. Cost-effectiveness of options for the diagnosis of high blood pressure in primary care: a modelling study. *Lancet* 2011;378:1219-30.  
[PUBMED](#) | [CROSSREF](#)
9. US preventive Services Task Force Krist AH, Davidson KW, et al. Screening for high blood pressure in adults: USPSTF reaffirmation recommendation state statement. *JAMA* 2021;325:1650-6.  
[PUBMED](#) | [CROSSREF](#)