A cross-sectional study: a hypertension screening model using digital tensimeter as the gold standard at public health centre in Gianyar Regency, Bali Province, Indonesia

I Nyoman Purnawan,1 Sri Widati,2 Chatarina Umbul Wahyuni2

1Doctoral Programme of Public Health, Faculty of Public Health, Universitas Airlangga, Surabaya; 2Faculty of Public Health, Universitas Airlangga, Surabaya, Indonesia

Abstract

The number of patients with hypertension in Gianyar Regency tent to increase in recent years. Hypertension is the first among the tenth rank from the most common diseases, with 23% cases according to the priority scale. Hypertension treatment and management include prevention, early diagnosis, diagnosis with therapy, and screening to detect early hypertension disease. This screening includes elderly >40 years old who come to Public Health Centre in September 2021. The screening uses a questionnaire to uphold the diagnosis of hypertension disease by using a digital tensimeter as the gold standard. Based on World Health Organisation in 2018, which said it would be confirmed as hypertension if systolic ≥140 mmHg or diastolic ≥90 mmHg. 86% of 255 respondents were diagnosed with hypertension, that’s 40% were >65 years old, 75% were female, and 31% worked as housewives. The screening tool with a question list of dizziness has a sensitivity value of 99%, a specificity value of 73% with a Positive Predictive Value (PPV), and each value of Negative Predictive Value (NPV) is 96% and 89%, respectively. Headache contains a sensitivity value of 90%, a specificity value of 100%, with PPV value of 100% and NPV value of 61%. The combination of symptoms of dizziness and headache has a sensitivity value of 78%, and a specificity value of 82%, with PPV of 96% and NPV of 36%. Clinical symptoms are considered an early diagnosis of hypertension. If people who experience complaints of dizziness, headaches, or a combination of the two should immediately check their blood pressure as early as possible.

Introduction

Hypertension is a very serious problem and has become a challenge to the public health field due to its high prevalence, and become the highest mortality and morbidity rate.1 It’s related to cardiovascular disease, stroke, and renal failure and ranks third in the causes of disability; the World Health Organization estimated the amount of population with hypertension in 2018 at 26.2%, of which 34.3% occurred in developed countries and 65.7% in developing countries. Hypertension globally has the greatest impact on mortality at 60% and morbidity at 43%.2 According to the Ministry of Health’s morbidity and disability report in 2020, the prevalence of hypertension in the population over 25 years old was 28% and ranked first in various types of degenerative diseases, followed by diabetes mellitus, ischemic heart disease and stroke. The prevalence of hypertension in women was 29% compared to the male sex by 27%.3 The proportion of deaths from cardiovascular disease has increased from 18.9% in 2020 to 26.4% and became the leading cause of death in 2021. Data on deaths in hospitals in 2021 was 16.7%. Hypertension is often referred to as the silent killer and heterogeneous group of diseases because it can affect anyone from various age groups and socioeconomics.2

In general, most patients do not seem aware of the threat of high blood pressure because they do not feel any specific clinical symptoms like in other diseases, even when they often feel unwell condition. Hypertension is identified as a risk factor for cardiovascular disease, so it is necessary to carry out prevention and early treatment. The program of prevention and treatment of high blood pressure disease requires prompt and appropriate measures. Supporting human resources, program managers, and simple protocols in diagnosing hypertension will accelerate the reduction of morbidity and death due to complications such as coronary heart disease, kidney failure, angina pectoris, congestive
heart disease, stroke, and even sudden death. The clinical symptoms of hypertension can be used as a good diagnosis guideline in an effort to prevent and treat hypertensive diseases. Diagnostic guidelines according to clinical symptoms in the community are important and must be handled immediately.1,4

In Gianyar Regency, the number of people with hypertension has tended to increase in recent years. The number of people with hypertension has increased based on data from house clinics dan outpatients visiting treatment at Public Health Centre and hospitals in Gianyar Regency. The prevalence of hypertension has tended to increase in the last five years, from 0.75% in 2016 to 2.26% in 2021. The number of people with hypertension also increased according to age group, where the number of patients began to increase in the population with an age group over 25 years, while most cases were found in the age group of 60-69 years old.5 According to the disease pattern on outpatient visits at the Public Health Centre, hypertension is ranked third among the ten most diseases. It is the first order for non-communicable diseases. In contrast to the pattern of outpatient visits at the Public Health Center in 2021, hypertension ranks first with a proportion of 23.3% of the ten most disease patterns.6 Hypertension is a preventable disease, but this needs to be supported by a good level of accuracy of disease diagnosis by medical personnel in healthcare places. Screening with the aim of diagnostics of clinical symptoms of hypertension is considered very important so that accuracy is obtained as a simple protocol in determining the diagnosis and management of high blood pressure disease early to facilitate treatment quickly and precisely. The gold standard in this screening is a systolic and diastolic blood pressure check using a digital tensimeter.7 The hypertension screening tool used here is a clinical symptom felt by respondents. The control of hypertension until now has not been satisfactory, even in developed countries. In many countries, hypertension control has only reached 8% due to various obstacles ranging from patient factors to available service facilities.8 Control of hypertension in Indonesia according to the priority scale includes prevention, early discovery, and diagnosis and therapy. Prevention includes lifestyle changes and periodic examinations for the purpose of identifying hypertension early. Early diagnosis of patients was carried out by screening the population using clinical symptoms; the symptoms of hypertension include: dizziness, headache, bleeding from the nose, fatigue, red face, and others.9 The most important effort is to increase public awareness, especially among those at risk.10

This screening tool is designed to improve the awareness of high blood pressure symptoms in people who experience complaints of dizziness, headaches, or the combination.11 This screening tool would raise the control of hypertension in order to support the program of prevention and treatment of high blood pressure.12

Materials and Methods

The target of this screening activity is residents around the Public Health Centre in Gianyar Regency who are 40 years old and above who come for treatment at the Public Health Centre outpatient in September 2021.13 There are 13 Public Health Centre in Gianyar Regency, such as: Gianyar I, Gianyar II, Sukawati I, Sukawati II, Blahbatuh I, Blahbatuh II, Ubud I, Ubud II, Tampaksiring I, Tampaksiring II, Tegalalang I, Tegalalang II and Payangan. The sample was taken in people over the age of 40 years because, based on the incidence of hypertension in the Public Health Centre, the highest prevalence and at that age was at a high risk of developing hypertension.14 Patients who come to visit are interviewed using questionnaires to find out the complaints or clinical symptoms that are felt subjectively.15 Blood pressure measurement using a digital tensimeter measuring instrument is carried out in a sitting position after resting for 5 minutes.16 The cuff must match the respondent’s arm size and encircle at least 80% of the upper arm; the width of the cuff is at least 2/3 times the length of the upper arm.17 The results of blood pressure measurements are taken on average measurements twice, where the interval of measurement between the first and second measurements is 5 minutes.11

The diagnosis test in this screening is based on the clinical symptoms of hypertension, such as dizziness, headache, insomnia, irritability, feeling tired, epistaxis, nocturia, palpitations, the combination of dizziness, headache, insomnia and tired, combination of dizziness, headache, insomnia, headache, insomnia and tired, combination of dizziness and headache, the combination of headache and insomnia, and combination of dizziness and insomnia.18,19 The gold standard in the implementation of this screening is based on measuring systolic blood pressure (SBP) and diastolic blood pressure (DBP) with a digital tensimeter measurement tool.20,21 The criterion used in enforcing hypertensive disease is the WHO classification (2018), such as: if the results show that the systolic blood pressure is the same or above 140 mmHg and or the diastolic blood pressure is the same or above 90 mmHg.22,23

Results

Based on the results of the screening implementation carried out in September 2021 at 13 Public Health Centre in Gianyar Regency, the status of respondents who visited the outpatient Public Health Center was obtained in Table 1.

The results show that from 79 respondents who came for treatment at 13 Public Health Centers for 1 month after measuring systolic blood pressure and diastolic blood pressure, 68 people (86%) suffered from hypertension, and 11 people (14%) did not suffer from hypertension. The limits of systolic blood pressure and diastolic blood pressure are said to be hypertension when they are above 140/90 mmHg. The results obtained the characteristics of respondents according to the female sex, age group, and occupation. The distribution of respondents can be seen in the Table 2. Based on gender, the female sex has a larger proportion (70%) than the male sex (30%); the high proportion in women compared to men was also obtained through research conducted by Emita in 2018 that the proportion in women (55.3%) and men (44.7%).10 Meanwhile, the proportion of hypertension sufferers is most commonly found in the age group over 65 years. In line with age, almost everyone experiences an increase in blood pressure.24 In old age, an increased state of blood is needed to pump a certain amount of blood to the brain and other vital devices, but blood vessels at an advanced age have begun to weaken and the walls of blood vessels have thickened.11 The highest number of hypertension patients found in housewives (31%) this result is in

Table 1. Result of hypertension screening at 13 public health centres at Gianyar Regency in 2021.

<table>
<thead>
<tr>
<th>Respondents’ status</th>
<th>Amount (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>68 (86)</td>
</tr>
<tr>
<td>Non-hypertension</td>
<td>11 (14)</td>
</tr>
<tr>
<td>Total</td>
<td>79 (100)</td>
</tr>
</tbody>
</table>
line with a study conducted by Ranisa in 2019, which states that the proportion of housewives who experience hypertension is 79.1%. The distribution of respondents based on the clinical symptoms of hypertension and hypertension status can be seen in the following Table 3.

Table 3 proves the clinical symptoms felt by respondents showed that the single symptom was most dizziness (89%) and the least felt by respondents were symptoms of epistaxis (1%), while after combining the most clinical symptoms were a combination of dizziness and headache (68%). The lowest combined symptom is headache, insomnias, dizziness, and fatigue (7%). Meanwhile, the results of clinical trials that gave the highest positive results of hypertension were in the symptoms of dizziness (87%) and the lowest with symptoms of epistaxis (3%).

The screening of respondent’s blood pressure who come to the outpatient of the Public Health Center can be seen in Table 4.

The table proves that the respondent’s SBD ranges from 140-270 mmHg, with the average is 171.28 mmHg; from the median value, it is known that the respondent’s systolic blood pressure of 50% is above 170 mmHg, and another 50% is below 170 mmHg. Respondents’ DBD ranged from 80-140 mmHg with an average of 98.05 mmHg, while 50% of respondents had systolic blood pressure above 100 mmHg and another 50% were below 100 mmHg. The yield of each screening tool using clinical symptoms can be seen in Table 5.

Discussion

In general, the implementation of screening using clinical symptoms has a good enough yield to separate patients with hypertension from healthy individuals so that the goal of managing hypertension early can be carried out immediately. Thus, efforts to prevent the occurrence of complications against the appearance of other diseases such as coronary heart disease, kidney failure, angina pectoris, congestive heart, stroke, and even sudden death can be optimized. According to the results of the calculation of the validity of the tool, the sensitivity value and specificity of the single clinical symptoms that are best in screening cases of hypertension are dizziness and headaches. Dizziness has a sensitivity value of 99% and a specificity value of 73%, with PPV and NPV of 96% and 89%. Headaches have a sensitivity value of 90% and specificity of 100%, with PPV of 100% and NPV of 61%. Common symptoms related to hypertension as stated by Edward in 1995 such as headache, fatigue, and epistaxis, are not dominant in contributing to the exact symptoms of hypertension; this is related to the location and lifestyle of the community where the screening is carried out.

The purpose of screening is to find early cases and give adequate therapeutic. If the screening is used to find cases in order to receive treatment and treatment, then a test with a high sensitivity value is more appropriately used without regard to the specificity value of the test kit. The results of this screening are similar to Long’s research in 2019 which found that the first level of hypertension is asymptomatic; if there are early clinical symptoms, patients generally feel headaches that often arise in the morning, blurry eyes, blurred vision, fatigue and anger, insomnias and spontaneous epistaxis. Singular symptom, after being combined with other symptoms, turns out to give a fairly high value of sensitivity and specificity. The combination of dizziness and headache is a high-sensitivity screening tool value compared to other combinations of symptoms. The combination of symptoms of dizziness and headache has a sensitivity value of 76%, and a specificity value of 82% with PPV 96% and NPV 36%. This result shows that there are still 4% who are sick

Table 2. Respondents’ distribution based on sex, age range, work, and hypertension status at 13 public health centres at Gianyar Regency in 2021.

<table>
<thead>
<tr>
<th>Respondents’ characteristic</th>
<th>Hypertension status</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes (%)</td>
<td>No (%)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>17 (25)</td>
<td>7 (12)</td>
</tr>
<tr>
<td>Female</td>
<td>51 (75)</td>
<td>4 (6)</td>
</tr>
<tr>
<td>Age range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td>2 (3)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>45-49</td>
<td>15 (22)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>50-54</td>
<td>7 (10)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>55-59</td>
<td>6 (9)</td>
<td>2 (3)</td>
</tr>
<tr>
<td>60-64</td>
<td>11 (16)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>&gt;65</td>
<td>27 (40)</td>
<td>5 (7)</td>
</tr>
<tr>
<td>Work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seller</td>
<td>8 (12)</td>
<td>2 (3)</td>
</tr>
<tr>
<td>Self-preneur</td>
<td>16 (23)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Farmer</td>
<td>17 (25)</td>
<td>6 (9)</td>
</tr>
<tr>
<td>Civil servant</td>
<td>1 (1)</td>
<td>0 (1)</td>
</tr>
<tr>
<td>Housewives</td>
<td>21 (31)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Unemployment</td>
<td>5 (8)</td>
<td>1 (1)</td>
</tr>
</tbody>
</table>

Table 3. Respondents’ distributions based on clinical hypertension symptoms and hypertension status at 13 public health center in Gianyar Regency, in 2021.

<table>
<thead>
<tr>
<th>Clinical symptoms</th>
<th>Amount (%)</th>
<th>Hypertension status (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dizziness</td>
<td>70 (88)</td>
<td>67 (85)</td>
</tr>
<tr>
<td>Headache</td>
<td>61 (77)</td>
<td>61 (77)</td>
</tr>
<tr>
<td>Combination dizziness and headache</td>
<td>54 (68)</td>
<td>52 (66)</td>
</tr>
<tr>
<td>Insomnia</td>
<td>31 (39)</td>
<td>29 (37)</td>
</tr>
<tr>
<td>Combination dizziness and insomnia</td>
<td>28 (35)</td>
<td>26 (33)</td>
</tr>
<tr>
<td>Combination headache and insomnia</td>
<td>23 (29)</td>
<td>20 (25)</td>
</tr>
<tr>
<td>Combination headache, insomnia and dizziness</td>
<td>20 (25)</td>
<td>19 (24)</td>
</tr>
<tr>
<td>Fatigue</td>
<td>16 (20)</td>
<td>14 (18)</td>
</tr>
<tr>
<td>Anger</td>
<td>15 (19)</td>
<td>11 (14)</td>
</tr>
<tr>
<td>Combination headache, insomnia and fatigue</td>
<td>12 (15)</td>
<td>10 (13)</td>
</tr>
<tr>
<td>Palpitations</td>
<td>7 (9)</td>
<td>4 (5)</td>
</tr>
<tr>
<td>Combination headache insomnias, dizziness, fatigue</td>
<td>11 (14)</td>
<td>10 (13)</td>
</tr>
<tr>
<td>Nocturia</td>
<td>5 (6)</td>
<td>3 (4)</td>
</tr>
<tr>
<td>Epistaxis</td>
<td>4 (5)</td>
<td>2 (3)</td>
</tr>
</tbody>
</table>

Table 4. The scale of clients with hypertension’s blood pressure at 13 public health center outpatient client Gianyar Regency in 2021.

<table>
<thead>
<tr>
<th>Blood pressure</th>
<th>Lower (mmHg)</th>
<th>Higher (mmHg)</th>
<th>Mean (mmHg)</th>
<th>SD (mmHg)</th>
<th>Median (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic</td>
<td>140</td>
<td>270</td>
<td>171.28</td>
<td>18.86</td>
<td>170</td>
</tr>
<tr>
<td>Diastolic</td>
<td>80</td>
<td>140</td>
<td>98.05</td>
<td>10.11</td>
<td>100</td>
</tr>
</tbody>
</table>
declared not sick, and 64% who should not be sick are declared sick.\textsuperscript{35,36}

In other words, the yield of this screening tool has the ability to identify hypertension quite well. This tool is expected to be considered a screening tool.\textsuperscript{37} This is in accordance with previous research conducted by Jiang \textit{et al.} in 2018. Jiang \textit{et al.} reported that clinical symptoms that have high validity in establishing a diagnosis of hypertension in the community are headaches and dizziness with sensitivity and specificity values of 98.1% and 2.1% for headaches and 85.2% and 33.4% for dizziness, respectively, while PPV and NPV were 36.1% and 66.7% for headaches and 85.2% and 33.4% for dizziness, respectively.\textsuperscript{10}

**Conclusions**

Screening tools that have high validity are dizziness, headaches, or a combination of the two that can be used as a hypertension screening tool.\textsuperscript{38} It is hoped that screening tools need to be tested on more patients with hypertension in the wider community.\textsuperscript{39} Patients diagnosed with hypertension should be treated immediately in accordance with hypertension management procedures.\textsuperscript{40}

**References**


**Table 5. Yield clinical screening at 13 public health centers in Gianyar Regency.**

<table>
<thead>
<tr>
<th>Hypertension clinical screening</th>
<th>Sensitivities</th>
<th>Specificities</th>
<th>Validity (%)</th>
<th>PPV</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dizziness</td>
<td>99</td>
<td>73</td>
<td>96</td>
<td>89</td>
<td></td>
</tr>
<tr>
<td>Headache</td>
<td>90</td>
<td>100</td>
<td>100</td>
<td>61</td>
<td></td>
</tr>
<tr>
<td>Combination Dizziness and Headache</td>
<td>76</td>
<td>82</td>
<td>96</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Insomnia</td>
<td>43</td>
<td>82</td>
<td>92</td>
<td></td>
<td>19</td>
</tr>
<tr>
<td>Combination Dizziness and Insomnia</td>
<td>38</td>
<td>82</td>
<td>93</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Combination Headache and Insomnia</td>
<td>29</td>
<td>72</td>
<td>87</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Combination Headache, Insomnia and Dizziness</td>
<td>28</td>
<td>90</td>
<td>95</td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>Fatigue</td>
<td>21</td>
<td>82</td>
<td>88</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Anger</td>
<td>16</td>
<td>64</td>
<td>73</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Combination Headache, Insomnia and Fatigue</td>
<td>15</td>
<td>89</td>
<td>83</td>
<td></td>
<td>13</td>
</tr>
<tr>
<td>Palpitations</td>
<td>6</td>
<td>72</td>
<td>57</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Combination Headache, Insomnia, Dizziness and Fatigue</td>
<td>15</td>
<td>91</td>
<td>91</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Nocturia</td>
<td>4</td>
<td>89</td>
<td>60</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Epistaxis</td>
<td>3</td>
<td>89</td>
<td>50</td>
<td></td>
<td>12</td>
</tr>
</tbody>
</table>

PPV, positive predictive value; NPV, negative predictive value.


