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Proportion and Characteristics of Patients who Measure their Blood Pressure at Home: Nationwide Survey in Slovenia

Marija Petek-Šter, Igor Švab, Dean Klančič

Department of Family Medicine, Medical Faculty, University of Ljubljana, Ljubljana, Slovenia

SUMMARY

Introduction Home blood pressure monitoring has several advantages over blood pressure monitoring at a physician's office, and has become a useful instrument in the management of hypertension.

Objective To explore the rate and characteristics of patients who measure their blood pressure at home.

Methods A sample of 2,752 patients with diagnosis of essential arterial hypertension was selected from 12596 consecutive office visitors. Data of 2,639 patients was appropriate for analysis. The data concerning home blood pressure measurement and patients' characteristics were obtained from the patients' case histories.

Results 1,835 (69.5%) out of 2,639 patients measured their blood pressure at home. 1,284 (70.0%) of home blood pressure patients had their own blood pressure measurement device. There were some important differences between these two groups: home blood pressure patients were more frequently male, of younger age, better educated, from urban area, mostly non-smokers, more likely to have diabetes mellitus and ischemic heart disease and had higher number of co-morbidities and were on other drugs beside antihypertensive medication. Using the logistic regression analysis we found that the most powerful predictors of home blood pressure monitoring had higher education level than primary school OR=1.80 (95% CI 1.37-2.37), non-smoking OR=2.16 (95% CI 1.40-3.33) and having a physician in urban area OR=1.32 (95% CI 1.02-1.71).

Conclusion Home blood pressure monitoring is popular in Slovenia. Patients who measured blood pressure at home were different from patients who did not. Younger age, higher education, non-smoking, having a physician in urban area and longer duration of hypertension were predictors of home blood pressure monitoring.

Keywords: hypertension; home blood pressure monitoring; general practice; nationwide survey; characteristics of patients

INTRODUCTION

Home blood pressure monitoring has some advantages over the monitoring of blood pressure at a healthcare institution, such as a higher frequency of measurements, no 'white coat' effect, and no observer bias in the case of automatic devices [1]. Home blood pressure measurement – opposite to office measurements and similarly to ambulatory blood pressure measurement – predict cardiovascular mortality [2, 3], targeted organ damage [4], and are better predictors of stroke compared to office measurements [5].

In a meta-analysis, where 18 randomized trials were compared, it was found that the values of systolic and diastolic blood pressure were lower in patients who measured their blood pressure at home, and a higher proportion of patients reached their target blood pressure [6]. Another primary care study confirmed these findings. The main reasons for better blood pressure control in patients who measured their blood pressure at home were better treatment compliance and more active management by the physicians [7].

General practitioners accept home blood pressure measurement as a simple method which improves patients' insight into blood pressure control and prevents unnecessary treatment or changes of treatment [8-10]. In a nationwide survey about physicians' view on the use of home/self blood pressure monitoring in Hungary, they found that 90% of physicians recommended its use either often or almost all the time and 75% considered the results of self blood pressure monitoring either considerably or extremely important [11].

The patients accepted self-measurement of blood pressure in the general practitioner's office as valuable, their level of anxiety was not increased [8], and in some studies it was found that the number of physician's office visits decreased [8, 12]. Home blood pressure measurement was shown to be cost-effective in diagnosis and treatment of arterial hypertension [12, 13].

The European Society for Hypertension recommended home blood pressure measurements for any hypertensive patient who was sufficiently motivated to participate in the treatment of his own hypertension and who stayed under medical supervision [14]. An international consensus on home blood pressure measurements recommended the use of automatic, validated blood pressure measurement devices with an arm-cuff appropriate for the patients, whose ability for home blood pressure measurement should be checked once a year [15].

Self monitoring of blood pressure has the potential to improve blood pressure control without additional cost and it is well accepted by physicians and patients. There are no data in the literature about the proportion and characteristics of patients who measure their blood pressure at home on the nationwide level.

OBJECTIVE

According to verbal reports, there is high interest for home blood pressure measurements in Slovenia, but until now there were no data on the proportion and characteristics of patients who also measured their

own blood pressure out of the physician's office. This study aimed at finding the proportion and characteristics of primary care patients with arterial hypertension who measured their blood pressure at home in Slovenia.

METHODS

We took a random sample of 50 out of 806 family physicians from the list of Slovene Family Medicine Society. They were chosen randomly from the register of Slovene Family Physicians Society. Forty-two physicians consented to participate in the study (response rate was 84%).

According to the number of inhabitants in the area of the general practice, we classified the practices into urban area (over 10,000 inhabitants) and rural area (below 10,000 inhabitants). Patients in Slovenia usually have their general practitioner in the community in which they live, meaning that we should assume that patients attending the general practitioner in the urban area live in urban regions and vice versa.

The sample comprised all patients aged over 18 years with diagnosis of arterial hypertension, who were among 300 consecutive office visitors in each of 42 randomly selected general practices in Slovenia.

Out of 12,596 visits of the physician's office, 2,752 (21.9%) patients were diagnosed with arterial hypertension. One hundred thirty-three patients were excluded from the analysis, because we did not have data on out of office blood pressure monitoring. We analyzed the sample of 2,639 patients.

This randomly selected sample of general practitioners and patients provided a representative national sample of patients with arterial hypertension.

The research was observational and cross-sectional. The source of data for filling in the questionnaires was a written medical record and patients' answers to questions on home blood pressure measurement.

The data on home blood pressure measurement were provided by patients during the visit in which the sample population was selected. All patients who said that they also measured their blood pressure out of physician's office were included in the group of patients who performed home blood pressure monitoring, irrespective of the place or person who performed out of office blood pressure monitoring (home, pharmacy, neighbours, community nurse, etc.), blood pressure device they used or the frequency of home blood pressure measurements.

Co-morbidities were defined as any chronic condition (lasting at least three months) other than hypertension.

Definitions of the most important chronic conditions were:

- Smoking – regular smoking at least one cigarette per day
- Obesity – body mass index 30 kg/m^2 or over
- Dislipidemia – total cholesterol >6.5 mmol/l or hypolipemic drugs
- Diabetes mellitus – fasting blood glucose 7.0 or more on two different occasions or blood glucose 11.1 or more on any occasion
- Ischemic heart disease – data about angina or myocardial infarction in medical record
- Cerebrovascular disease – data about cerebrovascular insult or transitory ischemic attack in medical record
- Arrhythmias – data on chronic atrial fibrillation in medical record

The data were obtained from 1st October 2003 to 31st March 2004.

Statistical analysis

The data were analyzed using the statistical package SPPS for Windows, version 14. Mean values and standard deviations (SD) were calculated. We used the Student t-test for comparison between independent samples, the chi-square test to detect qualitative differences between the samples. We used the method of multiple logistic regression to compare the characteristics of patients in self blood monitoring group to the group of patients without self-blood pressure mentoring. We used $p<0.05$ as the threshold of statistical significance. The National Ethical Committee approved the study.

RESULTS

Characteristics of participating physicians and practices

The sample of GPs consisted of 42 physicians - 13 men and 29 women, aged from 33 to 63 years, with the mean of 44.1 years (SD 7.7 years). Twenty-two physicians were vocationally trained, 11 physicians were on vocational training and 9 physicians were without vocational training. Eight physicians were private contractors working in independent practices, and 34 were employed by health centres and working in group practices.

The participants were from all regions of Slovenia. There were 22 practices from urban and 20 practices from rural areas. The average distance between the practices and the nearest hospital was 24.7 km (from 1 to 80, SD 27.4 km, median 16 km).

The sample of patients with hypertension

Out of 12,596 office visitors in 42 general practices there were 2,752 patients (21.9%) with arterial hypertension. The data of 2,639 patients fulfilled the requirements of the analysis. The characteristics of study population are presented in Table 1.

The number of patients according to the out of office blood pressure monitoring is presented in Table 2.

Characteristics of patients with hypertension who measured their blood pressure at home

A total of 1,835 (69.5%) patients measured their blood pressure also out of physician's office; of these, 1,284 (70.0%) patients measured their blood pressure at home with their own blood pressure monitoring device.

Table 1. Characteristics of participating patients

Variables	Value
Number of males	39.8%
Mean age (SD)	64.0 (12.5) years
Educational level higher than primary school	51.1%
Patients from rural areas	51.6%
Mean duration of hypertension (SD)	10.0 (7.5) years
Patients with arrhythmias	8%
Mean BMI (SD)	28.9 (4.9) kg/m2
Clinically obese patients	35.5%
Smokers	9.5%
Patients with dislipidemia	56.0%
Patients with diabetes	19.0%
Patients with cerebrovascular disease	7.0%
Patients with ischemic heart disease	20.6%
Mean number of comorbidities (SD)	1.5 (1.2)
Mean number of antihypertensive drug classes (SD)	2.0 (1.0)
Mean number of other drug classes (SD)	1.4 (1.2)
Mean systolic blood pressure	146.3 (16.5) mm Hg
Mean diastolic blood pressure	86.0 (9.3) mm Hg

NS – non-significant

Table 2. Number of patients measuring their blood pressure at home

Characteristics of patients	Number of the patients
Home blood pressure monitoring, with their own blood pressure monitoring device	1284 (48.7%)
Home blood pressure monitoring, without their own blood pressure monitoring device (community nurse, pharmacy, neighbours,...)	551 (20.9%)
Without home blood pressure monitoring	804 (30.5%)

There were statistically significant differences in the characteristics of the patients with self blood pressure measurement and office measurement (Table 3).

Logistic regression of patients' characteristics influencing home blood pressure monitoring

Using the multivariate analysis, home blood pressure monitoring depended on the listed characteristics of the patients (Table 4); younger age, education higher than primary school, practice in urban area, longer duration of hypertension, non-smoking. Other variables included in the analysis were sex, body mass index, dislipidemia, diabetes, cerebrovascular disease, ischemic heart disease, number of co-morbidities, number of other than antihypertensive drugs.

DISCUSSION

Statement on principal findings

Two-thirds of the patients with arterial hypertension who visited their general practitioner also measured their blood pressure at home. The patients who measured blood pressure at home differed significantly in some characteristics from those who did not. The patients who measured their blood pressure at home were more frequently male; they were younger, better educated, from urban area, less often smoked, were more likely to have diabetes mellitus and ischemic heart disease and had a higher number of co-morbidities and took other drugs besides antihypertensives.

The most powerful predictors of home blood pressure measurement were higher education, non-smoking and patients' attending practices in urban area.

Strengths and weaknesses of the study

The strength of the study is that it included a large and on the national level representative sample of general practitioners and patients with arterial hypertension. Physicians who participated in the study were not different from the general population of Slovene GPs according to their demographical characteristics (sex, age), level of professional education or location of the practice (urban, rural) [16]. Representative sample of physicians and their patients gave us valuable data on the extent of home blood pressure measuring and the characteristics of patients with arterial hypertension who measured their blood pressure at home.

The study had some limitations. First of all, the findings were representative of the attendees of general practitioner's offices in Slovenia, but not for the entire hypertensive population in our country. The second limitation of the study was that we did not know if the patients were urged by their general practitioners to measure their blood pressure at home or not. It could be possible that general practitioners advised home blood pressure monitoring more often to patients who were at the highest risk for cardiovascular disease or in patients whom they considered to be more appropriate for home blood pressure measurement (affordable blood pressure monitoring device, high motivation, understanding the explanation of method).

Based on the studied factors we were able to explain only a small proportion of variability of the use of home blood pressure monitoring. Potential other factors which could explain the rest of variability could be other characteristics of patients; predominantly psychosocial characteristic of the patients [17], patients' level of hypertension knowledge [18], working style of the physician including doctor's recommendation to perform home blood pressure monitoring [19] and the level of cooperation between the physician and the patient [20].

Strengths and weaknesses in relation to other studies

A high proportion of treated primary care patients with arterial hypertension in Slovenia measured their blood pressure out of physician's office. In a survey about the prevalence of home blood pressure monitoring in treated hypertensive patients attending a hypertensive hospital in Italy, it was found that 74.7% of patients regularly measured their blood pressure at home [21]. In a cohort survey of primary care patients, 43.1% of patients reported currently using home blood pressure monitoring [18].

Table 3. Characteristics of patients with and without home blood pressure measurements

Variables	Group with home blood pressure measurements (N=1835)	Group without home blood pressure measurements (N=804)	p
Number of males	42.0%	36.0%	<0.001
Mean age (SD)	63.0 (12.2) years	65.8 (12.7) years	<0.001
Educational level higher than primary school	58.5%	38.0%	<0.001
Patients from rural areas	46.1%	64.1%	<0.001
Mean duration of hypertension (SD)	10.3 (7.6) years	9.3 (7.3) years	0.002
Patients with arrhythmias	8%	10%	0.071 (NS)
Mean BMI (SD)	28.9 (4.7) kg/m^2	29.0 (5.3) kg/m^2	0.747 (NS)
Clinically obese patients	35.2%	36.1%	0.684 (NS)
Smokers	9.0%	10.7%	0.196 (NS)
Patients with dislipidemia	57.0%	55.0%	0.481 (NS)
Patients with diabetes mellitus	20.0%	17.0%	0.027
Patients with cerebrovascular disease	7.0%	7.0%	0.866 (NS)
Patients with ischemic heart disease	22.3%	16.7%	0.001
Mean number of comorbidities (SD)	1.5 (1.2)	1.3 (1.2)	0.003
Mean number of antihypertensive drug classes (SD)	2.1 (1.1)	1.9 (1.0)	<0.001
Mean number of other drug classes (SD)	1.4 (1.2)	1.3 (1.2)	0.015

NS – non-significant

Table 4. Logistic regression of home blood pressure monitoring (model: χ^2=68.890; 13 degrees of freedom; p<0.001). The model explains 8.0% of the total variability of home blood pressure monitoring.

Variable	B	SE	χ^2	p	Exp (B)	95% CI (lower)	95% CI (upper)
Constant	2.148	0.648	11.003	0.001			
Younger age	0.024	0.006	13.687	<0.001	1.023	1.011	1.037
Educational level higher than primary school	0.589	0.139	17.804	<0.001	1.801	1.371	2.368
Patients from urban areas	0.297	0.133	4.370	0.037	1.321	1.017	1.715
Duration of hypertension	0.038	0.010	15.111	<0.001	1.038	1.019	1.058
Non-smoking	0.767	0.223	11.824	0.001	2.160	1.390	3.330

The data about the number of treated hypertensive patients who owned a blood pressure monitoring device in France was comparable to our data. In France 43% of treated hypertensive patients owned a blood pressure monitoring device [22].

In our study we did not ask the patients who recommended them home blood pressure monitoring, which is one of the shortcomings of our study. According to the literature, home blood pressure monitoring was recommended in only 12% of hypertensive patients in France [22] and in 43.1% of primary care patients included in the cohort study performed in the USA [18].

The reasons for the high proportion of patients measuring their blood pressure at home in Slovenia could include the positive attitudes of general practitioners toward home blood pressure measurement [8-11], the provision of blood pressure measurement in public places (for example, at a pharmacy) and advertisements for low-cost home blood pressure monitors by mass media.

The characteristics of the patients who measured blood pressure at home differed in some characteristics from the patients who did not. The study confirmed the finding of a previous study that younger, male patients who were better educated measured their blood pressure at home more often [21, 23]. On the contrary to the finding of the study performed at a secondary healthcare institution [23] and in line with the results of the study performed at a primary healthcare institution it was found that patients with the history of stroke/transitory ischemic attack were more likely to use home blood pressure monitoring [18], we found that primary care patients who measured their blood pressure at home were more seriously ill (longer duration of hypertension, a higher number of co-morbidities, diabetes or ischemic heart disease). A possible explanation for this finding could be better compliance to treatment and higher interest for blood pressure control in patients who were at the highest risk for cardiovascular diseases [24, 25].

In our study we found that the patients from urban regions measured their blood pressure at home more frequently. Patients from urban regions compared to rural regions had a better blood pressure control [24, 26, 27], which could be explained by home blood pressure monitoring that potentially improved the patient's compliance with treatment and better blood pressure control [6, 25].

The most important predictors of home blood pressure monitoring were a higher level of education (lasting over 8 years), non-smoking and attending the general practitioner in urban area. It was found that patients with the knowledge level of hypertension higher than 90th percentile were more likely to use home blood pressure monitoring than patients with a level of hypertension knowledge lower than 10th percentile [18]. There was probably a correlation between hypertension knowledge and the level of education.

The level of education is a valuable indicator of the socioeconomic status [27]. According to the results of our study we can conclude that home blood pressure monitor-

ing could be predicted in higher socioeconomic classes, which once again confirms the socioeconomic inequalities in hypertensive patients [29]. These findings support the need for more effective interventions if health disparities in patients with chronic conditions and low socioeconomic status should be reduced.

CONCLUSION

Patients with arterial hypertension are motivated for home blood pressure monitoring. We found several important differences between the patients who measured blood pressure at home and those who did not. The most powerful predictors of home blood pressure monitoring are better education, non-smoking and living in urban areas. All these factors correspond to higher socioeconomic classes.

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Односи и одлике болесника који врше мерење крвног притиска код куће: национално истраживање у Словенији

Марија Петек-Штер, Игор Шваб, Деан Кланчич

Одељење за породичну медицину, Медицински факултет, Универзитет у Љубљани, Љубљана, Словенија

КРАТАК САДРЖАЈ

Увод Мерење крвног притиска код куће има неколико предности у односу на бележење вредности крвног притиска у лекарској ординацији, што постаје корисна испомоћ у лечењу хипертензије.

Циљ рада Циљ рада је био да се испитају односи и одлике болесника који врше мерење крвног притиска код куће.

Методе рада Од 12.596 особа које су у консекутивном низу долазиле у лекарске ординације, одабран је узорак од 2.752 болесника са дијагнозом есенцијалне артеријске хипертензије. Од њих је затим одабрано 2.639 испитаника чији су подаци били одговарајући за анализу. Подаци о кућном мерењу крвног притиска и одликама болесника добијени су из њихових историја болести.

Резултати Од 2.639 болесника 1.835 (69,5%) је мерило крвни притисак код куће. Од тог броја 1.284 испитаника (70,0%) су имала сопствене апарате за мерење крвног притиска. Утврђене су значајне разлике између две групе испитаника: болесници који су мерили крвни притисак код куће били су најчешће мушкарци, млађе старосне доби, образованији, из урбаних средина, ређе пушачи, чешће оболели од дијабетес мелитуса и исхемијског обољења срца; такође, чешће су имали још неко обољење и узимали су друге лекове сем антихипертензивних. Анализом логистичке регресије утврђено је да су најзначајнији фактори предикције да ће болесник мерење крвног притиска вршити код куће били следећи: степен образовања већег степена од основне школе (*OR*=1,80; *95% CI* 1,37-2,37), непушење (*OR*=2,16; *95% CI* 1,40-3,33) и доступност лекара у урбаној средини (*OR*=1,32; *95% CI* 1,02-1,71).

Закључак Мерење крвног притиска код куће је веома популарно у Словенији. У нашем истраживању болесници који су мерили крвни притисак код куће разликовали су се од оних који то нису чинили. Предсказатељи особа које су крвни притисак мериле код куће били су: млађа старосна доб, виши степен образовања, непушачи, приступачност лекара у урбаним насељима и продужено трајање хипертензије.

Кључне речи: хипертензија; кућно мерење притиска; општа медицина; национално истраживање; одлике болесника

Marija PETEK-ŠTER

Department of Family Medicine, Medical Faculty, University of Ljubljana, Poljanski nasip 58, 1000 Ljubljana, Slovenia

Phone: +386 31 607752; **Fax:** +386 7 3481769; **Email:** marija.petek-ster@mf.uni-lj.si