

# The Use of a Modified Blood Pressure Device to Detect Atrial Fibrillation in Outpatients

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## To cite this article:

Haroldas Razvadauskas, Laima Jankauskienė, Albinas Naudžiūnas. The Use of a Modified Blood Pressure Device to Detect Atrial Fibrillation in Outpatients. *Cardiology and Cardiovascular Research*. Vol. 4, No. 2, 2020, pp. 47-51. doi: 10.11648/j.ccr.20200402.13

**Received:** March 6, 2020; **Accepted:** March 24, 2020; **Published:** April 21, 2020

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**Abstract:** The prevalence and integration of self-monitoring devices is increasing across healthcare systems, [1] and this is leading to patients taking greater responsibility for their health and well-being. Our aim was to compare two groups of patients with reoccurring atrial fibrillation (AF) and their ability to detect AF with the Microlife BP A6 device. The groups were divided according to being symptomatic or asymptomatic for AF. Method: The study was conducted for 3 years. The patients were selected from Kaunas clinical hospital in Kaunas, Lithuania. In total, 60 people took part in the study. The major criterion for inclusion was based on patients having AF upon arrival. During the period of hospitalisation, they were restored to having sinusoidal rhythm (SR). There were two groups of patients in the study. The first group had clear symptoms during the onset of rhythm disturbance and the second group was asymptomatic. All patients under the age of 18 years and those who did not sign the agreement to participate were excluded from the study. The patients were contacted every 6 months by phone call and a questionnaire was filled. The statistical analysis was performed using SPSS 23 and Microsoft Office Excel 2007 software. The results were deemed statistically significant when  $p < 0.05$ . Results: There is a statistical difference between the symptomatic and asymptomatic AF patients as compared to how useful they found the device and its effect on anxiety ( $p < 0.05$ ). There was no statistical difference between the two groups on how frequently they used the device. The research also shows that there was no difference based on gender, education levels. Conclusion: There is a statistically significant portion of AF asymptomatic patients that find the Microlife BP A6 “very useful” and an anxiety reliever as compared to patients that are symptomatic for the condition. Both groups have statistically equally poor adherence in using the device at home.

**Keywords:** Atrial Fibrillation, AF, Secondary Prevention of Atrial Fibrillation, Stroke, Self-monitoring Device, Microlife BP A6

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## 1. Introduction

Self-monitoring devices are starting to play a larger role in modern healthcare systems — especially in cardiology [1, 2]. A growing problem in cardiology is the rising number of people suffering from atrial fibrillation (AF) and this number is expected to increase in the E. U. [3]. Patients that develop AF have a fivefold greater likelihood of suffering from brain stroke [3].

Patient self-care with self-monitoring devices can be greatly beneficial in earlier diagnosis, prevention of complications and in reducing healthcare costs [3, 4]. There is

also an indication that atrial fibrillation detection devices can even reduce anxiety levels in subjects [13].

The other problem with AF is that there is a certain group of patients who do not feel heart rhythm disturbance and the silent or asymptomatic AF prevalence is hard to assess. Though in about one - third of patients with this arrhythmia, patients are not aware of the presence of AF [10] and this can lead to a delay in detection and diagnosis. Therefore AF detection devices might play an important role in such patients.

At the same time, self-monitoring devices can present their own challenges. It is known that self-monitoring for hypertension or medication use can be lacking in patients [5].

Our study focused on the use of the Microlife BP A6 blood pressure monitoring device with atrial fibrillation detection. Microlife BP A6 technology has shown to effectively detect atrial fibrillation [6]. The specificity of 86% and sensitivity of 95%.

Another study showed that the Microlife BP A6 showed a sensitivity of 95%, specificity of 92% and an accuracy of 94% [8]. The effective detection of rhythm disturbances can prevent medical complications and debilitating complications such as strokes [8, 9].

Though the device has shown to be effective in detection, there [8] has been little research done in the ability of Lithuanian patients to use the device independently at home.

Whilst the effectiveness of self-monitoring depends on two key factors: on the device and on the patient using it, we were interested in the ability of the patients to adhere to using the device for a period of months at home. We were also interested in investigating if the device can reduce anxiety in AF patients.

Hence, the research was set up to investigate patients' adherence to the use of the Microlife BP A6 device over a period of a couple of years and to examine its effect on anxiety.

## 2. Method

The study was conducted for three years. The patients were selected from Kaunas clinical hospital in Kaunas, Lithuania. In total 60 people took part in the study. The major criterion for inclusion was based on patients having AF upon arrival. During the period of hospitalisation, they were restored to having sinusoidal rhythm (SR). All patients under the age of 18 years and those who did not sign the agreement to participate were excluded from the study.

There were two groups of patients in the study: one that had clear symptoms during the onset of rhythm disturbance and the second which was asymptomatic.

The research was conducted for 3 years. The patients were contacted every 6 months by phone call and a questionnaire was filled. The statistical analysis was performed on a total of

34 patients.

The statistical analysis was performed using SPSS 23 and Microsoft Office Excel 2007 software.

The results were deemed statistically significant when  $p < 0.05$ .

## 3. Results

The study included 34 patients: 18 (52.9%) males and 16 (47.1%) females. The age of the subjects' ranged from 53 to 91 years with a mean age of  $73.09 \pm 8.781$ .

There were 6 (17.6%), 18 (52.9%) and 10 (29.4%) patients with primary, secondary and tertiary education, respectively. From the 34 patients, 23 (67.6%) subjects felt AF and the other 11 (32.4%) were asymptomatic for it.

The study was run for three years. There were 26 patients that dropped out such that there were 34 patients by the end of the study.

The statistical analysis was performed using SPSS 23 and Microsoft Office Excel 2007 software. Due to the sample size, the Shapiro-Wilk test was applied to evaluate the normality of the data distribution. Where data was not naturally distributed a Chi-square test was applied. The association between age and frequency of AF blood pressure apparatus use was evaluated using the Spearman's correlation test. The results were deemed statistically significant when  $p < 0.05$ .

Our analysis focused on symptomatic and asymptomatic AF groups. We were interested to find out how frequently the device was used and how useful the patients found the device (tables 1 and 2).

Then we looked at the possible influence of gender, the frequency of use and patients' perspective on how useful the device was (table 3 and table 4).

We compared the influence of age on the frequency of use and patients' perspective on how useful the device was (table 5). The possible influence of education levels on use frequency and patients' perspective on how useful the device was also analysed (table 6 and table 7).

Finally, we examined if patients self-reported reduced anxiety levels (table 8).

**Table 1.** The frequency of use of the BP device for symptomatic and asymptomatic AF subjects.

Groups	How frequently do you use the BP measuring device per week?				$\chi^2$ and p sig. values
	Do not use	Use less than 7 per week	Use 7-14 per week	Use 14 per week	
Symptomatic for AF n=23	2 (8.7%)	12 (52.2%)	1 (4.3%)	8 (34.8%)	$\chi^2 = 0.358$
Asymptomatic for AF n=11	1 (9.1%)	5 (45.5%)	1 (9.1%)	4 (36.4%)	p= 0.949

There is no statistical difference in how frequently the devices are used between asymptomatic and symptomatic AF patients ( $p > 0.05$ ).

**Table 2.** The subjects' perception of how useful the BP device as compared to symptomatic and asymptomatic AF patients groups.

AF groups	Was the BP device useful?				$\chi^2$ and p sig. values
	No	Not a lot	Average usefulness	Very useful	
Symptomatic AF n=23	6 (26.1%)	4 (17.4%)	6 (26.1%)	7 (30.4%)	$\chi^2 = 8.437$
Asymptomatic AF n=11	1 (9.1%)	1 (9.1%)	0 (0.0%)	9 (81.8%)	p= 0.038

There is a statistical difference between symptomatic and asymptomatic AF patients and their perception on how useful they found the device to be ( $p < 0.05$ ). The patients that were asymptomatic for AF found the BP device more useful in contrast to symptomatic AF subjects.

**Table 3.** The frequency of the BP device use as compared to gender.

Gender	How frequently do you use the BP measuring device per week?				$\chi^2$ and p sig. values
	Do not use	Less than 7 per week	Between 7 to 14 per week	14 times per week	
Male n=18	1 (5.6%)	11 (61.7%)	0 (0.0%)	6 (33.3%)	$\chi^2 = 3.699$ p= 0.296
Female n=16	2 (12.5%)	6 (37.5%)	2 (12.5%)	6 (37.5%)	

There is no statistically significant difference between genders and the frequency of use of the BP device ( $p>0.05$ ). It seems that both men and women used the device equally frequently.

**Table 4.** The patient's perspective on how useful the BP device as compared to gender.

Gender	Was the BP device useful?				$\chi^2$ and p sig. values
	No	Not a lot	Average usefulness	Very useful	
Male n=18	4 (22.2%)	3 (16.7%)	2 (11.1%)	9 (50.0%)	$\chi^2 = 1.146$ p= 0.766
Female n=16	3 (18.8%)	2 (12.5%)	4 (25.0%)	7 (43.8%)	

There is no statistically significant difference between gender and patient's perspective on the usefulness of the device ( $p>0.05$ ).

**Table 5.** The relationship between age and BP device frequency of use and perspective of the patient on how useful the device is.

		Age
The frequency of use of the device	r	-0.022
	p	0.900
The patients' perspective on how useful the BP device is	r	-0.217
	p	0.219

The results show that there is a negative correlation between age and frequency of use of the BP device. The older the patient the less he or she uses it. Though this finding is statistically insignificant  $p>0.05$ . There is also a negative correlation between the perspective of the patient on how useful the device is and the subject's age. This is statistically insignificant ( $p>0.05$ ).

**Table 6.** The frequency of use of the BP device as compared to patient education levels.

Education level	How many times do you use the device per week?				$\chi^2$ and p sig. values
	Do not use	Less than 7 per week	Between 7 to 14 per week	14 times per week	
Primary n=6	1 (16.7%)	4 (66.7%)	0 (0.0%)	1 (16.7%)	$\chi^2 = 6.411$ p= 0.378
Secondary n=18	2 (11.1%)	6 (33.3%)	2 (11.1%)	8 (44.4%)	
Higher education n=10	0 (0.0%)	7 (70.0%)	0 (0.0%)	3 (30.0%)	

There is no statistically significant difference between education levels and frequency of use of the device ( $p>0.05$ ).

**Table 7.** The patients' perspective on how useful the BP device is compared to their education levels.

Education	Was the BP device useful?				$\chi^2$ and p sig. values
	No	Not a lot	Average usefulness	Very useful	
Primary n=6	2 (33.3%)	4 (66.7%)	0 (0.0%)	0 (0.0%)	$\chi^2 = 19.651$ p= 0.003
Secondary n=18	3 (16.7%)	1 (5.6%)	3 (16.7%)	11 (61.1%)	
Higher education n=10	2 (20.0%)	0 (0.0%)	3 (30.0%)	5 (50.0%)	

There is a statistically significant difference between different education levels and on the perception of how useful the BP device is ( $p<0.05$ ).

**Table 8.** The comparison of anxiety levels reported by both groups of patients.

AF groups	Did the device reduce anxiety?		$\chi^2$ and p sig. values
	No	Yes	
Symptomatic AF (n=23)	16 (69.6%)	7 (30.4%)	$\chi^2 = 7.886$ p= 0.009
Asymptomatic AF (n=11)	2 (18.2%)	9 (81.8%)	

There is a statistically significant difference between symptomatic and asymptomatic patients and anxiety felt ( $p=0.009$ ).

## 4. Discussion

There has been little research done on the diagnostic

sensitivity and specificity of self-monitoring AF devices. Such devices have become more prevalent as discussed by H. R. Marston *et al.* in mobile self-monitoring of an ECG device to diagnose arrhythmia. Though little research has been done towards the adherence of patients in using them [12], our research sought to correct this.

The study shows that patients poorly adhere to

self-monitoring with only 35% of patients in both groups (symptomatic and asymptomatic) self-monitoring as recommended (Table 1). This result is in line with Michael Burnier and Brent M. Egan research article; Adherence in Hypertension: A Review of Prevalence, Risk Factors, Impact, and Management [11]. The research shows suboptimal compliance in using antihypertensive drugs among subjects with primary hypertension. Our research indicates that poor adherence extends to self-monitoring too.

The patients were informed of this fact, told about complications such as stroke and were provided with an information leaflet.

When comparing the two groups of the study, the patient group that felt signs and symptoms associated with AF as compared to the asymptomatic group, we saw a clear difference in the usefulness of the Microlife A6 device. There was a statically significant portion of asymptomatic patients that found the apparatus “very useful” as compared to patients that were symptomatic for the condition. The percentage was ~82% and ~30% respectively and the p-value was 0.038 (Table 2). There was no statistical difference between how frequently both genders used the device and how useful they found the device to be  $p > 0.05$  (Table 3 and Table 4).

What is peculiar about both groups of patients as mentioned before is that they used the device equally infrequently. This is contrary to logic that if one group would find the device more useful, they would use it more frequently. A larger study needs to be carried out to better analyse this result.

Looking back as to why asymptomatic patients might have found the device subjectively more useful, it could have been due to anxiety levels that are associated with not knowing about the possible new onset of rhythm disturbance. When two groups were compared on how they perceived the influence of the device on anxiety levels, 81.8% of asymptomatic for AF felt that having and using the device reduced anxiety. Whilst only 30.4% of symptomatic patients felt that the device had helped with anxiety. These results were indeed statistically significant  $p = 0.009$  (Table 8).

Though education level did not influence the frequency of use of the device, (Table 6) it played a role in patients’ perception of how useful the device was. There was a statistically significant difference between education levels and on the perception of how useful the BP device is ( $p = 0.003$ ). Though the sample is, of course, small, it indicates that patients with secondary and higher education more frequently deemed the device as being “very useful” as compared to patients with primary education (Table 7).

One speculation why this might be the case is a fear of the unknown. Asymptomatic patients never know when they can have reoccurring AF. This can increase anxiety in the patient. Hence the device provides the patient with an ability to check their heart rhythm and reduce anxiety. This conclusion concurs with research by N. Lowres *et al.* [13], where researchers suggested that using an iPhone electrocardiogram might be very important in reducing anxiety. As anxiety can be one of the triggers in reoccurring atrial fibrillation, hence

some therapeutic benefits could be attained by using AF self-monitoring devices by outpatients.

Though bizarrely enough asymptomatic patients did not use the device more frequently than symptomatic patients. Hence further investigations need to be performed before we can gain more insights into the use of AF self-monitoring devices.

The results show that there is a negative correlation between age and frequency of use of the BP device (Table 5). The older the patient the less he or she uses it. Though this finding is statistically insignificant  $p > 0.05$ .

This issue needs to be further investigated in larger studies as cognitive decline occurs with older age [15]. What is less known is how this could influence patients’ use of AF detection devices. Therefore further studies need to be conducted on the influence of cognitive function in self-monitoring.

There is also a negative correlation between the perspective of the patient on how useful the device is and the subjects’ age. This is statistically insignificant ( $p > 0.05$ ).

In summary, we can see that patients have poor adherence to self-monitoring and more needs to be done to improve it. Nonetheless, we can see devices can have usefulness beyond their intended diagnostic function. The devices seem to reduce perceived anxiety levels in AF asymptomatic patients much more than in the other group, though we state this with care as the sample size of the study was small and the patient population was homogenous.

Hence we see that self-monitoring devices have a large part to play in patients’ health today and the future, yet informing patients of complications and even giving out leaflets is not enough.

We also propose that patients that are asymptomatic for reoccurring AF should be advised to acquire these BP measuring devices with an atrial fibrillation detection function.

## 5. Conclusion

The research indicates that patients’ devotion to using the Microlife BPA6 device can be as low as for any anti-hypertensive drug [5]. Hence, more research is needed to understand how patients can better conform to using such self-monitoring devices. This is despite patients being informed of the importance of early self-diagnosis and the complications which can arise from AF, such as stroke.

The device seems to reduce anxiety more in patients with asymptomatic AF as compared to symptomatic patients which concurs with previous research [13]. The reduction in anxiety could have benefits in decreasing reoccurring AF [14]. Therefore, we recommend that Cardiologists and family doctors take a more proactive approach in recommending the Microlife BPA6 or any other such device to asymptomatic AF patients.

Our research showed that age could have a negative correlation with the use of the apparatus. However, this was statistically insignificant, and a larger study needs to be done

to reject or accept this conclusion.

## Conflict of Interest Statement

There is no conflict of interest for this study to report. The Microlife BP A6 devices were acquired with researchers funds.

## Acknowledgements

We want to thank Darius Milkevičius a Microlife representative in Lithuania for assisting us with the use and maintenance of the devices during the research period.

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