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## THE IDEAL PROFILE OF THE TELEMEDICINE USER– EXPERIENCE FROM PORTUGAL

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### Abstract

Over the last few years, all over the world, telemedicine has been gaining momentum, and became more accepted by both health workers and patients as an essential tool in medicine. There have been a considerable number of studies whose results show the benefits of telemedicine programmes, not only in cost reduction and decreasing the number of exacerbations and hospital admissions, but also in improving health outcomes, with the patients having a better understanding of their illness and how they can manage it. This study is based on a tele monitoring programme being carried out in the village of Sabugueiro in Portugal. This village is one the first “Smart mountain villages” in the world, and besides having the concept of Internet of Things” applied to its infrastructure, it also has a tele-monitoring component, where blood pressure, blood glucose levels and weight of part of the population are monitored, in both healthy and unhealthy individuals. Abnormal changes of these parameters are very prevalent in our society, being responsible for a great deal of the national health system expenditure and being an important risk factor for cardiovascular events, the number one cause of death in Portugal. Therefore, their correct management is of vital importance in order to reduce costs, morbidity and mortality related to these events. However, this programmes results fell short of what was desired, with low compliance by the patients, who did not make the recommended number of measurements. The main goal of this study was to understand what can improve the compliance of a telemonitoring patient, what they find the most difficult to cope with, and when this kind of programme is useful.

**Keywords:** telemedicine; telehealth; eHealth; informatics; Internet of Things; adherence

### Introduction

Over the last few years, telemedicine has been gaining momentum, and has become more accepted as an essential tool in medicine. Many studies demonstrate the benefits of telemedicine programmes.<sup>1,2,3</sup> In Portugal there has been a significant increase in the demand for telemedicine services, not only due to differences in healthcare access between rural and urban areas, but also in an attempt to decrease waiting lists. Many programmes have been very successful, like COPD telemonitoring, dermatology, and paediatric cardiology, amongst others.<sup>4</sup> Every telemedicine programme faces a lot of challenges, therefore, before they can be implemented, it is crucial to plan carefully. Details related to demographics, health professionals and technologies available, as well as economic feasibility should always be considered.<sup>5-8</sup> Despite all the technology and innovation supporting telemedicine, these systems are still imperfect, given that they are still very dependent on human interaction and most of them do not work in tandem with one another. Only about 2% of all devices in healthcare are interconnected, this reality will soon suffer a revolution with the development of the “Internet of Things” (IoT).<sup>9</sup>

This study is based on a telemonitoring programme being carried out in the village of Sabugueiro in Portugal. This village, one the first “smart mountain villages” in the world, has the concept of IoT applied to its infrastructures, but also has a health telemonitoring component. Blood pressure (BP), blood glucose (BG) levels, and weight of part of the population are monitored in both healthy and unhealthy individuals. Abnormal changes of these parameters, which are prevalent in our society, are responsible for a great deal of the national health system expenditure. They are important risk factors for cardiovascular events, the number one cause of

death in Portugal. Therefore, their correct management is of vital importance in order to reduce costs, morbidity and mortality related to these events. The main goal of this study was to understand what can improve the compliance of a telemonitoring patient, what they find the most difficult to cope with, and when this kind of programme is useful.

### Methods

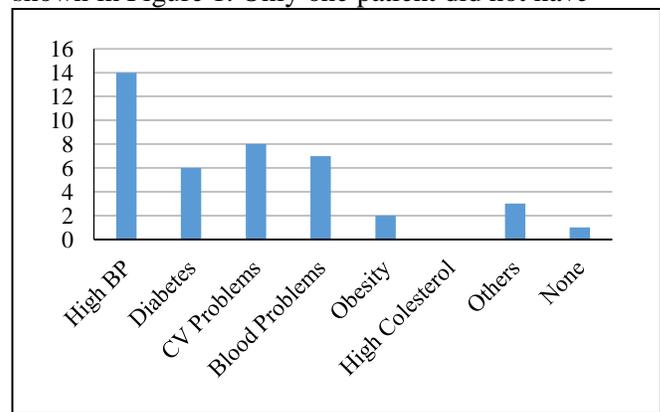
The patients of the telemonitoring programme in Sabugeiro were invited to answer an questionnaire, after written consent. Seventeen (17) patients have answered it so far. The questionnaire was based on a “technology acceptance model”, which consists of a behavioural model commonly used to predict and explain the use of information technologies in scientific research by analysing the ease of use, the perceived usefulness, and the intention to use.<sup>10</sup> According to Davis it is the most frequently used model to investigate the adherence to new information technologies in the professional sphere.<sup>11</sup> This questionnaire is divided into four different segments: demographics, ease of use, perceived usefulness, and intention to use. A statistical analysis of these intermediate results was performed.

**Table 1.** Demographics

Patient	Age (y)	Sex	Level of study	Employment	Exercise	Annual Doctor's appointments	Internet Access	Do you know the term telemedicine?
1	71	M	1° Cycle	Retired	No	Three to five	Yes	No
2	50	F	Secondary school	Yes	Yes	One to two	Yes	Yes
3	43	M	1° Cycle	Yes	Yes	One to two	Yes	No
4	82	F		Retired	No	One to two	No	No
5	45	M	2° Cycle	Yes	No	Three to five	Yes	No
6	47	F	1° Cycle	Yes	Yes	One to two	Yes	No
7	74	M	1° Cycle	Retired	Yes	Three to five	No	No
8	90	F	1° Cycle	Retired	No	More than ten	No	No
9	72	F	1° Cycle	Retired	No	More than ten	No	No
10	71	F	1° Cycle	Retired	Yes	Five to Ten	No	No
11	62	F	1° Cycle	Retired	Yes	Three to five	No	No
12	73	F	1° Cycle	Retired	Yes	One to two	No	No
13	66	F	1° Cycle	Retired	Yes	Three to five	No	No
14	80	F	1° Cycle	Retired	Yes	Three to five	No	No
15	54	F	2° Cycle	Yes	Yes	One to two	No	No
16	84	F	1° Cycle	Retired	No	Three to five	No	No
17	76	M	Illiterate	Retired	No	One to two	No	No

### Results

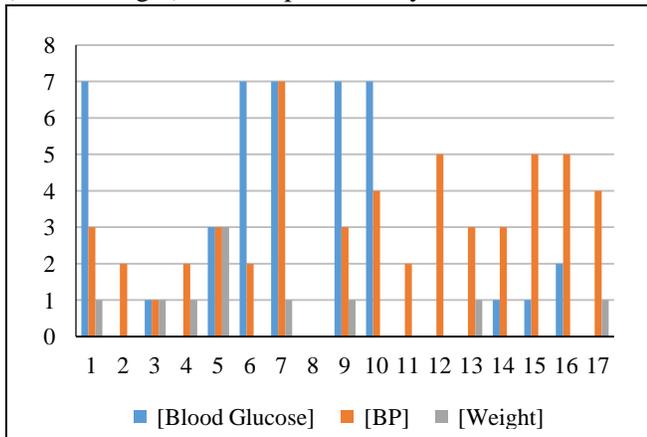
The mean age of the patients was 67 years, with most being females 12 (70.6%), retired 12 (70.6%) and with a low level of education. All have regular appointments with their physician, but only a few measure their BP, BG and weight regularly. Despite expectations, only 5 (29.4%) of the patients had Internet access in their home. (Table 1) All of them considered the use of information and communications technologies (ICT) in healthcare to be important. The health status of the population is shown in Figure 1. Only one patient did not have



**Figure 1.** Reported health status of the patients who responded.

any health problem diagnosed. Fourteen had high BP, 12 had more than one illness, and 9 (53%) noted at least one hospitalisation due to complications. The patients had a good understanding of their condition and know the ideal values of the readings, mainly when it comes to BP.

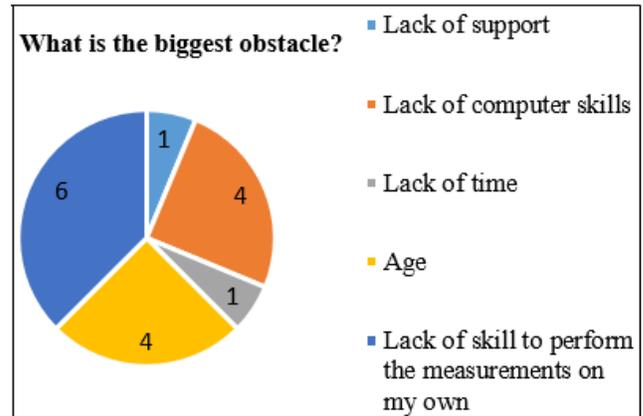
Regarding ease of use, the number of answers fell short from what was expected, because 10 of the patients were not able to make the measurements on their own, receiving help from caregivers in the senior’s residence. For the remaining seven patients, six considered the system easy to use, having all the help they needed. Half of the patients do their measurements regularly (Figure 2), with BP being the most frequently monitored parameter. One patient (number eight) did not provide any information.



**Figure 2.** Number of measurements by patients.

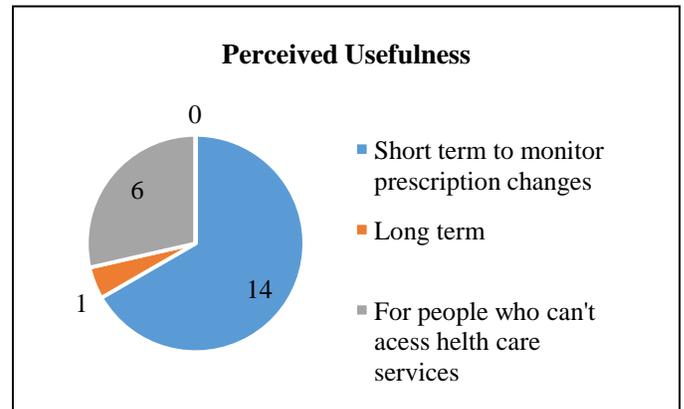
Since the beginning of the programme, 10 patients (66.7%) maintained the number of recommended measurements, with only two reducing the frequency. Also the majority of patients complained not being able to justify changes in measurements related to their health status. Lack of skill to make the measurements on their own was considered to be the main limitation to the use of this system. (Figure 3)

All the patients admitted to having developed a better understanding of the way certain activities, food or habits can influence their health status. They also All the patients admitted to having developed a better understanding of the way certain activities, food or habits can influence their health status. They also considered that the system can help improve their communication with health workers and most were happy with the feedback they receive.



**Figure 3.** Obstacles to telemonitoring cited by patients.

Fourteen patients (82%) found telemonitoring to be most useful for “short term situation(s) to monitor prescription changes” (Figure 4). Each patient could choose more than one answer.



**Figure 4.** Perceived usefulness.

Many considered that the population could benefit from this kind of initiative, and from the 11 answers, all wanted to join this study because they either felt that it was important to participate in their health management, or because they felt the need to participate due to health problems. All wanted to continue in the programme, except for one patient who would only continue if some changes were implemented. Almost all were happy with the telemonitoring programme (Figure 5).

## Discussion

The advanced mean age and low levels of education are probably the main obstacles to an efficient



**Figure 2.** Level of satisfaction.

implementation of the programme. Elder patients referred to having difficulties using the system and most of them could not perform the measurements on their own. However those that were able to do so, found the system easy to use, as found by Abdullah et al.<sup>12</sup> and Hanley et al.<sup>13</sup> with their telemonitoring programmes. Abdullah et al.<sup>12</sup> also found to be important the lack of a way to justify the changes in measurements, and that their patients were afraid that the physicians would not correctly interpret the readings. The same complaint was seen in this study. However, Abdullah et al.<sup>12</sup> said that their patients had difficulty understanding the implications of their readings and had lack of feedback, which was not the case here.

All patients in this study considered the use of these technologies in health care important, and were open to it. Saddik and Al-Dulaijan also saw this<sup>1</sup> noting that diabetic patients were in favour of using a telemonitoring programme, and by Finkelstein et al.<sup>14</sup> who found that a population of asthmatic patients had a great deal of interest in the use of tele-technologies to monitor their illness.

Similar to Saddik and Al-Dulaijan<sup>1</sup> this study showed advanced age, low level of education, and the lack of an Internet connectivity to be related to low interest in using tele technologies. Their study showed patient age, level of education, employment, and access to the Internet were directly correlated with interest in using teletechnologies. On other hand, some recent studies have stated the exact opposite, saying that old age significantly predicts a better adherence to telemonitoring, with educational levels

not playing such an important role.<sup>15</sup> Finally, similar to Abdullah et al.<sup>12</sup> patients considered this kind of programme to be useful, particularly for a specific reason such as for the adjustment of prescriptions and monitoring side effects for a short term.

## Conclusion

Despite limitations, there was adherence to the telemonitoring programme, with a significant increase in the number of measurements after the beginning of the programme. Overall patients were satisfied with the feedback, and most reported a positive impact on their health status and were motivated to continue. However, changes to the programme are required for long term success. Patients suggested free Internet access in the village and a more efficient way to solve technical problems would improve adherence. Also, improvement of the data base, implementation of a way of bi-directional interaction between patient and professional, and creation of an alarm system are necessary. As concepts such as IoT progress, it would be interesting to try new technologies that could be more autonomous. Pending changes and further successful evaluation, implementation of similar projects in other areas should be considered to promote better integration and access to health services and to fight isolation of the elderly, a prevalent problem in Portugal.

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**Conflict of interest.** The authors declare no conflicts of interest.

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