A Survey on Telemedicine in a Sleep Clinic During the COVID-19 Pandemic: Benefits and Barriers!

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Abstract

Background. Several restrictive measures have been taken to prevent the spread of SARS-CoV-2, restricting the access to outpatient follow-ups, increasing waiting lists in chronic diseases, such as obstructive sleep apnea (OSA). The aim of study is to evaluate the benefits and the barriers of telemedicine in a sleep clinic.

Methods. Subjects with diagnosis of OSA treated with continuous positive airway pressure (CPAP) were surveyed with a phone-questionnaire to assess the difficulties and knowledge of remote monitoring systems (telemedicine). Furthermore, the participants were divided into two groups according to the favor of telemedicine visits, POSITIVE (in-favor) and NEGATIVE (in favor of in-person visits) and compared with statistical methods.

Results. Fifty-three OSA participants (85% men), aged 67,9±7,5 yrs and BMI 36,0±8,0 kg/m 2 were enrolled in the study. The comparison of POSITIVE (24/53) and NEGATIVE (29/53) groups showed some significant differences: knowledge of telemedicine (p=0,001), high education level (p=0,01) and high computer skills (p=0,001) are the main factors influencing the acceptance of telemedicine. In addition, 57% of overall participants seem more likely to conduct a remote visit in the future.

Conclusions. Although telemedicine is a useful tool, a majority of patients in our study preferred in-person visits. However, they are willing to conduct telemedicine visits in the future, so our findings suggest that improving patient computer skills and updating technological systems in order to facilitate patients' access may be important strategies to boost acceptance of telemedicine.

Background

In the face of an aging population, increasing chronic disease, anticipated shortages of many types of health care workers, and soaring health care costs, new models of health care delivery are inevitable(1). The COVID-19 pandemic has forced many providers to move quickly to Telemedicine, including visits by phone and video, thus avoiding disruption in patient care(2). Telemedicine is a doctor-patient interaction encompassing any medical activity at a distance via a telecommunications system(3). In the last few decades, these systems have attracted increasing attention and have been used in the management of chronic diseases such as respiratory diseases, e.g., COPD(4).

Among the chronic diseases in which use of Telemedicine systems has found wide application in the management of disease is Obstructive Sleep Apnea (OSA)(5). OSA is a sleep disorder that affects a large number of people who require night-time ventilation therapy as they experience partial (hypopnea) or total (apnea) cessation of airflow due to brief and repeated episodes of upper airway obstruction spaced by the resumption of regular breathing subsequent to awakening(6). Therefore, these patients need continuous health and technical support for the evaluation of ventilatory prostheses which is lacking during the SARS-CoV-2 pandemic.

In response to the spread of SARS-CoV-2, the AASM (American Academy of Sleep Medicine) in accordance with the recommendations of the Centers for Disease Control and Prevention (CDC) had initially stopped all routine procedures in the diagnosis and follow-up of patients with OSA and recommended only emergency procedures. Subsequently, the recommendations included implementing the use of face coverings by employees and patients, physical removal, hygiene practices, symptom screening before entering clinical spaces, COVID-19 pre-testing and, above all, the widespread use of telemedicine(7, 8).

Based on this background, the aim of the study is to evaluate the current knowledge of telemedicine, to highlight some challenges on patients with chronic diseases such as OSA that require a long-term management and to help the implementation of the telemedicine as an important tool to provide remote clinical care.

Methods

The study was conducted on subjects with severe OSA in night-time therapy with CPAP between January 2020 and December 2020. After informed consent, the following data were collected from each participant: age, sex, body mass index (BMI), comorbidity, educational level, place of residence (urban or rural) and daytime sleepiness by Epworth sleepiness scale (ESS) (9). Further on, a telephone questionnaire was administered to these participants from July 2020 to August 2020. The questionnaire was designed in 9-items focusing on different topics: device management problems during the period of suspension of follow-up care services due to the Covid-19 pandemic, knowledge of telemedicine, experience with computer systems, willingness to replace in-person visits with remote visits and the possibility of applying these remote visits to solving waiting list problems. After administering the questionnaire, participants were divided into two groups according to their perception of telemedicine, the POSITIVE group (participants in favor of telemedicine) and the NEGATIVE group (in favor of in-person visits) and then the two groups were compared with several statistical analyses (see statistical analysis paragraph).

All procedures performed in studies were in accordance with the ethical standards of the Institutional Review Board and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants.

Statistical analysis

The continuous variables are presented as mean (± standard deviation), while categorical variables as count or percentage. According to the preferences of remote visits, the participants were classified in two groups (POSITIVE and NEGATIVE) and then were compared by T-test for unpaired samples or Mann-Whitney U-test, as appropriate. X^2 (Chi-square) was used to confirm variables statistically significant. A *p*-value less than 0.05 was considered statistically significant. All analyses were performed by SPSS (IBM, Armonk NY) and graphs by GraphPad (GraphPad Software Inc., San Diego, CA).

Results

Study design and population

One hundred and eleven participants diagnosed with OSA undergoing night-time CPAP therapy were assessed, of whom fifty-eight refused and fifty-three joined the present study. The mean age of study participants was 67,9 ± 7,5 years, of which 85% were male. The mean BMI was 36,0±8,0 kg/m2 with a weight of 103,0±25,0 kg. The daytime sleepiness was measured by the ESS with a score of 5,6 ± 3,7.

After administering the telephone questionnaire, the participants were divided according to their preference regarding telemedicine: the POSITIVE group (participants in favor of telemedicine visits) consisted of 24/53 (45%) participants and the NEGATIVE group (those not in favor of telemedicine) consisted of 29/53 (55%) and subsequently the groups were compared.

The main comorbidities found among participants were hypertension 75% (40 out of 53), chronic heart disease 34% (18 out of 53) and diabetes 38% (20 out of 53) and did not differ between the two groups (POSITIVE and NEGATIVE), whilst the analysis of the education level and work experience showed some significant differences. Only 8% (2/24) of the participants in the POSITIVE group had an elementary school education compared to 31% (9/29) in the NEGATIVE group with a p=0,04. Meanwhile, 58% (14/24) of the POSITIVE group had a high school education in comparison to 24% (7/29) of the NEGATIVE group with a p=0,01 (Figure 1). Furthermore, 72% (21/29) of the participants in the NEGATIVE group were pensioners, compared to 46% (11/24) in the POSITIVE group with a p=0,04 (Table1).

Table 1
Characteristics of the population surveyed and split between POSITIVE (in favour of telemedicine visits) and NEGATIVE (in favour of in-person visits) groups.

Variables	**Total (N = 53)**	**POSITIVE (N = 24)**	**NEGATIVE (N = 29)**	***P***
Demographic characteristics				
Age [yrs]	67,9±7,5	66,5±7,0	69,0±7,5	0,22
Gender (female), n. (%)	8 (15)	4 (17)	4 (14)	0,77
Weight [kg]	103,0±25,0	104,0±28,5	101,9±22,5	0,73
BMI [kg/m2]	36,0±8,0	36,0±10,0	36,0±6,0	0,87
Married, n. (%)	51 (96)	22 (92)	29 (100)	0,11
Inhabitance (city), n. (%)	49 (92)	24 (100)	25 (86)	0,06
Education level				
Elementary school, n. (%)	11 (21)	2 (8)	9 (31)	0,04
Middle school, n. (%)	20 (38)	7 (29)	13 (45)	0,25
High school, n. (%)	21 (40)	14 (58)	7 (24)	0,01
College graduation, n. (%)	1 (2)	1 (4)	0 (0)	0,27
Work experience				
Pensioniers, n. (%)	32 (60)	11 (46)	21 (72)	0,04
Comorbidities				
Hypertension, n. (%)	40 (75)	19 (79)	21 (72)	0,57
Chronic heart disease, n. (%)	18 (34)	7 (29)	11 (38)	0,51
Diabetes, n. (%)	20 (38)	8 (33)	12 (41)	0,55
COPD, n. (%)	6 (11)	2 (8)	4 (14)	0,54
Asthma, n. (%)	2 (4)	1 (4)	1 (3)	0,89
ENT, n. (%)	4 (8)	0 (0)	4 (14)	0,06
Anxiety-depressive disorder, n. (%)	3 (6)	0 (0)	3 (10)	0,10
Other, n. (%)	41 (77)	18 (75)	23 (79)	0,71

All numerical data are expressed as mean±SD, while categorical as number (n.) and (percentage).

Abbreviations: BMI (body mass index); COPD (chronic obstructive pulmonary disease); ENT (ear, nose, throat disorders); ESS (Epworth sleepiness scale).

Variables	Total (N = 53)	POSITIVE (N = 24)	NEGATIVE (N = 29)	*P*
None, n. (%)	1 (2)	0 (0)	1 (3)	0,36
Residual daytime sleepiness				
ESS	5,6±3,7	5,9±4	5,0±3,5	0,61
All numerical data are expressed as mean±SD, while categorical as number (n.) and (percentage).				
Abbreviations: BMI (body mass index); COPD (chronic obstructive pulmonary disease); ENT (ear, nose, throat disorders); ESS (Epworth sleepiness scale).				

Survey

The participants were encouraged to complete a telephone interview composed of 9 closed-end questions that gave us a greater precision and uniformity. After analyzing each survey question, we received some significant outcomes (Table 2): 11 out of 24 (46%) participants in the POSITIVE group had knowledge of telemedicine compared to 3 out of 29 (10%) in the NEGATIVE group (*p*=0,001). Of the NEGATIVE group, 17% (5/29) possessed or were proficient with computer systems in contrast to the POSITIVE group (12/24, 50%) with a *p*=0,01.

Table 2
Phone-questionnaire results of the two groups.

Phone questionnaire	POSITIVE (N = 24)		NEGATIVE (N = 29)		*P*
Have you performed any examinations during the COVID-19 emergency?	2	(8)	2	(7)	0,85
Have you had any problems with the night-time ventilator in the COVID-19 emergency?	3	(13)	5	(17)	0,64
Are you afraid you might catch the virus in an outpatient waiting room?	9	(38)	17	(59)	0,13
Do you know what telemedicine consists of?	11	(46)	3	(10)	0,001
Do you own a computer and if so would you know how to use the computer to connect with us?	12	(50)	5	(17)	0,01
Are waiting lists long for a visit for sleep apnea?	21	(88)	23	(79)	0,44
Could we reduce waiting lists for “sleep visits” with video calls?	21	(88)	12	(41)	0,001
Notes. Data are expressed as count (N) and percentage (%).					

Other topics investigated were the usefulness of telemedicine in reducing waiting lists for a sleep visit with a statistically significant difference between groups: 88% (21/24) of the POSITIVE group and 41% (12/29) of the NEGATIVE group (*p*=0,001).

An item that was surveyed in the participants is the possibility of future telemedicine visits, which found an interesting result given the increase of favorable participants, 57%, vs. unfavorable, 43%, with a 12% increase from baseline (45% POSITIVE vs. 55% NEGATIVE) (Figure 2).

Discussion

Telemedicine started in the 1950s with several hospital systems that shared images and information over the phone and developed with the advent of the internet, laptops and later smartphones(10). Further advances were spearheaded on March 11, 2020, the World Health Organization declared the coronavirus disease 2019 (COVID-19) outbreak as a pandemic and in this context, telemedicine, particularly video consultations, has been promoted and scaled up to reduce the risk of transmission.

With the second largest burden of COVID-19 in the world, Italy does not include telemedicine in the essential levels of care granted to all citizens within the National Health Service. No formal input was given on telemedicine by health authorities, despite high pressure on health services during the first phase of the epidemic.

Therefore, we tried to understand how much misinformation or other factors such as computer skills are determining in the application of telemedicine systems.

For this purpose, a telephone questionnaire was designed with different questions ranging from computer skills to knowledge of telemedicine. This survey was submitted to adult participants with OSA in CPAP treatment and in follow-up at our sleep clinic during pandemic-related limitations. Although studies on telemedicine have demonstrated its usefulness in reducing geographical and time barriers, there are several barriers that need to be addressed for the application of telemedicine technology as observed in our study.

Thirty articles related to the significant barriers to implementing telemedicine around the world were reviewed and the authors showed that the age of the patient and level of education each accounted for five out of the twenty-nine patient barriers and four out of twenty-nine is the unawareness of telemedicine(11). These barriers also seem to involve the participants of our study, in fact it has shown that participants with a low level of education (21%, 11 overall) are more likely to be unaware of telemedicine, as a result of the absence of the right equipment and eventually the inability to use it (32%, 17 overall). Similar to our result, Miyawaki et al. found through a survey conducted in Japan that younger individuals were more likely to use telemedicine than older individuals, individuals with a university degree were more likely to use telemedicine than those with a high school diploma or less (6,6% vs. 3,5%; *p*<0,001). The work of Hwang et al. also shows that telemedicine education improved participation in the clinic compared to no telemedicine education (participation rate 68,5% vs 62,7%; p=0,02)(12).

Another problem that we have addressed, and which is one of the main problems in chronic diseases such as OSA, is the long waiting lists for an in-person visit. A 5-year retrospective study by Baig et al. have compared the efficiency of a conventional protocol (in-person sleep clinic consultations) and a telemedicine protocol. They defined telemedicine efficiency by improvement in the interval between a sleep consultation and the prescription of CPAP, the total number of sleep consultations, and the waiting list time for the sleep clinic. The results indicated that telemedicine decreased the interval between sleep consultation and CPAP prescription from more than 60 days to fewer than 7 days(13).

However, in our study the participants considered these systems useful in reducing waiting lists (62%, 33 overall).

A significant result is the willingness of the study participants to perform remote visits in the future. In fact, we found an increase of 12 percentage points in the total number of subjects willing to make video calls in the future compared to baseline (57% favorable vs. 43% unfavorable overall).

A limitation of our study may be the small sample size, but it may nevertheless provide useful indications for improving and implementing telemedicine systems in the future.

Conclusions

Telemedicine being an increasingly discussed tool and its application being increasingly recommended for health monitoring, patients prefer in-person visits as demonstrated by our results due to the factors analysed, such as lack of information, computer skills and cultural level. Therefore, an increase in information campaigns would be useful, as well as the continuous updating of telematics and technological systems to reduce the need for patients' skills. In the light of the data collected, our study seems to give useful information on what to improve or implement, so that telemedicine can be increasingly used, not only to avoid the interruption of health care for chronic patients, if access to dedicated clinics is difficult, but especially to reduce long waiting lists for follow-up visits.

List Of Abbreviations

BMI (body mass index); COVID-19 (coronavirus disease 2019); CPAP (continuous positive airway pressure); ESS (Epworth sleepiness scale); NEGATIVE group (participants in favor of in-person visit); OSA (obstructive sleep apnea); POSITIVE group (participants in favor of telemedicine); SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2).

Declarations

Ethics approval and consent to participate

All procedures performed in studies involving human participants were in accordance with the ethical standards of University of Foggia’ Ethics Committee (approval no. 145/CE/2020) and with the 1964

Helsinki declaration and its later amendments or comparable ethical standards. Written consent was signed by all study participants.

Consent for publication

All authors gave the consent for publication.

Availability of data and materials

All data generated or analysed during this study are included in this published article.

Competing interests

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Authors' contributions

DL designed the study; PT, GS, AH wrote the original draft; PT, RS collected data; PT and DL performed statistical analyses; DL and MPFB reviewed the manuscript and supervisioned the work. All authors have read and approved the final version of the manuscript.

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Figures

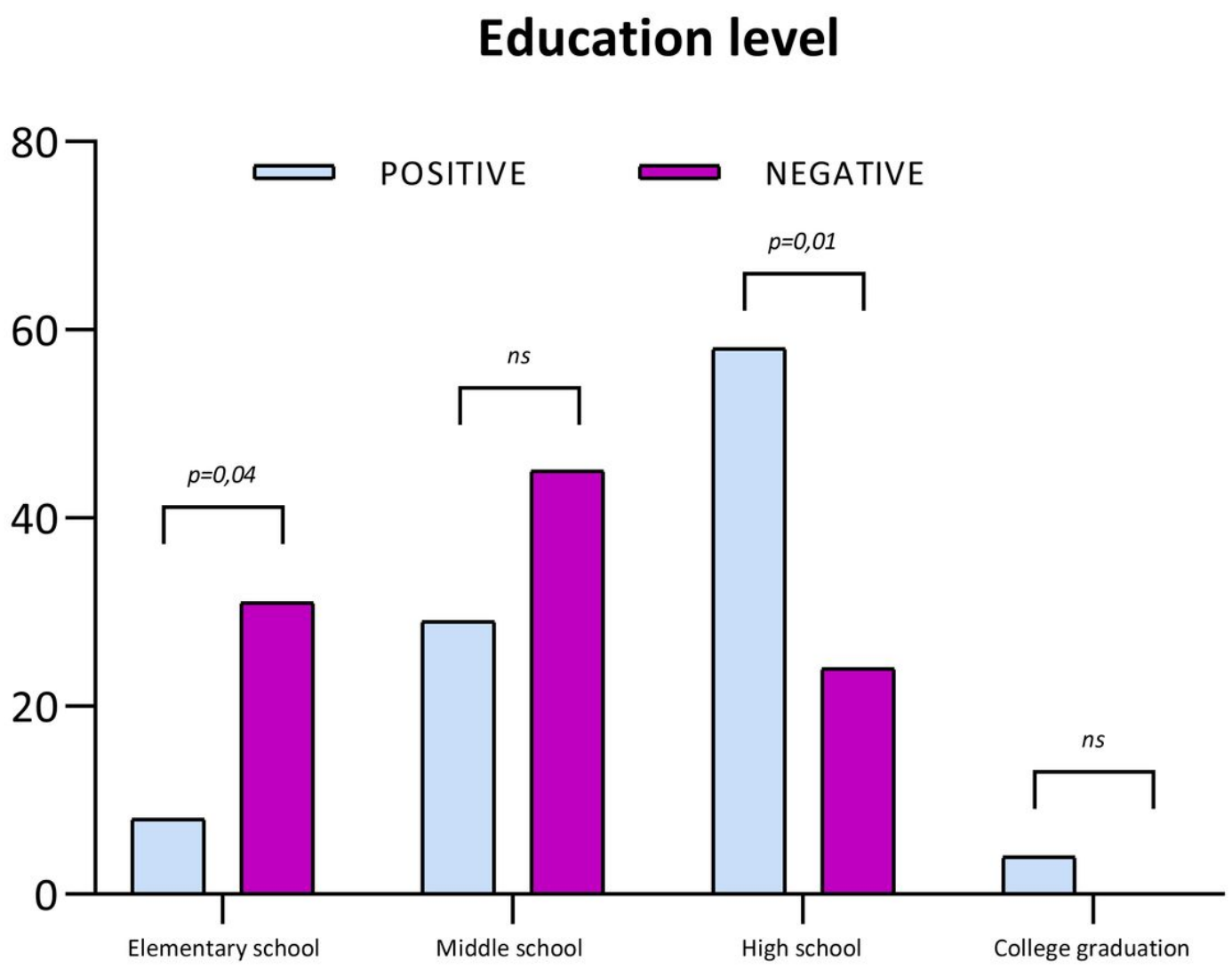

Figure 1

The bar chart represents the comparison of the education level between the two groups.

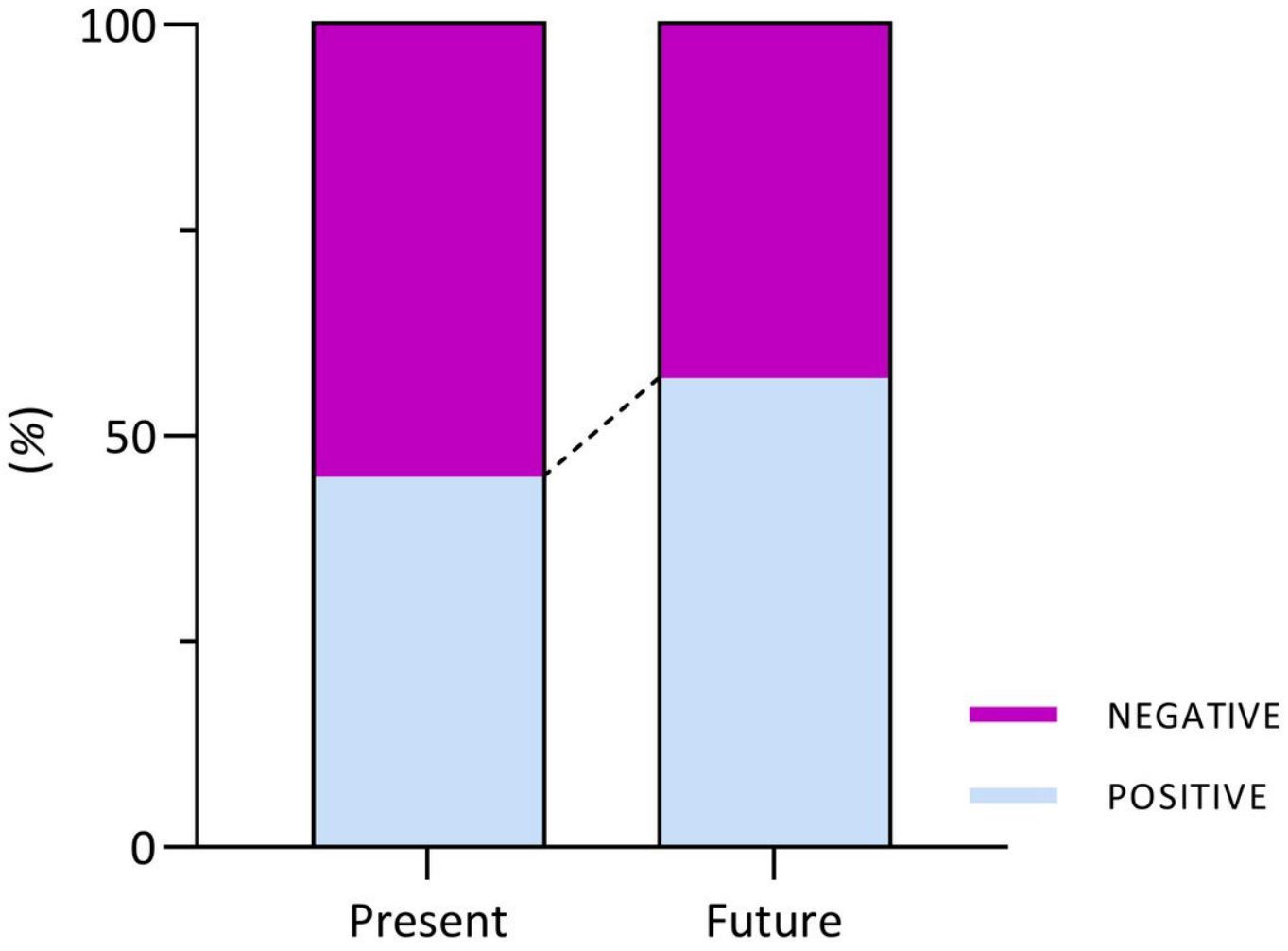

Figure 2

The graph shows the increasing willingness of the participants to eventually perform a telemedicine visit in the future.