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Opinions of patients with persistent asthma regarding the use of mobile applications for disease monitoring

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"The greatest enemy of knowledge is not ignorance, it is the illusion of knowledge."
Stephen Hawking

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Abstract (Portuguese)

Os objetivos primários deste estudo foram avaliar a adesão ao tratamento e as necessidades em adultos com asma persistente; o seu interesse em utilizar aplicações móveis (apps) para a gestão da asma e adesão à terapêutica e descrever o uso de dispositivos móveis, redes sociais e apps. O objetivo secundário foi investigar as opiniões dos utilizadores sobre uma app para avaliar e melhorar a adesão ao tratamento.

Trata-se de um estudo transversal com pacientes adultos com asma persistente, prescrição ativa de terapêutica inalada e acesso a dispositivos móveis (smartphone/tablet). Os participantes foram recrutados durante 120 períodos de consultas de imunoalergologia e de pneumologia, entre Setembro 2017 e Junho 2018, no Hospital Pêro da Covilhã. Quatro desses pacientes participaram numa extensão prospectiva do estudo, em que foram convidados a utilizar a app InspirerMundi. Os participantes responderam a um inquérito que incluía dados sociodemográficos, hábitos tabágicos, controlo da doença (Teste de Controlo da Asma e Rinite Alérgica), adesão ao tratamento (e.g. escala de adesão à medicação de Morisky de 4 itens) e utilização de dispositivos móveis, redes sociais e aplicações móveis (e.g. escala de Utilização e Atitudes face às redes sociais e às Tecnologias de Informação e Comunicação - TIC). Na extensão do estudo, os pacientes responderam a entrevista por telefone após 6 meses, para avaliar sua opinião sobre a app.

Os 40 participantes (78% sexo feminino) tinham uma idade média de 49,9±15,8 anos. Metade (48%) tiveram pelo menos uma agudização nos últimos 12 meses e 85% não tinham a doença controlada. A maioria (85%) não usava nenhum método de monitorização da asma entre as consultas. Na avaliação da auto perceção da adesão ao tratamento, um em quatro participantes tinha baixa adesão. Pelo menos uma vez por dia, 55% dos participantes navegavam na internet com o seu smartphone/tablet e 35% usavam aplicações. Quanto às redes sociais, 93% dos participantes utilizavam-nas e 68% acediam pelo menos uma vez por dia. Nove (22%) participantes já tinham feito download e utilizado aplicações móveis de saúde/fitness (apenas um para a asma); 65% gostariam de utilizar uma app para melhorar a adesão à medicação inalada para a asma.

A maioria dos participantes tinha asma não controlada e reportou elevada adesão ao tratamento. A maioria dos que usavam dispositivos móveis utilizava as redes sociais e a internet diariamente e apenas 1/4 usam aplicações móveis atualmente, mas 2/3 gostariam de vir a usar apps para a asma.

Keywords

Asma, Adesão à terapêutica, Aplicações móveis, Uso de telemóveis

Extended Abstract (Portuguese)

Introdução: A asma é uma patologia crónica frequente em todo o mundo e um dos principais problemas da sua gestão é a adesão terapêutica. Para melhorar a adesão terapêutica é fundamental o envolvimento ativo do doente na monitorização e controlo da sua doença. Os dispositivos móveis, pela sua ubiquidade e baixo custo, podem ter um papel importante nessa melhoria. Assim, os objetivos primários deste estudo foram avaliar a adesão ao tratamento e as necessidades de adultos com asma persistente; o seu interesse em utilizar aplicações móveis (apps) para a gestão da asma e adesão à terapêutica e descrever o uso de dispositivos móveis, redes sociais e apps. O objetivo secundário foi investigar as opiniões dos utilizadores sobre uma app para avaliar e melhorar a adesão ao tratamento.

Métodos: Trata-se de um estudo transversal em que os critérios de inclusão foram pacientes adultos com asma persistente, prescrição ativa de terapêutica inalada e acesso a dispositivos móveis (smartphone ou tablet). Os participantes foram recrutados durante 120 períodos de consultas entre Setembro 2017 a Junho 2018 durante consultas de imunoalergologia e pneumologia do Hospital Pêro da Covilhã. Quatro desses pacientes participaram numa extensão prospectiva do estudo, em que foram convidados a utilizar a app InspirerMundi. Os participantes responderam a um inquérito que incluía dados sociodemográficos, hábitos tabágicos, controlo da doença (Teste de Controlo da Asma e Rinite Alérgica), adesão ao tratamento (e.g. escala de adesão à medicação de Morisky de 4 itens) e utilização de dispositivos móveis, redes sociais e apps (e.g. escala de Utilização e Atitudes face às redes sociais e às TIC). Na extensão prospectiva do estudo, os participantes responderam a um questionário por entrevista telefónica após 6 meses para avaliar a sua opinião sobre a aplicação móvel (escala de usabilidade de um sistema), bem como, avaliar as componentes da app e o seu impacto na adesão à terapêutica.

Resultados: Os 40 participantes (78% sexo feminino) incluídos tinham uma idade média de 49,9±15,8. Metade (48%) tiveram pelo menos uma agudização nos últimos 12 meses e 85% não tinham a doença controlada. A maioria (85%) não usava nenhum método de monitorização da asma entre as consultas (p.e.diário de sintomas, medidor de pico de fluxo). Avaliada a auto perceção da adesão ao tratamento um em quatro participantes tinha baixa adesão. Pelo menos uma vez por dia, 55% dos participantes navegavam na internet com o seu smartphone/tablet, 45% liam as notícias e verificavam os emails, 43% procuravam informação, 35% usavam aplicações e apenas 8% tiravam fotografias. Quanto às redes sociais, 93% dos participantes utilizavam-nas e 68% acediam pelo menos uma vez por dia. Nove (22%) participantes já tinham feito download e utilizado aplicações móveis de saúde/fitness (apenas um para a asma); 65% gostariam de utilizar uma aplicação móvel para melhorar a adesão à medicação inalada para a asma.

Conclusão: A maioria dos participantes tinha asma não controlada e reportou elevada adesão ao tratamento. A maioria dos que usavam dispositivos móveis utilizava as redes sociais e a internet diariamente e apenas 1/4 usam aplicações móveis atualmente, mas 2/3 gostariam de vir a usar apps para a asma.

Abstract (English)

The aims of this study were to evaluate adherence to treatment and needs of adults with persistent asthma; to assess their interest in using mobile applications (apps) for management and adherence to treatment, and to describe the use of mobile devices, social networks and apps. The secondary aim was to investigate users' opinions about an app (Inspirermundi) to assess and improve adherence to treatment.

A cross-sectional study was conducted with adult patients with persistent asthma, active prescription of inhaled therapy, and access to a mobile device (smartphone/tablet). Patients were recruited at 120 immunoallergology and pulmonology outpatient clinic appointments, between September 2017 and June 2018, at *Hospital Pêro da Covilhã*. Four of the recruited patients participated in a prospective extension of the study, in which they were invited to use the Inspirer Mundi app. Participants answered a survey on sociodemographic data, smoking habits, disease control (Control of Allergic Rhinitis and Asthma Test), adherence to treatment (e.g. 4-item Morisky Medication Adherence Scale) and use of mobile devices, social networks and mobile applications (e.g. smartphone usage of the Media and Technology Usage and Attitudes Scale). In the prospective extension of the study, patients answered a telephone interview at 6 months to assess their opinion regarding the app.

The 40 participants (78% women) included had a mean age of 49.9±15.8 years. Almost half (48%) had at least one exacerbation in the previous 12 months and 85% had uncontrolled disease. Most (85%) did not use any asthma monitoring method between medical appointments (e.g. symptoms diary, peak flow meter). Self-reported adherence to treatment showed that one in four participants had low adherence. At least once a day, 55% of participants navigate on the internet with their smartphone/tablet and 35% use apps. As for social networks, 93% of participants used them and 68% accessed it at least once a day. Nine (22%) participants had previously downloaded and used mobile health/fitness apps (only one for asthma); 65% stated that would like to use apps to improve adherence to inhaled asthma medication.

Most participants had uncontrolled asthma and rhinitis, reported high adherence to treatment and the majority of those with mobile devices were daily users of social networks and the internet. Currently only 1/4 use mobile applications but 2/3 would like to use apps for supporting their asthma management.

Keywords (English)

Asthma; Medication adherence; Mobile applications; Cell phone use

Table of Contents

List of Figures

List of Tables

List of Acronyms

Apps	Mobile Apllications
BMI	Body Mass Index
BMQ	Beliefs about Medicines Questionnaire
CARAT	Control of Allergic Rhinitis and Asthma Test
GINA	Global Iniciative for Asthma
MMAS-4	4-item Morisky Medication Adherence Scale
MTUAS	Smartphone Usage of the Media and Technology Usage and Attitudes Scale
SUS	System Usability Scale
WHO	World Health Organization

Introduction

Asthma is a chronic inflammatory disease of the airways, characterised by variable symptoms including cough, breathlessness and wheezing, and according to the World Health Organization (WHO) it affects around 235 million people worldwide.[1] This disease affects patient's quality of life, since it interferes at the social, school or work context.[1] Although mortality has declined, it still presents a high morbidity rate and considerable economic costs.[2,3]

Asthma, as a chronic disease, is not curable, but regular monitoring of the disease and its proper management may allow a normal life.[1,4] Inhaler controller medications are the cornerstone of effective asthma treatment. However, there is low adherence to medication by patients with asthma, which leads to worse outcomes and higher economic burden.[5]

One of the main factors contributing to the difficulty in controlling and adhering to asthma treatment is the patients' poor perception of asthma, since asthma attacks are episodic and variable, which may constitute a barrier to understanding the need for the use of control medication. It was also demonstrated that low adherence to treatment is associated with patient's perception of the medication as unnecessary and their concern about secondary effects (beliefs about their use, e.g. dependence on inhaled corticosteroids).[6,7] There is a need to improve our understanding of the patterns of adherence to inhaled controller medications and to identify the specific reasons for non-adherence and other needs among adolescents and adults with persistent asthma.

Furthermore, clinicians need to be more effective at communicating with patients namely when addressing the benefits and risks of medication. Indeed, it was observed that when decisions about treatment are made with the patients' involvement and taking into account their preferences, adherence to treatment improved.[8] It is also important to develop patient-centred solutions, allowing them to be actively involved in the control of their asthma, through the implementation of self-monitoring strategies.[9]

Advances in technology have enabled the use of interactive asthma monitoring tools through the use of internet-based and social media solutions, with these technologies being associated with better outcomes in patients with asthma.[10] According to the literature, patients who used mobile applications in contrast with paper journals considered the former to be easier, and thus web-based management was regarded as viable and preferred by patients.[11] It was also verified in previous studies that a simple daily text message reminder was associated with increased adherence to treatment.[12] In addition, most patients with asthma show a preference for using internet applications for future self-monitoring.[13] However, it is important to improve our understanding of the preferences, interest and usage of web-based strategies in daily routine of people with persistent asthma, to improve adherence to treatment.

Mobile applications can thus be a feasible solution, since they can be used at any time, are easily integrated into daily life, can combine mechanisms to determine treatment adherence, interactive communication and gamification that can influence patients' behaviour changes.[22] In fact, it was established that with the use of mobile applications, patients with chronic diseases felt more secure, because they thought that their disease was more strictly monitored, self-monitoring turned out to be more effective and made patients feel that their health care continued even outside the hospital.[13]

It is therefore hypothesised that a mobile application, with gamification and peer-support elements, may have the ability to improve adherence to asthma inhalers in patients with asthma. However, usefulness and acceptability of the mobile application by end users needs to be assessed in a real-world study.

Objectives

Primary goals:

- To evaluate adherence to treatment and needs of adults with persistent asthma;
- To assess their interest in using mobile applications for management and adherence to treatment;
- To describe the use of mobile devices, social networks and apps.

Secondary goal:

- To investigate users' opinions about an app (Inspirermundi) to assess and improve adherence to treatment.

Methods

1. Study design and participants

A cross-sectional study with 40 adults with asthma to reach the primary aims was followed by a pilot extension study with four of those patients to achieve the secondary aim. The pilot extension study included a telephone interview at 6 months.

Patients were recruited from the immunoallergology and pulmonology outpatient clinics of *Hospital Pêro da Covilhã,* at 120 outpatient clinic appointment periods, between September 2017 and June 2018. Patients attending the outpatient clinics were included if they had persistent asthma, were older than 18 years, had an active prescription of combination therapy of an inhaled long-acting beta2-adrenoceptor agonist and a corticosteroid, and had access to a mobile device (smartphone or tablet). Patients with a diagnosis of a chronic lung disease, other than asthma or those with a diagnosis of another significant chronic condition with possible interference with the study aims were excluded.

Eligible patients were identified by clinicians during scheduled medical visits, were given an explanation of the purpose of the study and were asked about their willingness to participate. Written informed consent was obtained and the study was conducted in agreement with the principles of the Helsinki Declaration for clinical research. The Hospital Ethics Committee of *Hospital Pêro da Covilhã* approved the study.

2. Data collection and procedures

First, sociodemographic (age, marital/civil status, education level, occupation) and clinical (smoking habits, body mass index-BMI) data were collected to characterise the sample.

Subsequently, asthma characteristics, control and health care were assessed. Clinicians reported patient's asthma clinical characteristics and control according to Global Initiative for Asthma (GINA).[14] Patients also answered questions about disease control – the Control of Allergic Rhinitis and Asthma Test (CARAT).[15] This test consists of 10 questions scored on a 4-point Likert scale with a recall period of 4 weeks. Seven questions relate to the frequency of airway symptoms, four of which focus on upper airway symptoms and three focus on lower airway symptoms. The other three questions deal with sleep impairment, activity limitations and the need for higher doses of medication. The total score is calculated by summing up the scores of all 10 questions, resulting in a range of 0–30 points, with a score >24 indicating disease control. Number of exacerbations, treatment with oral corticosteroids, days of work/school lost due to routine medical visits, unscheduled asthma medical care, hospital admissions and days of work/school lost due to asthma attacks in previous 12 months were also assessed.

Patients answered questions about asthma treatment, adherence and satisfaction with their inhalers. Questions included age of asthma diagnosis, asthma self-monitoring and asthma written treatment plan. Patients reported their adherence to inhalers during the previous week, self-perception on his/her inhaler technique, satisfaction with the inhaler device, comfort with public use of the inhaler and perception on how his/her preferences were taken into account at the time of inhaler's prescription (using Visual Analogic Scales 0-100).[16] Patients also answered a 4-item Morisky Medication Adherence Scale (MMAS-4).[17,18] The MMAS has two dimensions: the first two items assess the unintentional nonadherence and the last two items measure the intentional nonadherence. The items give a range of scores from 0 to 4 (a score of 0 indicates high adherence, a score of 1 to 2 indicate medium adherence and a score of 3 to 4 indicates low adherence). Then, to assess patients' beliefs about medication, the participants answered the Portuguese version of the specific Beliefs about Medicines Questionnaire (BMQ-Specific).[19] The BMQ-Specific is an 11-item questionnaire that includes two subscales: a 5-item Necessity scale, to assess beliefs about the necessity for prescribed medication, and a 6-item Concerns scale, to assess beliefs about the danger of dependence and long-term toxicity and the disruptive effects of medication. Each item is scored on a five-point Likert scale and the total scores for the Necessity and Concerns subscales range from 5 to 25 and from 6 to 30, respectively. The higher the score is, the greater is the patient's belief in the concept represented by the scale.

Finally, participants answered the Media and Technology Usage and Attitudes Scale (MTUAS), specifically the Smartphone Usage Scale (9 items) which evaluates activities performed specifically on mobile devices (searching for information, browsing the web, using apps, listening to music, taking photos, recording video, reading e-mail, getting directions/using a GPS and checking the news) and the General Social Media Usage Subscale (1 item) which evaluates social networking activities for those indicating that they had a Facebook page (use Facebook/check Facebook page).[20] Patients were also asked about mobile applications (previous download and use of health/fitness apps or asthma apps, if they would like to use apps for asthma and if they would like to use apps to improve inhalers adherence).

To reach the secondary goal, four patients agreed to participate in the pilot extension study. These patients had the InspirerMundi app installed on their mobile devices or were explained how to do it and installed the application afterwards. Patients were invited to use the app daily during the following 6 months and were informed that they would be contacted by telephone at the end of that time period to answer a survey about the app. An additional follow-up telephone interview at four weeks of using the app was made to check if everything was going well with the app.

The survey applied after six months of using the InspirerMundi app included the European version of the System Usability Scale (SUS), validated in Portuguese.[21] SUS assesses the usability of a product by providing a reference score for participants' view of a product's usability and includes 10 statements that are scored on a 5 point Likert scale of strength of agreement. Its

final score can range from 0 to 100, where higher scores indicate better usability. A SUS score above 68 would be considered above average meaning a good usability of the system and anything below 68 is below average. The users also answered questions regarding their satisfaction with the app components. Improvement in motivation and awareness of the importance of adherence to treatment was assessed. Finally users were asked to describe what they liked the most, what they liked the least and what could be improved in the mobile application.

InspirerMundi App

The aim of InspirerMundi is to transform adherence to treatment into a positive experience through immediate and enjoyable feedback (gamification).[22] The app available for iOS and Android mobile devices will be used by the patient in their day-to-day life. InspirerMundi app integrates 3 components: monitoring, gaming, and social/peer support.

In the monitoring component, users will be able to add their current medications (name, dose, medication bar code, treatment duration, treatment dosage and schedule) and record performed inhalations using the image-based medication adherence detection tool or manually. The mobile app allows patients to view statistics on the adherence to medications and shows reminders (alerts of scheduled medication). Patients will be able to record their asthma-related symptoms on a daily basis, using visual analogue scales, and their 4 week-long asthma control using the CARAT. Patients will also be encouraged to report any asthma exacerbation (use of relief medication, unscheduled health care use). Users can choose to share data with their physician if she/he agrees.

In the gaming component, the aim is to level up in the game through a points system and increase the sphere of influence by the network of Inspirers and Warriors. The mobile app engages patients with a customisable “Warrior” (beginning player), which can become an Inspirer (player at a higher level) that gives support to his/her Warriors. Points are given when users take their own medication according to plan and when Inspirers have a positive influence on the other players in their network (Warriors). The mobile app also uses virtual badges to “reward” individuals for engaging with the app. Whenever the user reaches a certain goal or does something special, him/her will get rewarded and get a virtual badge for that. For example, when an Inspirer gets his/her first Warrior, him/her will get a “Role Model” badge. Users will be able to see their impact in the world by visualising the region/country of each element of his/her network of Inspirers and Warriors and position on the leaderboard.

In the social/peer support component, users can share and demonstrate their points/badges and achieve social recognition; exchange messages and alert their warriors regarding missing medication doses (buzz). These features enable peer-to-peer support regarding their asthma and the Inspirer to stimulate his/her Warriors when not compliant with the therapeutic plan (the Inspirers do not have access to what specific treatments the warriors are taking, only to the schedule of treatments).

3. Statistical analysis

Statistical analyses were conducted with IBM SPSS Statistics v21 (IBM SPSS, Chicago, US). Categorical variables were described with absolute and relative frequencies. Continuous variables were described using mean with standard deviation (SD) or median with interquartile range, as appropriate to the data distribution. Differences between patients with or without interest in using mobile applications were tested using the Pearson Chi-square test for categorical variables and Mann-Whitney U Test for continuous variables.

Logistic regression analysis was used in an attempt to explain the interest in use applications for asthma. Odds ratio (OR) with [95% confidence interval (95% CI)] were calculated. All the variables with a possible relation with interest or not interest in using mobile applications, including patients' characteristics (age, marital/civil status, education level, BMI and age of asthma diagnosis), patients preferences regarding their inhalers and the activities most used in mobile devices (browse the web, listen to music, record video, use apps, search for information and check Facebook page) were considered. The level of significance was set at $p<0.05$.

Results

1. Characterisation of the participants

Forty patients (31 females) with a mean age of 49.9±15.8 years participated in this study. Most were married, had an education level equal to or higher than ten years and were employed. Almost two thirds of the participants had never smoked tobacco, one quarter were ex-smokers and only 12% were current smokers. Nearly half of participants (43%) were exposed to passive smoking. Table 1 summarises these results. An association between interest in using mobile applications for asthma and age, marital/civil status, education level and BMI was observed (table 1).

Table 1- Characteristics of the participants.

Characteristics	Without interest (n=18)	With interest (n=22)	Total (n=40)
Age, mean±SD (range) years	59.6±11.1	41.9±14.8*	49.9±15.8 (20-77)
Female, n (%)	12 (67)	19 (87)	31 (78)
Marital/Civil Status, n (%)			
Married/ Civil union	16 (89)	12 (55)*	28 (70)
Singled/Divorced	2 (11)	10 (46)*	12 (30)
Education level, n (%)			
< 10 years	13 (72)	4 (18)*	17 (43)
≥10 years	5 (28)	18 (82)*	23(57)
Employment, n (%)			
Employed	7 (39)	14 (64)	21 (53)
Retired	8 (44)	2 (9)	10 (25)
Unemployed/Not working due to poor health	3 (17)	1 (3)	5 (13)
Student	0	3 (8)	3 (8)
BMI, mean±SD (range) kg/m^2	27.9±2.6	25±4.7*	26.3±4.1 (18.5-35.1)
Smoking status, n (%)			
Non-Smokers	12 (67)	13 (59)	25 (63)
Ex-smoker	4(22)	6 (27)	10 (25)
Current smoker	2 (11)	3 (14)	5 (12)
Passive smoking, n (%)	5 (28)	12 (55)	17 (43)

BMI-Body Mass Index ; *p<0.05

2. Adherence to treatment and management needs

Table 2 describes the clinical characteristics of the participants. The mean age at diagnosis of asthma was 29.6±15.6 years. According to CARAT, 85% (n=34) of the participants had uncontrolled asthma with results regarding the upper airways of 6.4±3.4 and the lower airways of 11.5±5.8. Almost half of the patients had exacerbations in the previous 12 months. However, almost none of the participants had lost a work/school day due to asthma attacks in the past 12 months. A relation between interest in using mobile applications for asthma and the age of asthma diagnosis was observed (table 2).

Patients' beliefs, adherence and preferences regarding inhalers are summarised in table 2. The BMQ necessity score had a mean of 19.1±3.3 and the BMQ concern score a mean of 15.6±3.9. Importantly, in terms of the 4-MMAS questionnaire, most patients (55%) had medium adherence to treatment, and only one fifth had high adherence. The results of the self-perception of adherence to inhalers in the previous week was high (median 91%, p25-p75 74-100%) as were self-evaluation of inhaler technique (median 99%, p25-p75 92-100%), satisfaction with the current device (median 99%, p25-p75 94-100%), patient's perceived involvement in the choice of the device(s) (median 98%, p25-p75 67-100%) and public use of the inhalers (median 100%, p25-p75 94-100%). Association with interest in using mobile applications for asthma and self-perception on adherence to inhalers last week, self-evaluation of inhaler technique, patient's perceived involvement in the choice of the device(s) and public use of the inhalers was observed (table 2).

Table 2- Asthma control and patients' beliefs, adherence and preferences regarding inhalers.

Variables	Without interest (n=18)	With interest (n=22)	Total (n=40)
Age of asthma diagnosis, mean±SD (range) years	37±12.9	23.5±15.1*	29.6±15.6 (1-55)
Number of different inhalers, n (%)			
1	7 (39)	3 (14)	9 (23)
2	8 (44)	17 (77)	26 (65)
3	3 (17)	2 (9)	5 (12)
GINA classification of asthma control n (%)			
Well controlled	6 (33)	11 (50)	17 (43)
Partly controllled	7 (39)	5 (23)	12 (30)
Uncontrolled	5 (28)	6 (27)	11 (27)
CARAT, mean± SD (range)	19.9±6.7	17±8.4	17.9±7.7 (0-29)
CARAT, n (%)			
Controlled (>24)	2 (11)	4 (18)	6 (15)
Not controlled	16 (89)	18 (82)	34 (85)
CARAT Upper Airways	7.2±3,0	5.7±3.6	6.4±3.4
CARAT Lower Airways	11.7±5.9	11.3±5.8	11.5±5.8
Asthma self-monitoring, n (%)	1 (6)	4 (18)	5 (13)
Days of work/school lost due to routine medical visits past 12 months, n (%)			
0	16 (89)	17 (77)	33 (83)
1-4	2 (11)	5 (23)	7 (17)
Clinician explain how to use the inhaler past 12 months, n (%)	16 (89)	20 (91)	36 (90)
Asthma written treatment plan, n (%)	15 (83)	19 (86)	34 (85)
Exacerbations past 12 months, n (%)			
0	11 (61)	10 (46)	21 (53)
1-2	7 (39)	9 (40)	16 (40)
≥3	0 (0)	3 (14)	3 (7)
Treatment with oral corticosteroids past 12 months, n (%)	7 (39)	8 (36)	15 (38)
Asthma unscheduled medical care past 12 months, n (%)			
Emergency department visits past 12 months	5 (28)	5 (23)	11 (27)
Hospital admissions past 12 months	1 (6)	0	1 (3)
Days of work/school lost due to asthma attacks past 12 months, n (%)			
0	17 (94)	21 (96)	39 (98)
≥1	1 (6)	1 (5)	1 (2)

BMQ necessity, mean± SD (range)	19.6±2.1	18.7±3.9	19.1±3.3 (8-25)
BMQ concern, mean± SD (range)	15.6±2.2	15.5±4.8	15.6±3.9 (6-27)
4-MMAS, n (%)			
High adherence	4 (22)	4 (18)	8 (20)
Medium adherence	9 (50)	13 (59)	22 (55)
Low adherence	4 (22)	5 (23)	9 (22)
Adherence to inhalers last week[a] , Median (P25-P75)	100 (83-100)	83 (71-98)*	91 (74-100)
Preferences [a], Median (P25-P75)			
I perform correctly the technique of my inhaler	100 (97-100)	97 (98-100)*	99 (92-100)
I feel satisfied with my inhaler	100 (90-100)	98 (94-100)	99 (94-100)
I feel that my physician took into account my opinion and preferences when choosing my inhaler	100 (95-100)	93 (49-100)*	98 (67-100)
I feel comfortable using my inhaler in public	100 (99-100)	96 (90-100)*	100 (94-100)

GINA- Global Initiative for Asthma; CARAT- Control of Allergic Rhinitis and Asthma Test; *p<0.05; BMQ-The Beliefs about Medicines Questionnaire; 4-MMAS-Morisky 4-item Medication Adherence Scale; [a]Visual analogic scale, range 0-100(best).

Self-reported adherence results of participants, in terms of 4-MMAS, specified by each item are shown in Figure 1. It was observed that most of the participants had at least one problem regarding adherence to treatment and that most patients (68%) forget to take their medication.

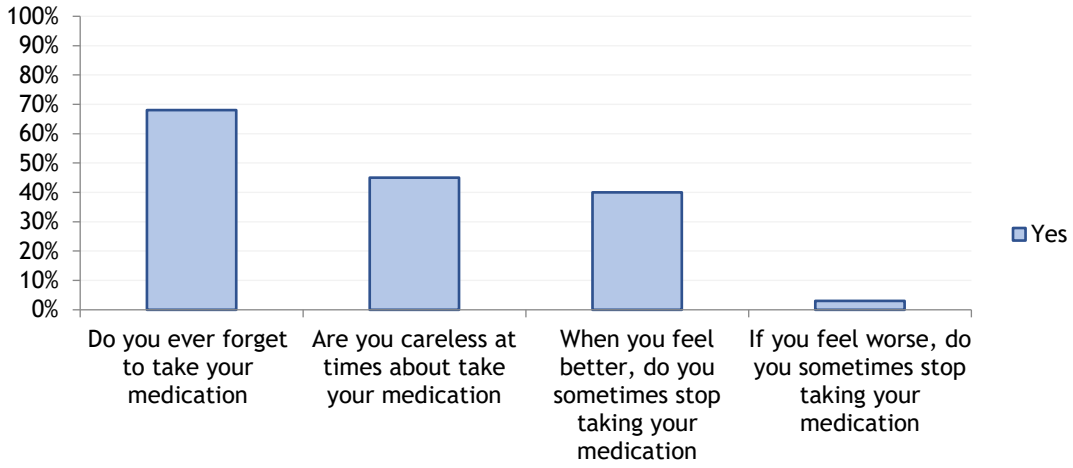

Figure 1 – 4-item Morisky Medication Adherence Scale.

3. Mobile devices usage

Figure 2 shows the activities performed at least once a day by the participants on their mobile devices. Participants mostly browse the web, search for information and use apps on their smartphone. Those who used their smartphone/tablet more also showed greater interest in using apps. A relationship between interest in using mobile applications for asthma and browse the web, listen to music, record video, use apps, search for information and check Facebook page was observed.

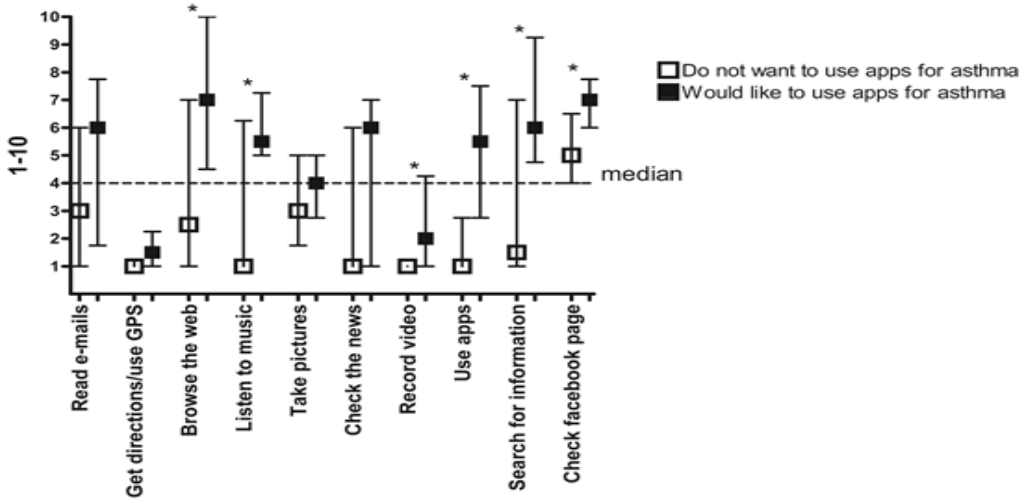

Figure 2 – Smartphone usage scale (9 items) and General social media usage subscale (1 item) of Media and Technology Usage and Attitudes Scale.

4. Social networks, usage and interest in using apps for management and adherence to treatment

Figure 3 shows the habits of using social networks and apps and the interest of the participants in using apps for asthma. Most (93%) of the participants use Facebook, 22 % used apps of health/fitness, only one participant had already used an app for asthma. However, most patients (65%) would like to use apps to improve adherence to treatment.

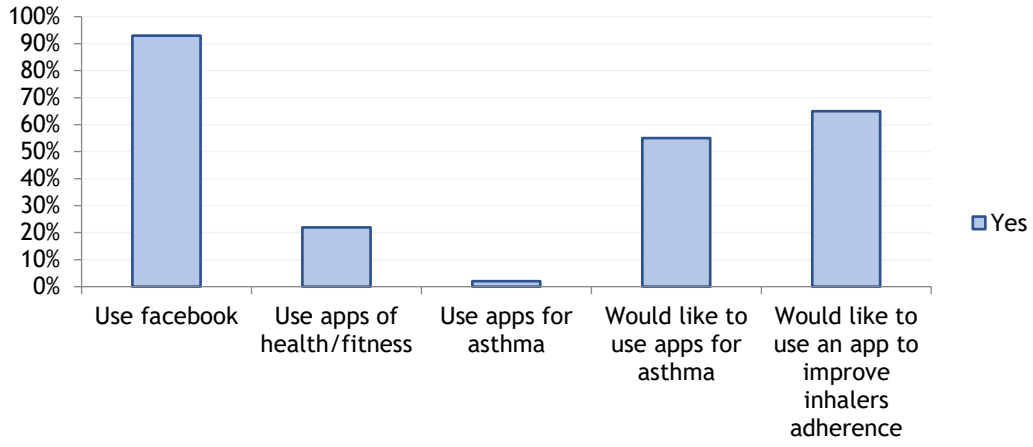

Figure 3 – Use of social networks and apps and interest in using apps for asthma.

The logistic regression model was statistically significant (X^2=21.284, p<0.001) and explained 59% (Nagelkerke R^2) of the interest in use applications for asthma. The variables use of applications (OR=28.3; 95%C.I. 2.1-374.9) and the frequency of Facebook use (OR=2.3; 95% C.I. 1.1-4.7) were the independent variables.

5. Pilot extension study – patients' feedback

Four (1 male) of the 40 participants were invited to test the InspirerMundi app in the pilot extension study. They were between 20 and 46 years old and all had at least 10 years of education. The average SUS score was 65 for one participant and above 68 for the other three participants (80, 82.5 and 85) which represent good usability of the app. Concerning the symptoms monitoring component, two patients were completely satisfied, one was satisfied and one had no opinion. Regarding the inhaler usage detection tool, one participant was completely satisfied, one was satisfied and the other two had no opinion. Regarding the app gamification, two were satisfied, one had no opinion and the other was unsatisfied. As for the app social network, one was completely satisfied, one was satisfied, one had no opinion and the other was unsatisfied.

All participants were satisfied with the application (three of them completely satisfied) and all would recommend it to others with asthma. However, only one participant considered that the use of the application increased their awareness of the importance of adherence to medication and two stated that the application increased their motivation to adhere to the medication.

When asked about what they liked most, participants stated that the application allowed them to control the time and doses of the medication; to register their symptoms and to have greater perception of control of their asthma symptoms. In terms of factors they were displeased with, two of the participants considered that game component should be more engaging, while another participant considered that the application stalled several times. They suggested that the main screen, instead of including the timeline with a lot of information, could simply present three menus: medication, CARAT and weekly/daily symptoms. They also suggested simplifying the way inhaled medication was recorded, for example, with no need to give detailed information on brand or remaining doses.

Discussion

This study contributes to the much needed knowledge about adherence to treatment, asthma management problems and about the opinions on the use of mobile applications for asthma patients. A main finding was that two thirds of the participants with access to mobile devices would like to use a mobile application for asthma to improve monitoring and adherence to treatment. Furthermore insufficient control of asthma, poor monitoring between medical appointments and a possible overestimation of the participants regarding treatment related perceptions were observed.

The main management needs identified were the high proportion of patients with insufficient control of rhinitis, the lack of self-monitoring between medical visits and the mismatch between clinical outcomes and patients' perceptions about their management. Near half of the patients had an asthma exacerbation in the previous year, with more than one third needing oral corticosteroids and one quarter requiring emergency department care. However, patients reported very few days of missed work/school and very high levels of written treatment plan and doctor explanation of treatment in the previous year. In addition, perceptions of their adherence and inhaler technique were also very high. Therefore, there is a disassociation between patients' perceptions and clinical outcomes. Most of the participants reported a high satisfaction with the inhaler device, were confident about the correctness of their inhaler technique and about using their inhaler in public and considered being involved by the physician in the choice of the device. Our results on inhaler technique are apparently much better than those obtained by the study carried out by Chorão et al[16], but this difference may reflect the different methods used. In the study by Chorão et al, the inhaler technique was observed by the researcher while in our study we assessed the perception of correctness of inhaler technique by the patient. Additionally, Chorão et al included both patients with asthma and with chronic obstructive pulmonary disease.[16] Thus, opinions and preferences of patients concerning their inhaler device may be over-estimated. It seems that one of the most relevant management needs may be to improve patients' awareness of the importance of inhaler technique, adherence and involvement in treatment decisions. In fact, overestimation of disease control by patients was apparent in a study by Sá-Sousa et al[26] in which 88% of patients with uncontrolled asthma considered their asthma to be under control.

The majority of participants had uncontrolled rhinitis often associated with uncontrolled asthma, with CARAT scores similar to those observed in other studies. A similar situation was also observed in both elderly and non-elderly asthmatic patients from the region of Beira Interior.[35] A study by Lourenço et al, carried out in 224 participants recruited in pharmacies located in the same district of this study obtained similar results of CARAT (mean = 17.8±5.136.4; 87% had uncontrolled asthma)[23]. In another study, by Pereira et al, involving 200 patients with a mean age of 33.6±12.3 years, of which 86 had allergic rhinitis and

asthma, 86% had uncontrolled asthma [24]. As we can observe there is a high percentage of patients with uncontrolled asthma, which is a cause for concern and calls for measures to be taken to improve these outcomes. The availability and use of tools to support asthma self-monitoring may be one of the measures to improve asthma management.

We observed high values of treatment with oral steroids for asthma in the previous 12 months (38%) and visits to the emergency department (27%), and relatively few hospitalisations (3%). A study by Price et al, carried out among 8 000 patients with asthma from 11 European countries showed similar results in the percentage of treatment with oral corticosteroids in last 12 months (44%) and in the percentage of emergency department visits (24%), but obtained higher values in hospital admissions (12%). [25] These differences may be explained by the fact that in the European study, participants were recruited by an online survey which means that a broader spectrum of patients was represented, whereas in the present study participants were regularly followed up by a clinician at secondary care. It was observed that in the present study, according to GINA, 43% of the participants had well controlled asthma and, according to 4-MMAS, approximately half of the participants (55%) had medium adherence to treatment while in the European study only 20% had well controlled asthma and had a large percentage of participants with low adherence to therapy. In our case this factor may contribute towards reducing hospital admissions but adherence to treatment remains an important issue as only 20% of participants had high adherence to medication and we need objective data to confirm the high levels of adherence observed with the self-reported measures used in this study.

Patients have an average perception of the necessity and several concerns about asthma treatment which are somewhat in contradiction with the high values obtained in the evaluation of adherence to treatment. The mean scores for the Necessity and Concerns subscales of the BMQ questionnaire (19.1 and 15.6 respectively) are also comparable to previous studies such as a study by Salgado et al, carried out in 300 patients of several illness groups of public hospitals and outpatient clinics in *Guarda* and *Covilhã* (19.9 mean score for Necessity subscales and 17.7 mean score for Concerns subscales), which indicates that patients with asthma perceive necessity and concerns similarly to patients with other chronic diseases.[19] The BMQ results are associated with poor medication adherence and highlight the importance of addressing patients concerns at the time of medication prescription.

Holtz et al previously reported that using mobile devices for asthma management could improve compliance with asthma action plans and reduce adverse asthma events.[28] We studied the usage habits of mobile devices and verified that almost all of the participants used Facebook daily and that browsing the web, searching for information and using apps were also commonly used at least once a day on their smartphone.

Mobile devices can be an instrument that helps asthma self-monitoring because they are part of people's daily lives, allow the users to request data wherever they are, allow more timely health monitoring and can associate personal and social contact.[32] Darrel West stated that

mobile technology can help to provide access to information, facilitate remote care and increase efficiencies by connecting patients to their providers virtually anywhere.[30] We observed that one third of the participants had already download and used mobile applications of health or fitness and despite the fact that only one participant had used an app for asthma, more than half of the patients showed interest in using a mobile application to improve inhaler adherence. A study by Fonseca et al, carried out in 46 patients who had moderate to severe asthma and were followed at secondary care, reported patients with access to mobile phone had interest in using it for self-monitoring asthma (91%) and for information about medication (88%).[31] The designs of the studies and the 14-year difference in data collection do not allow direct comparisons but there may be differences in the interest of patients in using apps for different asthma related purposes. As mobile applications become instrumental in providing health care measures, further research is needed to prove the importance of these tools.

As an early pilot study of InspirerMundi app, four patients reported on the use of the app. The participants liked the app and the fact that it allows them to have better control of the prescribed medication. The components that had less positive opinions from the users were the gamification and the social network, but all components need to be improved in future versions of the app. Also, more studies with larger samples will be needed to further evaluate the app feasibility and validity.

Taken together our results support the importance of developing patient-centred interventions that allow the improvement of patients' understanding of asthma, increase patients' awareness and knowledge about medication and develop self-monitoring strategies that allow greater control of the disease.[32,33]

This study has some limitations that should be considered. One of the main limitations was the selection bias related to the inclusion criterion of having access to mobile devices, since the site of recruitment has a high proportion of older patients. Another important limitation is the small sample size, especially of the pilot extension study. Nevertheless, we report relevant information regarding important asthma management issues and new approaches to improve them. A third limitation involves the fact that most asthma patients had self-management asthma plans and their inhalation technique was regularly checked, a situation which is not often found in other clinical settings where asthmatic patients are seen and which may hinder generalisation.

Future studies to detect the effect of asthma management and adherence to treatment in the interest for mobile applications will need to recruit a larger sample with participants from several healthcare units with greater variety of age and socio-economic, educational variables and follow-up schedules from different regions.

Conclusion

In this study two-thirds of the participants with access to mobile devices would like to use a mobile application for asthma to improve monitoring and adherence to treatment.

Participants had a high daily usage of their mobile devices, and a high daily usage of social networks but only one third used other mobile applications. The self-reported measures about treatment adherence and perceptions related to inhaled treatment had high scores which contrast with poor asthma control and other clinical outcomes. This discrepancy may reflect a lack of awareness by the patients and a need to change asthma care. Improvements in the treatment of rhinitis, which had low levels of control and in self-monitoring between medical appointments are additional asthma management needs that are apparent from this study.

Further studies should evaluate the influence of the possible overestimation of the participants regarding treatment-related perceptions of asthma outcomes. These data imply that apps can be an effective method to improve outcomes in patients with asthma and can be an important tool as more people worldwide have access to mobile devices.

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Appendix

Appendix I: Informed consent

Consentimento livre e informado

Faculdade Ciências da Saúde da Universidade da Beira Interior ● Mestrado Integrado em Medicina
Mestrando: Célia Alexandra Soares Carvalhal, contacto telefónico: 915420612, email: celia32190@outlook.pt
Orientador: João Almeida Lopes da Fonseca, jfonseca@med.up.pt
Co-orientador: Luís Taborda Barata, email: tabordabarata@fcsaude.ubi.pt

Introdução

A asma e a rinite são doenças inflamatórias que frequentemente não estão bem controladas o que leva à diminuição da qualidade de vida e aumento dos custos em saúde. Um dos aspetos que dificulta o seu controlo é a insuficiente adesão ao plano terapêutico.

Este projeto para o qual o/a convidamos a participar, tem como objetivo avaliar a opinião dos pacientes adultos com asma e/ou rinite relativamente à utilização de aplicações móveis para a monitorização da doença inflamatória.

Descrição

Os objetivos deste projecto de investigação são: avaliar, em adultos com asma e/ou rinite, a relação entre as expetativas e limitações sobre a doença bem como o interesse em utilizar aplicações móveis para a asma; avaliar a adesão à terapêutica de doentes com asma após a utilização de uma aplicação móvel.

Para isso, os participantes adultos com asma e/ou rinite, familiarizados com o sistema Android e/ou ios, serão recrutados em consulta de Imunoalergologia no Hospital Pêro da Covilhã.

A cada participante será realizado um primeiro inquérito, a preencher na consulta, e instalada ou explicado como instalar a aplicação no dispositivo móvel. Após a consulta, o participante deverá utilizar a aplicação instalada durante um período de 6 meses.

Após este período, a exequibilidade da aplicação será avaliada através de um questionário que será realizado por via telefónica telefónica após quatro semanas bem como no final dos seis meses de utilização. (os contactos telefónicos não terão qualquer custo adicional para o hospital nem para os participantes).

Participação voluntária

A sua participação é totalmente voluntária, podendo desistir a qualquer momento sem que por isso venha a ser prejudicado nos cuidados de saúde prestados pelo CHCB, EPE.

Confidencialidade

A informação recolhida durante o estudo é confidencial, só o investigador a pode relacionar com o mesmo. O material recolhido será posteriormente utilizado somente para fins de investigação e desenvolvimento, de acordo com a Lei de Proteção de Dados de Portugal (Lei n.º 67/98. de 26 de Outubro).

Risco/benefício da participação

Neste estudo não é expectável qualquer risco específico.

A sua participação pode contribuir para uma melhor monitorização da doença e um controlo mais efetivo dos seus sintomas.

Consentimento Informado – Aluno / Investigador

Ao assinar esta página está a confirmar o seguinte:

* Entregou esta informação;

* Explicou o propósito deste trabalho;

* Explicou e respondeu a todas as questões e dúvidas apresentadas pelo participante ou representante legal.

_____

Nome do Aluno / Investigador (Legível)

_____ ____ / ____ / ____

Assinatura do Aluno / Investigador Data

Consentimento Informado – Participante

Ao assinar esta página está a confirmar o seguinte:

* O Sr. (a) leu e compreendeu todas as informações desta informação, e teve tempo para as ponderar;

* Todas as suas questões foram respondidas satisfatoriamente;

* Se não percebeu qualquer das palavras, solicitou ao aluno/investigador uma explicação, tendo este esclarecido todas as dúvidas;

* Informa-se ainda:

O participante dos 6 aos 13 anos tem de ser informado verbalmente, sendo imprescindível a assinatura dos pais no consentimento livre e informado;

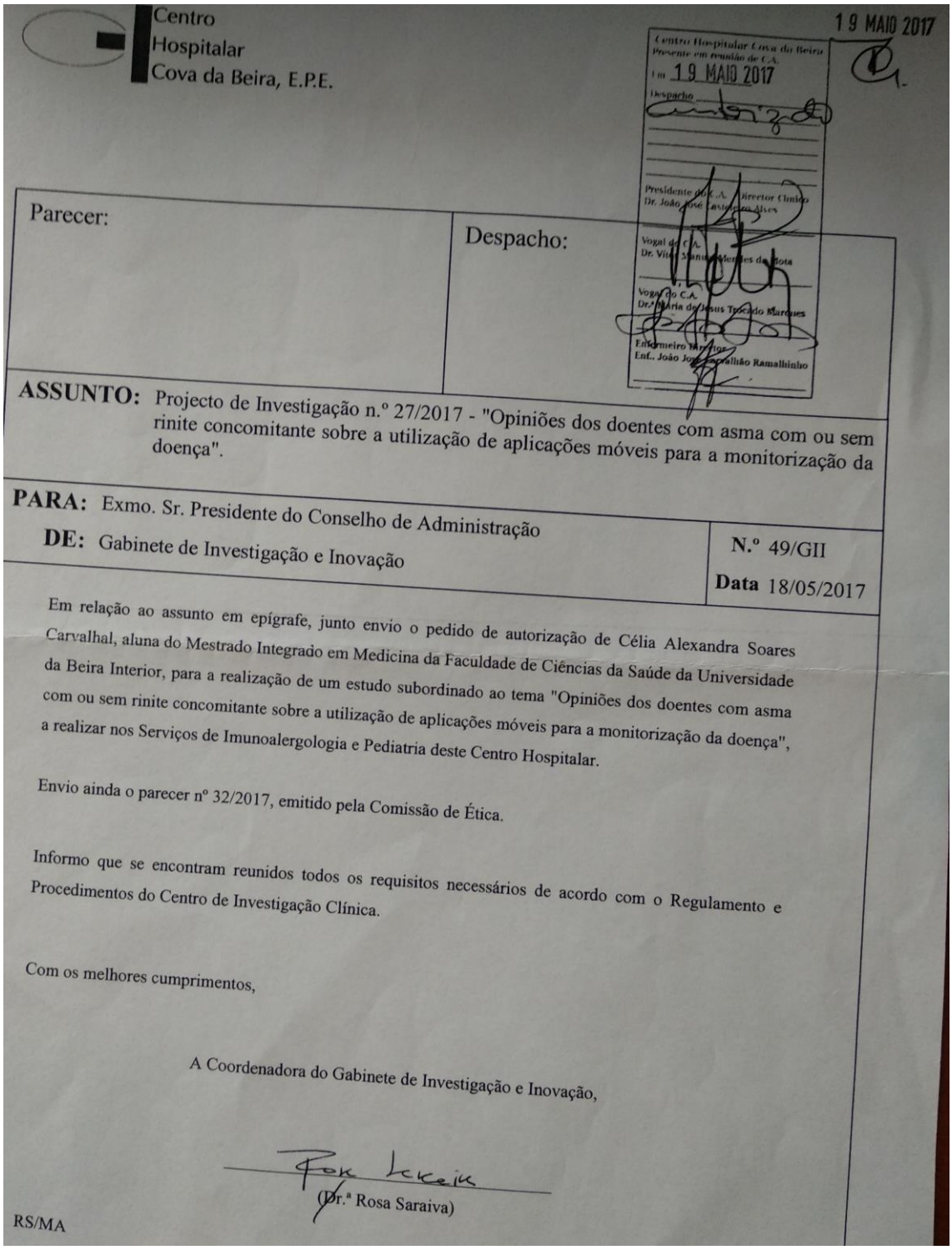
O participante dos 14 aos 16 anos assina, conjuntamente com os pais, o consentimento livre e informado;

A partir dos 16 anos assina apenas o participante;

* O Sr. (a) recebeu uma cópia desta informação, para a manter consigo.

_____	_____
Nome do Participante (Legível)	Representante Legal
_____	____ / ____ / ____
(Assinatura do Participante ou Representante Legal)	Data

Appendix II: Authorization of the Ethics Committee



Centro Hospitalar Cova da Beira, E.P.E.

19 MAIO 2017

Centro Hospitalar Cova da Beira
Presente em reunião de C.A.
Em 19 MAIO 2017
Despacho Autorizado

Presidente do C.A. / Diretor Clínico
Dr. João [illegible]

Vogal do C.A.
Dr. Vítor [illegible]

Vogal do C.A.
Dr.ª Maria de Jesus Trincado Marques

Enfermeiro Vogal
Enf.. João José [illegible] Ramalhinho

Parecer:	Despacho:

ASSUNTO: Projecto de Investigação n.º 27/2017 - "Opiniões dos doentes com asma com ou sem rinite concomitante sobre a utilização de aplicações móveis para a monitorização da doença".

PARA: Exmo. Sr. Presidente do Conselho de Administração

DE: Gabinete de Investigação e Inovação

N.º 49/GII

Data 18/05/2017

Em relação ao assunto em epígrafe, junto envio o pedido de autorização de Célia Alexandra Soares Carvalhal, aluna do Mestrado Integrado em Medicina da Faculdade de Ciências da Saúde da Universidade da Beira Interior, para a realização de um estudo subordinado ao tema "Opiniões dos doentes com asma com ou sem rinite concomitante sobre a utilização de aplicações móveis para a monitorização da doença", a realizar nos Serviços de Imunoalergologia e Pediatria deste Centro Hospitalar.

Envio ainda o parecer nº 32/2017, emitido pela Comissão de Ética.

Informo que se encontram reunidos todos os requisitos necessários de acordo com o Regulamento e Procedimentos do Centro de Investigação Clínica.

Com os melhores cumprimentos,

A Coordenadora do Gabinete de Investigação e Inovação,

(Dr.ª Rosa Saraiva)

RS/MA

Centro
Hospitalar
Cova da Beira, E.P.E.

DECLARAÇÃO

Para os devidos efeitos declaro que autorizo a realização do estudo **"Opinions of patients with persistent asthma on the use of mobile applications for disease monitoring"** no Serviço de Pneumologia.

Covilhã, 22 de Março de 2018.

Diretor de Serviço de Pneumologia

Appendix III: Survey

DADOS SOCIODEMOGRÁFICOS E ANTROPOMÉTRICOS

1. Data de nascimento	_____ / _____ / _____ (DD/MM/AAAA)
2. Género	Feminino ☐$_0$ Masculino ☐$_1$
3. Estado Civil	Solteiro(a) ☐$_1$ Casado(a) ☐$_2$ União de facto ☐$_3$ Separado(a) ☐$_4$ Divorciado(a) ☐$_5$
4. Nº pessoas no agregado familiar (contando com o próprio)	_____ pessoas
5. Escolaridade	Não sei ler nem escrever ☐$_1$ Sei ler e escrever ☐$_2$ I Ciclo (1º-4º anos) ☐$_3$ II Ciclo (5º-6º anos) ☐$_4$ III Ciclo (7º-9º anos) ☐$_5$ Secundário (10º-12º anos) ☐$_6$ Ensino Universitário ☐$_7$ Pós-graduação ☐$_8$
6. Ocupação	Empregado(a) ☐$_1$ Empregado(a) por conta própria ☐$_2$ Desempregado ☐$_3$ Não está a trabalhar devido a saúde precária ☐$_4$ Doméstico(a) ☐$_5$ Estudante ☐$_6$ Reformado(a) ☐$_7$ Outro ☐$_8$
7. Dados antropométricos:	
7.1 Peso	_____ kg
7.2 Altura	_____ m
8. Atualmente fuma?	Sim ☐$_1$ Não ☐$_0$
9. No passado alguma vez fumou?	Sim ☐$_1$ Não ☐$_0$
Se Sim na questão 8 ou 9:	
9.1 Com que idade começou a fumar?	____ anos
9.2 Se atualmente não fuma com que idade deixou de fumar?	____ anos
9.3 Quantos cigarros fuma/fumava por dia em média?	____ cigarros
10. Está exposto/a a fumo passivo do tabaco dentro de casa?	Sim ☐$_1$ Não ☐$_0$
11. Está exposto/a a fumo passivo do tabaco noutros locais?	Sim ☐$_1$ Não ☐$_0$
11.1 Se Sim, qual (ais)?	_____ _____

CONTROLO DA ASMA E CARACTERÍSTICAS CLÍNICAS (pelo clínico)

1. Há quanto tempo segue este doente? _____anos

Relativamente ao seu doente, nas últimas 4 semanas:

2. Sintomas diurnos de asma mais de 2 vezes por semana? Sim ☐1 Não ☐0

3. Ocorrência de sintomas durante a noite / perturbação no sono Sim ☐1 Não ☐0

4. Uso da medicação de alívio rápido de sintomas de asma mais de 2 vezes por semana? Sim ☐1 Não ☐0

5. Limitação da atividade física devido à asma? Sim ☐1 Não ☐0

6. Exacerbações nos últimos 12 meses Nenhuma ☐0
_____ vezes

7. FEV_1 (últimos 12 meses, se disponível) _____ % do valor teórico previsto pré-broncodilatador

8. Terapêutica inalada do doente:

Fármaco/Fármacos	Dose	Tipo de inalador	Número de tomas/dia

9. Outra terapêutica do doente para a asma (e.g., montelukcaste, teofilina):

Fármaco	Dose	Número de tomas

10. O doente faz imunoterapia antialérgica? Subcutânea ☐1 Sublingual ☐2 Não ☐0

11. O doente faz terapêutica biológica (e.g., IgE)? Sim ☐1 Não ☐0

12. O doente tem outras condições crónicas? Sim ☐1 Não ☐0

12.1 Se sim, qual (ais): _____
_____
_____

CONTROLO DA ASMA (pelo doente)

Nas últimas <u>4 semanas</u>, por causa da sua asma/rinite/alergia, em média, quantas vezes teve:	**Nunca**	**Até 1 ou 2 dias por semana**	**Mais de 2 dias por semana**	**Quase todos ou todos os dias**
1. Nariz entupido?	☐3	☐2	☐1	☐0
2. Espirros?	☐3	☐2	☐1	☐0
3. Comichão no nariz?	☐3	☐2	☐1	☐0
4. Corrimento/pingo do nariz?	☐3	☐2	☐1	☐0
5. Falta de ar/dispneia?	☐3	☐2	☐1	☐0
6. Chiadeira no peito/pieira?	☐3	☐2	☐1	☐0
7. Aperto no peito com esforço físico?	☐3	☐2	☐1	☐0
8. Cansaço/dificuldade em fazer as suas actividades ou tarefas do dia-a-dia?	☐3	☐2	☐1	☐0
9. Acordou durante a noite por causa da sua asma/rinite/alergia?	☐3	☐2	☐1	☐0

Nas últimas <u>4 semanas</u>, por causa da sua asma/rinite/alergia, quantas vezes teve que:	**Não estou a tomar medicamentos**	**Nunca**	**Menos de 7 dias**	**7 ou mais dias**
10. Aumentar a utilização dos seus medicamentos?	☐3	☐3	☐2	☐0

11. Nos <u>últimos 12 meses</u>, teve crises de asma (episódios de aumento progressivo de dispneia, tosse, pieira e/ou aperto torácico)?	Nenhuma ☐0 _____ vezes
12. Nos <u>últimos 12 meses</u>, precisou de fazer tratamento com corticóide oral (e.g., deflazacorte, medrol, celestone) devido a esses episódios?	Nenhuma ☐0 _____ vezes
13. Quantas consultas para a asma, não agendadas (previamente marcadas), necessitou <u>nos últimos 12 meses</u>?	Nenhuma ☐0 _____ consultas
14. Quantas vezes necessitou de ir a uma urgência por causa da sua asma, <u>nos últimos 12 meses</u>?	Nenhuma ☐0 _____ vezes
14.1 Que tipo de urgência é que foi por causa da sua asma/falta de ar, <u>nos últimos 12 meses</u>?	Centro de saúde / Unidade de Saúde Familiar ☐1 Hospital Público ☐2 Clínica / Hospital Privado ☐3

15. Quantas vezes esteve internado num hospital devido à sua asma, <u>nos últimos 12 meses</u>? (Por favor, não considere passar a noite nas urgências.)	Nenhuma ☐0 _____ vezes
16. Quantos dias de trabalho/escola perdeu por ter consultas de rotina de asma, <u>nos últimos 12 meses</u>?	Nenhum ☐0 _____ dias
17. Quantos dias de trabalho/escola perdeu por ter que tratar em casa as crises de asma, <u>nos últimos 12 meses</u>? (Por favor, não considere os dias de internamento.)	Nenhum ☐0 _____ dias
18. Quantos dias de trabalho/escola perdeu por estar internado por crises de asma, <u>nos últimos 12 meses</u>?	Nenhum ☐0 _____ dias

TRATAMENTO DA ASMA, ADESÃO E SATISFAÇÃO COM O INALADOR

1. Que idade tinha quando lhe foi diagnosticada asma?	_____ anos	
2. Usa alguma forma de monitorizar a sua asma (e.g., sintomas, medidor de pico de fluxo/peak flow meter/DEMI, aplicação movél)?	Sim ☐1	Não ☐0
2.1 Se Sim, qual?	_____ _____	
3. Nos últimos 12 meses, o seu médico explicou-lhe a forma como deveria usar os inaladores para a asma?	Sim ☐1	Não ☐0
4. Tem um plano de tratamento escrito para a asma dado pelo seu médico sobre como usar os inaladores para a asma?	Sim ☐1	Não ☐0

5. Como classificaria a sua adesão aos inaladores para a asma na última semana?

Pior ├──┤ Melhor

6. Atualmente toma medicamentos para outras condições de saúde?	Sim ☐1	Não ☐0
6.1 Se Sim, para qual(ais)?	_____ _____ _____	
7. Nunca tomou os inaladores para a asma?	Sim ☐1	Não ☐0

8. Com frequência opta por tomar menos doses do que as prescritas pelo seu médico?	Sim ☐1	Não ☐0
9. Alguma vez se esqueceu de tomar os inaladores?	Sim ☐1	Não ☐0
10. Alguma vez foi descuidado com as horas da toma dos inaladores para a sua doença?	Sim ☐1	Não ☐0
11. Alguma vez deixou de tomar os inaladores por se ter sentido melhor?	Sim ☐1	Não ☐0
12. Alguma vez deixou de tomar os inaladores, por sua iniciativa, após se ter sentido pior?	Sim ☐1	Não ☐0
13. Alguma vez interrompeu a terapêutica para a sua doença por ter deixado acabar os medicamentos?	Sim ☐1	Não ☐0
14. Alguma vez deixou de tomar os inaladores por alguma outra razão que não seja a indicação do médico?	Sim ☐1	Não ☐0
15. Quando está de férias ou ao fim-de-semana, deixa de tomar os inaladores?	Sim ☐1	Não ☐0
16. Levanta sempre na farmácia as receitas dos inaladores que o seu médico lhe passa para a asma?	Sim ☐1	Não ☐0
Alguns dos seguintes aspetos tornam difícil tomar os seus inaladores para a asma?		
17. Não saber realmente usar os inaladores	Sim ☐1	Não ☐0
18. Ter de tomar os inaladores várias vezes ao dia	Sim ☐1	Não ☐0
19. O preço dos inaladores	Sim ☐1	Não ☐0

20. Atualmente, a minha saúde depende destes inaladores.

Discordo Fortemente	Discordo	Não concordo nem discordo	Concordo	Concordo Fortemente
1	2	3	4	5

21. A minha vida seria impossível sem estes inaladores.

Discordo Fortemente	Discordo	Não concordo nem discordo	Concordo	Concordo Fortemente
1	2	3	4	5

22. Sem estes inaladores, eu estaria muito doente.

Discordo Fortemente	Discordo	Não concordo nem discordo	Concordo	Concordo Fortemente
1	2	3	4	5

23. A minha saúde no futuro dependerá destes inaladores.

Discordo Fortemente	Discordo	Não concordo nem discordo	Concordo	Concordo Fortemente
1	2	3	4	5

24. Estes inaladores protegem-me de ficar pior.

Discordo Fortemente	Discordo	Não concordo nem discordo	Concordo	Concordo Fortemente
1	2	3	4	5

25. Preocupa-me ter de tomar estes inaladores.

Discordo Fortemente	Discordo	Não concordo nem discordo	Concordo	Concordo Fortemente
1	2	3	4	5

26. Às vezes, preocupo-me com os efeitos a longo prazo destes inaladores.

Discordo Fortemente	Discordo	Não concordo nem discordo	Concordo	Concordo Fortemente
1	2	3	4	5

27. Estes inaladores são um mistério para mim.

Discordo Fortemente	Discordo	Não concordo nem discordo	Concordo	Concordo Fortemente
1	2	3	4	5

28. Estes inaladores perturbam a minha vida.

Discordo Fortemente	Discordo	Não concordo nem discordo	Concordo	Concordo Fortemente
1	2	3	4	5

29. Às vezes, preocupo-me em ficar demasiado dependente destes inaladores.

Discordo Fortemente	Discordo	Não concordo nem discordo	Concordo	Concordo Fortemente
1	2	3	4	5

30. Estes inaladores dão-me desagradáveis efeitos secundários.

Discordo Fortemente	Discordo	Não concordo nem discordo	Concordo	Concordo Fortemente
1	2	3	4	5

31. Uso corretamente a técnica do meu inalador

Totalmente incorreto ⊢——————————————————⊣ Totalmente correto

32. Sinto-me satisfeito com o meu inalador

Totalmente insatisfeito — Totalmente satisfeito

33. Senti que o médico teve em conta a minha opinião e preferências na escolha do meu inalador

Não teve nada em conta — Teve tudo em conta

34. Sinto-me confortável em usar o meu inalador em público

Nunca usaria em público — Completamente à vontade

ACESSO E UTILIZAÇÃO DE DISPOSITIVOS MÓVEIS

1. Tem algum dispositivo móvel? Sim ☐1 Não ☐0

1.1 Se Sim, qual é o dispositivo?
Telemóvel ☐1
Smartphone (*Iphone*/Android) ☐2
Tablet/*Ipad* ☐3

2. Com que frequência desempenha as actividades seguintes no *smartphone/tablet*?	**Nunca**	**Uma vez por mês**	**Várias vezes por mês**	**Uma vez por semana**	**Várias vezes por semana**	**Uma vez por dia**	**Várias vezes por dia**	**Uma vez por hora**	**Várias vezes por hora**	**Constantemente**
2.1. Ler os e-mails	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
2.2. Obter direções (como chegar a um local) ou usar o GPS	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
2.3. Navegar na internet	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
2.4. Ouvir música	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
2.5. Tirar fotografias	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
2.6. Verificar as notícias	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
2.7. Gravar vídeo	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
2.8. Usar aplicações (qualquer uma)	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
2.9. Procurar informação	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10

3. Tem uma página no facebook?	Sim ☐1		Não ☐0							
	Nunca	**Uma vez por mês**	**Várias vezes por mês**	**Uma vez por semana**	**Várias vezes por semana**	**Uma vez por dia**	**Várias vezes por dia**	**Uma vez por hora**	**Várias vezes por hora**	**Constantemente**
3.1 Se Sim, com que frequência acede ao facebook ou outras redes sociais?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
3.2 Já fez referência à sua asma nas redes sociais?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
4. Já fez o download e usou aplicações móveis de saúde e *fitness*?	**Nunca**		**Uma vez**	**Algumas vezes**		**Frequentemente**				
	☐1		☐2	☐3		☐4				
5. Já fez o download e usou aplicações móveis para a asma?	Sim ☐1		Não ☐0							
6. Gostaria de utilizar uma aplicação móvel para a asma?	Sim ☐1		Não ☐0							
7. Gostaria de utilizar uma aplicação móvel para melhorar a adesão à medicação inalada para a asma?	Sim ☐1		Não ☐0							
8. Gostaria de participar em estudos de avaliação e desenvolvimento de aplicações móveis para a asma?	Sim ☐1		Não ☐0							
8.1 Se Sim, autoriza ser contactado para este efeito por e-mail?	Sim ☐1		Não ☐0	E-mail: _____						

OPINIÃO E SATISFAÇÃO COM A APLICAÇÃO

1. Acho que gostaria de utilizar esta aplicação com frequência.

Discordo Fortemente				Concordo Fortemente
1	2	3	4	5

2. Considerei a aplicação mais complexa do que necessário.

Discordo Fortemente				Concordo Fortemente
1	2	3	4	5

3. Achei a aplicação fácil de utilizar.

Discordo Fortemente				Concordo Fortemente
1	2	3	4	5

4. Acho que necessitaria de ajuda de um técnico para conseguir utilizar esta aplicação.

Discordo Fortemente				Concordo Fortemente
1	2	3	4	5

5. Considerei que as várias funcionalidades desta aplicação estavam bem integradas.

Discordo Fortemente				Concordo Fortemente
1	2	3	4	5

6. Achei que esta aplicação tinha muitas inconsistências.

Discordo Fortemente				Concordo Fortemente
1	2	3	4	5

7. Suponho que a maioria das pessoas aprenderia a utilizar rapidamente esta aplicação.

Discordo Fortemente				Concordo Fortemente
1	2	3	4	5

8. Considerei a aplicação muito complicada de utilizar.

Discordo Fortemente				Concordo Fortemente
1	2	3	4	5

9. Senti-me muito confiante a utilizar esta aplicação.

Discordo Fortemente				Concordo Fortemente
1	2	3	4	5

10. Tive que aprender muito antes de conseguir lidar com esta aplicação.

Discordo Fortemente				Concordo Fortemente
1	2	3	4	5

11. Estou satisfeito com a componente de monitorização dos sintomas.

Discordo Fortemente				Concordo Fortemente
1	2	3	4	5

12. Estou satisfeito com a componente de deteção por vídeo do uso do inalador.

Discordo Fortemente				Concordo Fortemente
1	2	3	4	5

13. Estou satisfeito com a componente de jogo.

Discordo Fortemente				Concordo Fortemente
1	2	3	4	5

14. Estou satisfeito com a componente da rede social

Discordo Fortemente				Concordo Fortemente
1	2	3	4	5

15. Globalmente, estou satisfeito com a aplicação.

Discordo Fortemente				Concordo Fortemente
1	2	3	4	5

16. Eu recomendaria esta aplicação a outras pessoas com asma

Discordo Fortemente				Concordo Fortemente
1	2	3	4	5

17. O uso da aplicação aumentou a minha consciência sobre a importância da adesão à medicação.

Discordo Fortemente				Concordo Fortemente
1	2	3	4	5

18. O uso da aplicação aumentou a minha motivação para aderir à medicação.

Discordo Fortemente				Concordo Fortemente
1	2	3	4	5

19. O que gostou mais na aplicação móvel?

_____

_____

20. O que gostou menos na aplicação móvel?

_____

_____