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Journal:	*BMJ Open*
Manuscript ID	bmjopen-2015-010809
Article Type:	Research
Date Submitted by the Author:	14-Dec-2015
Complete List of Authors:	van Gaalen, Johanna L.; Leiden Univ, Medical Decision Making van Bodegom - Vos, Leti; Leids Universitair Medisch Centrum, medical decision making Bakker, Moira; Leids Universitair Medisch Centrum, medical desicion making Snoeck-Stroband, Jiska; Leiden University Medical Center, Medical Decision Making Sont, Jacob; Leids Universitair Medisch Centrum, Medical Decision Making
Primary Subject Heading:	Qualitative research
Secondary Subject Heading:	General practice / Family practice, Patient-centred medicine, Respiratory medicine
Keywords:	Asthma < THORACIC MEDICINE, Telemedicine < BIOTECHNOLOGY & BIOINFORMATICS, PRIMARY CARE

INTERNET-BASED SELF-MANAGEMENT SUPPORT FOR ADULTS WITH ASTHMA: A QUALITATIVE STUDY AMONG PATIENTS, GENERAL PRACTITIONERS AND PRACTICE NURSES ON BARRIERS AND FACILITATORS TO IMPLEMENTATION

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Keywords: asthma, self-management, ehealth, telemedicine, implementation
Word count: 3823

ABSTRACT

Objectives

To assess barriers and facilitators among patients, general practitioners and practice nurses to implementing internet-based self-management support for asthma in primary care.

Setting

Participants were recruited from general practices within the Leiden - the Hague region within The Netherlands.

Participants

Twenty-two asthma patients, twenty-one general practitioners and thirteen practice nurses.

Design

The study used a qualitative methodology, comprising focus groups and individual interviews based on a theoretical model. Four focus groups were held with patients (n=20), four with general practitioners (n=16) and two focus groups with practice nurses (n=8). Interviews were conducted with two patients, five general practitioners and five practice nurses. A semi-structured topic guide was used to facilitate the interviews.).Focus groups and interviews were audio-taped, fully transcribed and independently coded.

Results

Main barriers and facilitators mentioned by patients, general practitioners and practice nurses: level of usability of IBSM tool; the individual's attitude towards IBSM and perceived benefits; difficulties with changing routines; lack of structured routine asthma care. Additional barriers and facilitators mentioned by specific user groups included: need for personal guidance, disease perception (patients); lack of sense of urgency for asthma care and financial arrangements (general practitioners); self-efficacy and peer support (practice nurses). Asthma patients are perceived as a difficult target group by both practice nurses and general practitioners.

Conclusion

Our findings indicate several factors that could either hamper of facilitate implementation strategies. Future strategies should address all relevant factors among patients, general practitioners and practice nurses.

STRENGTHS AND LIMITATIONS OF THE STUDY

- This study provides in-depth information on barriers and facilitators to the use of internet-based self-management support among both patients, general practitioners and practice nurses
- Our study highlight that future implementation strategies should create a sense of urgency concerning the lack of asthma control among patients and general practitioners, and educate practice nurses to be able to function as a self-management coach
- Our recruitment strategy was designed to include a diverse sample of patients and professionals.
- Our data have been obtained in Dutch general practice, which might make it difficult to translate findings to different settings
- Participants have not been able to use the internet-based self-management programme in real life.

INTRODUCTION

Asthma is characterized by variability in symptoms and airflow limitation. [1] Therefore asthma treatment should be adjusted over time. [2] Within primary care, only one-third of patients have 'well-controlled' asthma, one-third have partly controlled asthma and one-third have uncontrolled asthma. [3, 4] Self-management is an important aspect of the treatment in order to achieve and sustain asthma control. Self-management strategies consisting of self-monitoring, education, regular consultation with a professional and provision of an action plan have been demonstrated to improve health outcomes for asthma patients. [5, 6] However, self-management strategies are poorly implemented within general practice. [7-9] Internet-technology might offer attractive means for encouraging patients to use self-management strategies within a day-to-day context. [10]

Van der Meer *et al* demonstrated that use of internet-based self-management support (IBSM) leads to improved asthma-related quality of life, asthma control and lung function as well as a greater number of symptom free days as compared to usual care. [11] Analysis of the cost-effectiveness and long-term outcomes of this study showed that IBSM is the preferred strategy as compared to current care in terms of a sustained improvement in quality of life with similar costs over a one-year period.[12, 13] Patients most likely to be willing to participate and benefit from IBSM are those with poorly controlled asthma. [4] The current challenge is to implement IBSM support in routine asthma management within primary care. It has been recommended that implementation strategies be tailored to factors either hampering ('barriers') or facilitating ('facilitators') take-up. [14, 15] Moreover, strategies that address patient, professional and organizational factors are the most successful in improving process and clinical outcomes. [16] Therefore, the aim of this study is to explore barriers and facilitators to implementing an IBSM support programme among patients with asthma, general practitioners and practice nurses.

METHODS

Design

We conducted semi-structured focus groups (FGs) and interviews (IVs) among patients (PTs), general practitioners (GPs) and practice nurses (PNs). IVs were held for those who were unwilling or unable to attend a focus group. Previous research has established that FGs and IVs are effective methods for detecting obstacles to change within healthcare. [17] A topic list (Supplementary files 1 and 2) was used to guide FGs and IVs. This topic list was based on a theoretical model developed by Grol and Wensing [15] *w*hich describes different levels of healthcare in which barriers and facilitators for change can be identified: the innovation itself, the individual professional, the patient, the social context, the organisational context, and the economic and political context. To assess whether the content of our topic list required changes, we analyzed data from the first three FGs prior to further data collection. No major adjustments were deemed necessary on the basis of this analysis.

Participant selection and recruitment

We estimated that we would need to interview approximately 20 PTs, 20 GPs and 15 PNs to obtain sufficient information. GPs were recruited by sending an invitation letter to general practices within the Leiden - the Hague region, which also includes practices from the Leiden general practice (LEON) network. By including LEON network practices we aimed to include GPs, and patients, who had previously participated in the Self-Management of Asthma Supported by Hospitals, ICT Nurses, and General Practitioners (SMASHING) study. [11] Due to privacy reasons, we were not able to directly invite previously participating patients. Positively responding GPs were asked permission to invite their patients and PNs to participate. Patient inclusion criteria were: physician-diagnosed asthma, age 18-50 years, use of inhaled corticosteroids and/or montelukast for at least 3 months in the previous two years, access to internet, no serious co-morbid conditions, and ability to understand Dutch. From thirteen practices (one GP practice covered two separate practices), we randomly selected 10 patients (130 patients). In total, 26 patients responded to our invitation, of whom 22 ultimately participated. Reasons for declining to participate not participating were: no asthma symptoms (n=6), lack of time (n=4), Ramadan (n=1), unknown (n=108). In total, 24 PNs responded positively, of whom 13 ultimately participated (reasons for declining to participate: lack of time (n=1), lack of financial reimbursement (n=1), unknown (n=9).

Four FGs were held with patients (n=20), four with GPs (n=16) and two with PNs (n=8). Two patients, five GPs and five PNs were individually interviewed. Six GPs and one patient previously participated in the SMASHING study. Participant characteristics are listed in tables 1 and 2.

Table 1. Patient characteristics.

		N (%) (n=22)
Age (y), mean (range)		38 (20-51)
Gender	Female	55
Smoking (%)	Never	68
	Past	18
	Current	14
ACQ[a] score, mean (range)		1.2 (0-2.9)
Prebrochodilator FEV1[b] % predicted, range		94 (79-107)
Highest level of education: completed high school or lower	Completed secondary school	45
Ethnicity	Dutch	22 (100)

All variables are in % except where indicated.

[a]Asthma Control Questionnaire, range (0) optimal asthma control – (6) uncontrolled asthma)

[b] FEV1 = forced expiratory volume in 1 second

Table 2. General practitioner and practice nurse characteristics**.**

		General practitioners (n=21)	Practice nurses (n=13)
Females %		29	100
Age (y), mean (range)		52 (36-60)	41 (27-58)
Years practicing as a GP or PN	5	0	54
	5-10	19	46
	>10	81	0
Number of GPs working within general practice	≤2	52	31
	>2	48	69
Setting	Urban	57	62
	Rural	43	38

All variables are in % except where indicated.

Focus groups and interviews

FGs and IVs were conducted between May and October 2010. FGs were performed at the Leiden University Medical Centre (LUMC) and were conducted separately for each participant group. IVs were held at the LUMC, at the general practice, or at the individual's patient's home. FGs took 1.5 hours, which included a 15- minute break. IVs lasted 40 minutes. FGs and IVs were conducted until data saturation was reached; that is, until no new barriers emerged in three consecutive focus groups or interviews for a given participant group. [18]

Asthma control was assessed using the Asthma Control Questionnaire, [19, 20] and lung function using a hand-held electronic spirometer (PiKo1: nSpire Health, Inc, Longmont CO, USA).

Data analysis

FGs and IVs were audio-taped and fully transcribed. Transcripts were coded independently by two researchers. Coding was compared and discrepancies were discussed until consensus was achieved. Identified factors were coded according to the theoretical model of Grol and Wensing and categorized within the appropriate domains. [15] The first IVs and FGs were discussed with the complete research team. Analyses were undertaken using the software NVivo; QSR International Pty Ltd. Version 10, 2012. The results have been reported in accordance with the Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist. [21]

RESULTS

Factors related to IBSM usage according to patients

We identified a variety of barriers and facilitators among patients (table 3), that could be grouped into 13 themes. Most barriers and facilitators were perceived at the level of the individual patient as compared to the other domains in which barriers and facilitators were identified. Items that have been reported in at least 70% of the interviews and/or focus groups will be described in the text below.

Table 3. Barriers and facilitators for IBSM usage according to patients.

Level	Theme	B[a]	F[b]
Innovation	**Patient professional partnership**		X
	Lack of (B) / Sufficient (F) ease of use	X	X
	Time consuming	X	
	Lack of (B) / Sufficient (F) evidence	X	X
Individual professional	Lack of (B)/ Sufficient (F) knowledge and skills on asthma management	X	X
Individual patient	**Negative (B) / Positive (F) attitude towards IBSM**	X	X
	Lack of (B) / sufficient (F) outcome expectancy	X	X
	Difficulties changing routines	X	
	Perception of asthma	X	
	Patient characteristics	X	X
Organisational context	**Lack of (B)/ Sufficient (F) routine asthma care**	X	X
Economic context	User fee	X	
Social context	Peer support		X

[a]B: barrier [b]F: facilitator. Themes depicted in bold have been reported within at least 70% of the focus groups/interviews

Innovation

Necessity of patient-professional partnership. Personal guidance by a healthcare professional was identified as a main condition for effective IBSM. "Alongside the programme I would like to have regular consultations with my healthcare professional. Just to be sure you're doing the right thing" [Patient 8, male, 29 years].

Ease of use. The programme should be easy to use "The design has to be simple, it should have bright colours and should be easy to read" [Patient 23, male, 33 years]. Settings should be tailored to patients' individual needs: "I want to decide during which period, i.e. 3 months I will be monitoring my symptoms, I also want to decide if I receive reminders for monitoring by e-mail or SMS and the frequency of these reminders" [Patient 8, male, 29 years].

Individual professional

Among interviewed patients no main themes emerged at the level of the individual professional.

Individual patient

Attitude towards IBSM. Some patients felt that the Internet is impersonal. "I don't like it at all. I'm not

interested in using the Internet. I believe that my GP should handle my asthma" [Patient 3, female, 48 years]

Outcome expectancy. Facilitating the patient's ability to self-manage their asthma was a perceived benefit. "I tend to respond to changes in my asthma too late I would be willing to use it as it might help me to respond more adequately" [Patient 18, female, 45 years].

However, some patients expressed concern that IBSM usage could confront them with difficulties they face in managing their own health: "I'm afraid about self-confrontation. When you're doing well and start smoking and all your graphs show you're getting worse." [Patient 21, male, 24 years].

Changing routines . Not all patients were willing to change their current routines for asthma treatment. "I'm using my medications twice daily and (because of this) I'm doing well. I'm not willing to change this" [Patient 2, male, 20 years].

Perception of asthma. Some patients did not perceive asthma as a chronic condition, and not all patients are aware (of the lack) of asthma control, which influences their actual asthma management. "During the summer I usually stop taking my maintenance medication (flixotide), but I tend to wait too long to restart my medication. Since two weeks I'm feeling exhausted when I wake up – and now I'm thinking I should restart it" [Patient 7, female, 37 years].

Organisational context

Lack of routine asthma care. During patient interviews it emerged that there is variation in the level of structured asthma care that patients are offered. "I do not attend my general practice on a regular basis. Only when symptoms get worse" [Patient 14, male, 30 years].

Possibly, well-organized asthma care could contribute to a better take-up of IBSM: "My GP practice invites me regularly for lung function measurements, which I always attend, as this provides me with insight" [Patient 23, male, 33 years].

Social and economic context

Among interviewed patients no main themes emerged at the level of the social and economic context.

Factors related to IBSM usage according to professionals.

Among GPs and PNs professionals, we identified barriers and facilitators that we grouped into 23 themes (table 4)**.** Items that have been reported in at least 70% of the interviews and/or focus groups will be described in the text below.

Table 4. Barriers and facilitators for IBSM according to general practitioners and practice nurses.

Level	Theme	General practitioners		Practice Nurses	
		B[a]	F[b]	B[a]	F[b]
Innovation	**Lack of (B) / Sufficient (F) ease of use**	X	X	X	X
	Lack of (B)/ adequate(F) integration within electronic medical record system	X	X	X	X
	Impersonal	X		X	
	Evidence		X		
	Time consuming	X			
	Lack of security				X
Individual professional	**Negative (B) / Positive (F) attitude towards IBSM**	X	X	X	X
	Discrepancy (B) / Concordance (F) with current work routines	X	X	X	X
	Lack of (B)/ Sufficient (F) perceived level of benefit	X	X	X	X
	Low sense of urgency with respect to asthma care	X			
	Lack of self-efficacy			X	
	Characteristics professional			X	
Individual patient	**Difficult target group**	X		X	
	Patient characteristics	X	X	X	X
	Difficulties changing routines	X		X	
	Characteristics asthma	X	X	X	X
Organisational Context	**Lack of (B) / Well organized (F) routine asthma care**	X	X	X	X
	General practice characteristics	X	X	X	X
	Lack of support by colleagues			X	
	Lack of (B)/ Sufficient (F) financial arrangements	X	X	X	
	Lack of (B)/ Sufficient availability of staff, tools, consultation rooms	X	X		
Economic context	**Lack of (B)/ Sufficient (F) financial arrangements**	X	X	X	
Social context	**Lack of support by colleagues**			X	

[a]B: barrier [b]F: facilitator. Themes depicted in bold have been reported within at least 70% of the focus groups/interviews

Innovation

Ease of use. Design and content should be straightforward and easy to integrate into the work routines of professionals. "It would be ideal if the GP could see the patient's data like" [GP 2, male, 56 years].

Integration within the electronic medical record system. Integration of IBSM within the electronic registry system emerged as a sine qua non condition for IBSM usage.

"What is most annoying is that these programmes are not integrated within our system" [GP 18, female, 43 years].

Impersonal. Some PNs and GPs felt that IBSM is impersonal: "I prefer to see patients in real life. When they're entering my consultation room my observation starts – that's invaluable" [GP 10, male, 53 years].

Individual professional

Attitude. The professionals who were interested in general in using innovations within their practice demonstrated a positive attitude towards IBSM*:* "The future is internet, also in medicine, especially for those who have busy lives" [GP 18, female, 43 years]

Current work routines. Among professionals working in practices without structured asthma care a more passive approach towards asthma management was identified: "I only see patients when they're having an exacerbation, or when I feel that someone is contacting too often for a refill of ventolin" [GP 9, male, 57 years]. This is in contrast to work routines of professionals in practices with structured asthma care, who vary professional involvement according to the needs of the patient: "We add a notification to a medical record if a patient has asthma or COPD, so we can ask a patient when they're attending consultations whether they experience asthma symptoms. If symptoms aren't under control we invite them for a consultation. We invite patients on a regular basis for spirometry" [GP 15, male, 51 years].

Perceived level of benefit. GPs mentioned they would be willing to invest in IBSM if the cost-effectiveness analysis proved favourable: "It will provide insight into the actual level of asthma control. This will be motivating for patients [with asthma], just like patients with diabetes (DM) and cardiovascular risk management" [GP 12, female, 57 years].

Sense of urgency with respect to asthma care. GPs demonstrated differing senses of urgency regarding asthma care: "I can't remember if I have had an emergency due to an asthma attack. Asthma is not that severe… apparently the self-management of patients is very good … probably due to the improved efficacy of inhalation therapy" [GP 6, male, 61 years].

Self-efficacy. PNs felt that sufficient knowledge is required to apply IBSM within their practice: "It's important to have sufficient knowledge, to be able to explain your treatment advice to a patient" [PN 8, female, 49 years]. Among PNs working in practices without structured asthma care a lack of

perceived self-efficacy was identified as a potential barrier. “The asthma protocol has to be written. Currently, I would refer patients to a GP as I don’t have the knowledge and experience to guide asthma patients” [PN 8, female, 49 years].

.**Individual patient**

Difficult target group. Professionals identified asthma patients as a challenging target group. “Routine asthma care is difficult to organize. Patients do not attend their routine asthma consultations” (PN). “Patients often visit our practice too late, as they think their asthma is doing fine, when it’s clearly not” [GP 1, male, 60 years]

Patient characteristics. A programme like IBSM was not found to be suitable for all asthma patients. “Patients do need certain skills in order to use the Internet. I think it’s unsuitable for elderly or first generation immigrants” [GP 10, male, 53 years]. IBSM was also not found suitable for all levels of symptom severity: “If asthma is under control, there’s no sense in using it in terms of benefit” [GP 17, male, 58 years].

Organisational context

Routine asthma care. Particularly among PNs, the level of organization of structured asthma care was identified as an important factor influencing their ability to use a programme like IBSM. “We do not have a protocol for asthma [..]Currently we are targeting diabetes, cardiovascular risk management in the elderly. Later on we will address COPD and asthma. COPD will be prioritized more highly” [PN 7, female, 55 years].

General practice characteristics. Some professionals expressed that although they were enthusiastic about IBSM, their practice location would make it difficult to use this programme: “Our practice is located in a rural setting. Our patients do not use the internet as often as those who are living in the city” [PN 13, female, 38 years].

Availability of staff, tools and consultation rooms. To provide asthma care using IBSM, GPs identified that they would need the availability of sufficient equipment and staff: “Nowadays, more sophisticated tools are available. Unfortunately I do not have them in my back pocket. For example a lung function meter. These are the tools you’re looking for that enable patients to monitor their symptoms” [GP 9, male, 57 years]. Moreover sufficient staff needs to be available: “If there’s only one PN, it’s more difficult to guarantee continuity of care” [GP 4, female, 36 years]. Some GPs mentioned the availability of consultation rooms.

Economic context

Almost all professional interviewees identified financial arrangements as an important factor relating to sustained IBSM usage, as IBSM requires a certain level of time investment. “Financial arrangements are important. You need to be reimbursed for your consultation time. A regular control visit lasts 20 minutes, which is hardly enough time [PN 5, female, 59 years].”

Social context

Lack of support from colleagues. Another impeding factor among PNs was lack of support from

colleagues. "I find it hard to arrange routine asthma consultations within my practice; I'm just the only PN" [PN 4, female, 35 years].

DISCUSSION

In this study, we explored potential barriers and facilitators to the implementation of an Internet-based Self-Management (IBSM) programme tool for asthma within primary care. To date, we are unaware of other studies on this topic that involve all three types of users: patients, GPs and PNs. Some factors were commonly identified by all user types. Firstly, the general opinion was that the IBSM tool should offer a high degree of usability. The patients found the possibility of adjusting settings (e.g. frequency of reminders) to their individual needs an important requirement. Secondly, we observed that both patients and professionals find it difficult to change their daily routines to fit IBSM into their schedule experience difficulties in changing their daily routines. For GPs, integration within the electronic registry system was an important requirement, thereby allowing IBSM to be accommodated to their work routine. Thirdly, attitudes towards the IBSM tool and perceived benefits of this tool influence willingness to use IBSM. Fourthly, we observed that the implementation level of structured asthma care varied between general practices and that this is an important factor for implementation of IBSM. Furthermore, we identified factors that were mentioned by specific user groups. Among patients, there was a need for personal guidance in using IBSM. Among GPs, we identified a varying sense of urgency regarding asthma care and the need for adequate financial resourcing as important factors. Among PNs, varying senses of self-efficacy in delivery of asthma care and levels of support from colleagues were important factors. Finally, both GPs and PNs perceived asthma patients as a difficult target group.

Our results indicated that implementation of IBSM within primary care will be influenced by known barriers to change in the routines of patients and GPs (e.g. individual attitude, difficulties with changing routines), [14] known barriers to delivering asthma care (e.g. asthma patients are a difficult target groups in terms of treatment adherence). [22] Moreover, the lack of structured asthma care observed within this study has been described in previous literature.[9, 23-24] Factors contributing to this dearth of structured care include a perceived lack of outcome expectancy of the innovation in terms of improved asthma care as compared to the (time, financial) investment. Other factors include organisational aspects, such as training and the availability of staff, [24-26] and lack of financial resources. [27] Even though we did not explicitly analyse which practices were successful in delivering of high-quality asthma care, our data suggest that explicit working procedures between GPs and PNs is an important factor toward achieving this end. This corresponds with findings previously described by Wiener-Oglivie et al. [28]

Moreover, practice nurses demonstrated – more than GPs – an active approach towards patients with chronic diseases, [29] thereby providing the type of care required for guiding patients in conducting self-management activities. [30] Among patients, a need was felt for personal guidance by a GP or PN in using novel technology. A similar outcome was found in studies involving other chronic diseases like DM and depression. [31-33] Additionally, usability needs to be ensured. Examples found in the literature include screen data and context-related factors, like ability to work on a laptop or tablet. [34] Colour schemes of the website, [35]and integration with software systems used by health care providers { have been reported to influence ease of use. [36] So called 'user-centred design', referring to actual involvement of end-users during the design process, has been suggested as a promising method for developing a health information system. [37, 38]

Strengths and limitations

This study has been designed to provide in-depth information on factors influencing potential IBSM usage among patient's-day-to-day life context and professionals' day-to-day medical practice. However, our study includes limitations. Participants have not been able to use the IBSM programme in real life. Our sample might not be representative for the whole asthma population, even though we aimed to include a diverse group of participants. Our data have been obtained in Dutch general practice, which might make it difficult to translate findings to different settings. However, our study also has many strengths. Our recruitment strategy was designed to include a diverse sample of patients and professionals. Focus groups were held in safe and secure settings. Data saturation was achieved, as no new viewpoints emerged from the last focus groups or from the three last individual interviews. We believe that this study provides in-depth information on barriers to the use of IBSM not only for asthma, but also for other chronic diseases.

Conclusions

In order to be successful, we believe future implementation strategies should target all barriers and facilitators discussed above, since patient, professional and organizational factors are equally important. Besides the usability aspects of the IBSM tool, patients need guidance by their health care provider on a continuous base. Therefore, in order to provide IBSM support the professional and the organisational aspects need to be addressed. This includes a sense of urgency regarding care for patients with not well-controlled asthma and the need for adequate reimbursement for self-management support and internet-based tools. Therefore, (asthma) patient organisations and health insurance companies play an important role to facilitate IBSM. Future research should be focused on assessing the (cost-) effectiveness of implementation strategies in real life settings.

ACKNOWLEDGEMENTS

The authors would like to thank all the patients, general practitioners and practice nurses who participated in this study. The authors also would like to thank Mirjam Garvelink and Céline van Lint who assisted in conducting focus groups.

CONTRIBUTORS

JG, MB, LB, JBS and JKS were involved in the design of the study. JG moderated FGs and IVs. MB and LB observed FGs. JG performed transcriptions. Coding was conducted by JG and MB. JG drafted the manuscript, which was critically reviewed by all authors. The manuscript has been read and approved by all authors.

CONFLICT OF INTEREST

JG, MB, LB, JBS, JKS have no conflicts of interests to be disclosed. JKS received unrestricted research grants from the Lung Foundation Netherlands, the Netherlands Organisation for Health Research and Development (ZonMW), Fonds NutsOhra, Chiesi NL, GlaxoSmithkline NL.

FUNDING

This work was supported by grants from the Netherlands Organization for Health Research and Development (ZonMW) (award number 80-82315-97-10004 and the Lung Foundation Netherlands (award number 3.4.09.011). Funding for this publication will be obtained from the Netherlands Organization for Scientific Research (NWO) Incentive Fund Open Access publications.

ETHICS APPROVAL

This study protocol was presented to the Medical Ethical Committee of the Leiden University Medical Center. An exemption was obtained, as ethical approval for this type of study is not required under Dutch law (project ID 10.048).

DATA SHARING STATEMENT

Transcripts – in Dutch – are available on request.

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TOPIC LIST FOR PATIENTS

Current asthma management

Could you describe how you currently manage your asthma?

Internet-based self-management support (IBSM) programme

- How do you feel about a web-based tool to support your asthma management?
- Demonstration of internet-based self-management support website and explanation of functionalities
- How do you feel about this IBSM support programme?
- Please give your positive and/or negative comments

Internet-based self-management support within general practice

If your general practitioner and/or practice nurse would invite you to use this program, would you be willing to use it?

- If yes, please explain why
- If no, please explain why. Could you think of any possible solution?

What would you need for using IBSM to manage your asthma?

TOPIC LIST FOR PROFESSIONALS

Current asthma care

Could you describe current asthma care for adults within your practice

What is the role of self-management within current asthma care?

Internet-based self-management (IBSM) support programme

- How do you feel about internet-based self-management support?
- *Demonstration of internet-based self-management support website and explanation of functionalities*
- How do you feel about this IBSM support programme?
- Please give your positive and/or negative comments.

Internet-based self-management support within general practice

- If you would be given the opportunity to use this IBSM support for asthma within your practice would you be willing to use it?
  - If yes, please explain why
  - If no, please explain why. Could you think of any possible solution?
- What would you need for using IBSM within your practice?

Interviewer	Johanna van Gaalen (JG, Interviewer); Moira Bakker (MB, facilitator); Leti van Bodegom – Vos (LB, facilitator)
1.Credentials	JG: MD MB: RN (respiratory nurse) LB: PhD, MSc
2. Occupation	JG: research physician MB: respiratory and research nurse LB: implementation fellow / project leader
3. Gender	JG,MB,LB: female
4. Experience and training	JG: Qualitative Health Research Course, Graduate School, Amsterdam Medical Centre. MB: assisted in a variety of clinical trials, including internet-based self-management support; respiratory nursing LB: Project leader in research related to quality of health care, including qualitative research
6. Relationship established	None
7. Participant knowledge of the interviewer	Both interviewer and facilitators introduced themselves at commencement of the focus groups/interviews.
8. Interviewer characteristics	Research goals were provided both in the information letter and at the start of the interviews/focus groups: obtaining in-depth information on barriers and facilitators of integrating an internet-based self-management programme within routine asthma care. It was explicitly stated to provide both positive and negative comments, especially for those not willing to use or feeling reluctant to use an internet-based self-management support programme. See topic list, additional file 1 and 2.

9. Theoretical framework	Identified factors were coded according to the theoretical model of Grol and colleagues and categorized within the appropriate domains. This model describes different levels of healthcare in which barriers and facilitators for change can be identified: the innovation itself, the individual professional, the patient, the social context, the organisational context, and the economic and political context. See page 5 'Data analysis'
Participant selection	
10. Sampling	General practitioners were recruited by sending an invitation letter to general practices within the Leiden - the Hague region, which also includes practices from the Leiden general practice (LEON) network. Positively responding general practitioners were asked permission to invite their patients and practice nurses to participate. From thirteen practices (one GP practice covered two separate practices), we randomly selected 10 patients (130 patients). See page 5 'participant selection'
11. Methods of approach	Primarily by means of an invitation letter, positively responding general practitioners, patients and practice nurses were either contacted by e-mail or by telephone to inform on interview/focus group location, date and time. See page 5 'participant selection'
12. Sample size	21 general practitioners, 22 patients and 13 practice nurses participated See page 5 'participant selection'
13. Non-participation	Patients: From thirteen practices (one GP practice covered two separate practices), we randomly selected 10 patients (130 patients). In total, 26 patients responded to our invitation, of whom 22 ultimately participated. Reasons for declining to participate not participating were: no asthma symptoms (n=6), lack of time (n=4), Ramadan (n=1), unknown (n=108). Practice nurses: In total, 24 PNs responded positively, of whom 13 ultimately participated (reasons for declining to participate: lack of time (n=1), lack of financial reimbursement (n=1), unknown (n=9). General practitioners: approximately 150 GPs received an invitation to participate, however we only collected data on positively responding GPs. See page 5 'participant selection'
Setting	
14. Setting of data collection	FGs were performed at the Leiden University Medical Centre (LUMC) and were conducted

	separately for each participant group. IVs were held at the LUMC, at the general practice, or at the individual's patient's home. See page 7 ' focus groups and interviews'
15. Presence of non-participants	Not applicable.
16. Description of sample	Patients: mean age 38 (range, 20-51), 55% female General practitioners (n=21), mean age 52 (range 36-60), 29% female Practice nurses, mean age 41 (27-58), 100% female See page 6, tables 1 and 2
Data collection	
17. Interview	All focus groups and interviews were held by using a semi-structured interview guide, which included prompts. See additional files 1 and 2. The interview guide was pilot tested among colleagues.
18. Repeat interviews	Not applicable.
19. Audio/visual recording	All interviews were audio-taped and transcribed verbatim. See page 7 'Data analysis'
20. Field notes	Field notes were obtained by facilitators during the focus groups or by the interviewer after conducting an individual interview
21. Duration	Focus groups took 1.5 hours, which included a 15-minute break. Interviews lasted 40 minutes.
22. Data saturation	FGs and IVs were conducted until data saturation was reached. This was discussed by JG and MB. The first three interviews and focus groups were discussed with the complete research team. See page 7 ' Focus groups and interviews'
23. Transcripts returned	Not applicable.
Data analysis	
24. Number of data coders	Two (JG and MB)
25. Description of the tree	Yes, see result section. See tables 3 and 4, page 11 and 12
26. Derivation of themes	Themes were created based on the theoretical framework. See item 9
27. Software	NVivo; QSR International Pty Ltd. Version 10, 2012. See page 7 ' Data analysis'
28. Participant checking	Not applicable
Reporting	
29. Quotations presented	Participant quotations were presented. Each quotation is identified. See page 8-9 (patients), 11-13 (general practitioners/practice nurses)
30. Data and findings consistent	See table 3 and 4
31. Clarity of major themes	" Items that have been reported in at least 70% of the interviews and/or focus groups will be described in the text below." (page 7 and 11) See table 3 and 4: "Themes depicted in bold

	have been reported within at least 70% of the focus groups/interviews."
32. Clarity of minor themes	See item 31.

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INTERNET-BASED SELF-MANAGEMENT SUPPORT FOR ADULTS WITH ASTHMA: A QUALITATIVE STUDY AMONG PATIENTS, GENERAL PRACTITIONERS AND PRACTICE NURSES ON BARRIERS TO IMPLEMENTATION

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2015-010809.R1
Article Type:	Research
Date Submitted by the Author:	14-Apr-2016
Complete List of Authors:	van Gaalen, Johanna L.; Leiden Univ, Medical Decision Making van Bodegom - Vos, Leti; Leids Universitair Medisch Centrum, medical decision making Bakker, Moira; Leids Universitair Medisch Centrum, medical desicion making Snoeck-Stroband, Jiska; Leiden University Medical Center, Medical Decision Making Sont, Jacob; Leids Universitair Medisch Centrum, Medical Decision Making
Primary Subject Heading:	Qualitative research
Secondary Subject Heading:	General practice / Family practice, Patient-centred medicine, Respiratory medicine
Keywords:	Asthma < THORACIC MEDICINE, Telemedicine < BIOTECHNOLOGY & BIOINFORMATICS, PRIMARY CARE

INTERNET-BASED SELF-MANAGEMENT SUPPORT FOR ADULTS WITH ASTHMA: A QUALITATIVE STUDY AMONG PATIENTS, GENERAL PRACTITIONERS AND PRACTICE NURSES ON BARRIERS TO IMPLEMENTATION

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Keywords: asthma, self-management, self-care, medical informatics, asthma, telemedicine, implementation, ehealth, medical informatics.

ABSTRACT

Objectives

The aim of this study is to explore barriers among patients, general practitioners (GPs) and practice nurses to implement internet-based self-management (IBSM) support for asthma in primary care.

Setting

Primary care within South Holland, the Netherlands.

Participants

Twenty-two patients (12 females, mean age: 38), twenty one GPs (6 females, mean age 52) and thirteen practice nurses (all female, mean age 41).

Design

A qualitative study using focus groups and interviews.

Outcomes

Barriers as perceived by patients, GPs and practice nurses to implementation of IBSM support.

Methods

Ten focus groups and twelve interviews were held to collect data: four patient focus groups, four GP focus groups, two practice nurse focus group, two patient interviews, five GP interviews and five practice nurse interviews. An example IBSM support system called 'PatientCoach' which included modules for coaching, personalized information, asthma self-monitoring, medication treatment plan, feedback, e-consultations and a forum was demonstrated. A semistructured topic guide was used. Directed content analysis was used to analyse data. Reported barriers were classified according to a framework by Grol and Wensing.

Results

A variety of barriers emerged among all participant groups. Barriers identified among patients include a lack of a patient-professional partnership in using PatientCoach and a lack of perceived benefit in improving asthma symptoms. Barriers identified among GPs include a low sense of urgency towards asthma care and current work routines. Practice nurses identified a low level of structured asthma care

and a lack of support by colleagues as barriers. Among all participant groups insufficient ease of use of PatientCoach, lack of financial arrangements, and patient characteristics such as a lack of asthma symptoms were reported as a barrier.

Conclusion

We identified a variety of barriers to implementation of IBSM support. An effective implementation strategy for IBSM support in asthma care should focus on these barriers.

STRENGTHS AND LIMITATIONS OF THE STUDY

- This study provides in-depth information on barriers to usage of internet-based self-management support among patients, GPs and practice nurses. Our findings can be relevant for internet-based self-management strategies in other chronic diseases.
- Our recruitment strategy was designed to include a diverse sample of patients and professionals.
- Our data have been obtained in one province in the Netherlands. Relevance and impact of our findings in other primary care settings are unknown.
- Participants have only been demonstrated a prototype of PatientCoach, data are based on their expectations towards PatientCoach.

INTRODUCTION

Asthma is characterized by variability in symptoms and airflow limitation,[1]. Therefore asthma treatment should be adjusted over time,[2]. Self-management is an important aspect of the treatment in order to achieve and sustain asthma control. Self-management strategies consisting of self-monitoring, education, regular consultation with a professional and provision of an action plan have been demonstrated to improve health outcomes for asthma patients, [3- 4]. However, self-management strategies are poorly implemented within general practice, [5-7]. Internet-technology might offer attractive means for encouraging patients to use self-management strategies within a day-to-day context, [8].This is demonstrated by the increasing number of available apps on asthma self-management, [9]. Previously we developed internet-based self-management (IBSM) support for asthma, consisting of the following components: internet-based asthma monitoring, internet-based goal setting, decision support with a treatment plan, online medical review, and tailored online information and communication with a health care provider, [10], IBSM support was based on focus groups, [11], the Chronic Care model, [12], and known key-components for effective self-management, [3]. The Chronic Care model is aimed at improving healthcare outcomes for patients with a chronic disease by means of a proactive patient-professional partnership by addressing both organizational factors (i.e. decision support systems) and resources (i.e. self-management support). It was developed to support patients in conducting self-management activities and to develop a patient-provider partnership in asthma care, [13]. Recently, we have shown that this IBSM support leads to improved asthma-related quality of life, asthma control and lung function as well as a greater number of symptom free days as compared to usual care.[10]. Moreover cost-effectiveness and long-term outcomes of this study showed that IBSM support is the preferred strategy as compared to current care in terms of a sustained improvement in quality of life with similar costs over a one-year period, [14, 15]. Currently, we aim to implement this IBSM support within primary care. It has been recommended that implementation strategies need to be tailored to factors either hampering ('barriers') or facilitating ('facilitators') take-up, [16-17]. Strategies that address barriers and facilitators at the patient, professional and organizational are the most successful in improving process and clinical outcomes, [18]. Therefore, the aim of this study is to explore and categorize all potential barriers associated with

implementation of IBSM support in asthma care within general practice as perceived by patients, practice nurses and GPs.

METHODS

Design

We conducted semi-structured focus groups and interviews among patients, GPs (GPs) and practice nurses. Interviews were held for those who were unwilling or unable to attend a focus group. Both focus groups and interviews are effective methods for detecting obstacles to change within healthcare, [19],

Setting

In the Netherlands a 'standard' general practice covers 2,300 patients per GP. The Dutch guideline for general practice on asthma states that medical review should be performed at least once a year, [20]. This guideline is in concordance with current international guidelines, [1]. In the Netherlands all persons are required to have a health care insurance package, which covers primary care. During 2010, approximately 90% of the Dutch households had internet access and approximately 80% had access to high speed internet. [21]. Our participant group was selected within the Leiden – the Hague region, which is located in South Holland, a province in the Netherlands with a high population density, containing both urban and rural settings.

Participant selection and recruitment

We aimed to conduct three focus groups, consisting of 6-8 participants, within each participant group. All participants were invited by using an information letter. We continued to invite until we included sufficient participants. For the purpose of this study we aimed to include GPs and patients, which previously participated in the *Self-Management of Asthma Supported by Hospitals, ICT, Nurses and GPs* (SMASHING) study. In this study we demonstrated cost-effectiveness of IBSM support. Full details of this study have been published elsewhere, [10, 15]. In the SMASHING study patients were guided by a respiratory nurse from the LUMC in using IBSM-support by using a 'SMASHING website'. This is in contrast to the current study with PatientCoach, as this has been developed for guidance of patients by their own GP and/or practice nurse.

First we selected GPs. To include GPs that previously participated in the SMASHING study we invited GPs from the Leiden general practice network (LEON). Additionally we invited non-LEON network GPs. In total we invited 150 GPs by information letter, of whom 27 responded positively to participate in focus groups/interviews. 21 GPs participated (participation rate 14%). Reasons for not participating included (no time (n=2), no show (n=1), unknown (n=126). Positively responding GPs were asked permission to invite their patients and practice nurses to participate. Unfortunately, we were not able to directly invite patients that participated in the SMASHING study, as informed consent was not obtained to approach patients in future studies. Patient inclusion criteria were: physician-diagnosed asthma, age 18-50 years, use of inhaled corticosteroids and/or montelukast for at least 3 months in the previous two years, access to internet, no serious co-morbid conditions (i.e. terminal illness or a severe psychiatric disease), and ability to understand Dutch. From thirteen practices (one general practice covered two separate practices), we randomly selected ten patients (130 patients) per practice, of whom 22 patients ultimately participated (participation rate 17%). Reasons for declining to participate were: no asthma symptoms (n=6), lack of time (n=4), Ramadan (n=1), and unknown (n=108).

In total, we invited 27 practice nurses, of whom 24 responded positively and 13 ultimately participated (participation rate 48%) Reasons for declining to participate were: lack of time (n=1), lack of financial reimbursement (n=1), and unknown (n=9).

IBSM support

IBSM support consists of both a generic web-based system and an instruction visit for patients. The current generic web-based system is called *'PatientCoach' (www.patientcoach.nl)* PatientCoach supports self-management of patients with a chronic condition (SUPPLEMENTARY FILE 1). It includes modules for coaching, personalized information (i.e. inhalation technique of medication), self-monitoring (i.e. asthma control questionnaire), reminders, medication treatment plan, (motivational) feedback, e-consultations and a forum. PatientCoach has been developed by the LUMC. During the time of this study only a prototype version of PatientCoach was available.

Focus groups and interviews

Focus groups and interviews were conducted in 2010. Focus groups were performed at the Leiden University Medical Centre (LUMC) and were conducted separately for each participant group. Focus groups were not hold separately for those who previously participated in the SMASHING study. We used focus group procedures of Morgan et al. to prepare and guide focus groups. [22]. Interviews were held at the LUMC, at the general practice, or at the patient's home.

During focus groups and interviews a topic guide was used. (SUPPLEMENTARY FILE 2). We explained the concept of self-management, background of IBSM support and demonstrated PatientCoach. Hereafter GPs and practice nurses were asked how routine asthma care is currently organized, and how self-management is implemented. Patients were asked how their current asthma care is arranged, and how they felt about self-management. All participants were asked to give positive and negative comments about PatientCoach, and to identify what they would need to start using PatientCoach. To assess whether the content of our topic list required changes, we analyzed data from the first three focus groups prior to further data collection. No major adjustments were deemed necessary on the basis of this analysis.

A trained moderator (JG) and an observer (LB or MB) conducted focus groups. JG is a qualified medical doctor, and has received postgraduate training on conducting qualitative research. The moderator and observers had no involvement in patient care, and the participants had no personal background information on the interviewers. Focus groups lasted 1.5 hours. JG conducted interviews, which lasted approximately lasted 40 minutes. Focus groups and interviews were conducted until data saturation was reached; that is, until no new barriers emerged in three consecutive focus groups or interviews for a given participant group. [23] Focus groups and interviews were audio-taped and fully transcribed.

In patients, asthma control was assessed using the Asthma Control Questionnaire, [24, 25]. Lung function was measured as forced expiratory volume in 1 second (FEV_1) using a hand-held electronic spirometer (PiKo1: nSpire Health, Inc, Longmont CO, USA).

Data analysis

Directed content analysis was used to analyze all focus groups and interviews. This method is well suited for research that extends conceptually to a framework. [26]. We used the framework developed by Grol and Wensing. [17] This framework categorizes barriers and facilitators into six domains of healthcare, namely the innovation in this case PatientCoach (e.g. ease of use), the individual professional (e.g. willingness to change), the patient (e.g. perceived benefit), the social context (e.g. support by colleagues), the organisational context (e.g. availability of professionals), and the economic and political context (e.g. financial arrangements). This information can be used to develop a tailored-based strategy, to facilitate implementation of PatientCoach in routine asthma care. We used predetermined barriers of this framework. [17]. New categories were developed for those barriers that could not be categorized within these predetermined barriers. Transcripts were coded independently by two researchers (JG, MB). Coding was compared and discrepancies were discussed until consensus was achieved. After coding, JG and MB independently classified barriers in the appropriate domains of the framework. The first interviews and focus groups were discussed with the complete research team. Analyses were undertaken using the software NVivo; QSR International Pty Ltd. Version 10, 2012. The results have been reported in accordance with the Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist. [27].

Ethics approval

This study protocol was presented to the Medical Ethical Committee of the LUMC. An exception was obtained, as ethical approval for this type of study is not required under Dutch law (project ID 10.048).

RESULTS

Characteristics of the population

Four focus groups were held with patients (n=20), four with GPs (n=16) and two focus groups with practice nurses (n=8). The average number of participants in each focus group is four. Interviews were conducted with two patients, five GPs and five practice nurses. Table 1 and 2 show the characteristics of the patients and professionals that participated in the focus groups and interviews. The participating patients covered a range with respect to age and level of asthma control. The participating GPs and practice nurses covered a wide range with respect to age, years of experience, and a variety in general practice settings. One GP and six patients previously participated in the SMASHING study.

Table 1. Patient characteristics

		N (%) (n=22)
Age (y), mean (range)		38 (20-51)
Gender	Female	55
ACQ[a] score, mean (range)		1.2 (0-2.9)
Prebronchodilator FEV1[b] % predicted, range		94 (79-107)
Level of education[c]	Low Unknown High education	45 10 45
Ethnicity	Dutch	22 (100)

All variables are in % except where indicated.
[a]Asthma Control Questionnaire, range (0) optimal asthma control – (6) uncontrolled asthma;
[b] FEV1 = forced expiratory volume in 1 second; [c]low education = Persons whose highest education level is primary education, junior general secondary education or lower vocational education.

Table 2. General practitioner and practice nurse characteristics.

		General practitioners (n=21)	**Practice nurses (n=13)**
Females		29	100
Age (y), mean (range)		52 (36-60)	41 (27-58)
Years practicing as a GP or PN	5 5-10 >10	0 19 81	54 46 0
Number of GPs working within general practice	≤2	52	31
Setting	Urban Rural	57 43	62 38

All variables are in % except where indicated.

Barriers to implementation of PatientCoach according to patients

For greater clarity, we will describe all found factors as potential barriers for implementation of PatientCoach. We identified a variety of barriers as perceived by patients (Table 3) and grouped them into thirteen categories. All categories are illustrated by a representative remark.

Table 3. Patients: barriers to PatientCoach usage, an overview of transcripts

Domain 1. Characteristics of PatientCoach	
	Lack of a patient-professional partnership "The danger of a programme like this is that the GP is not involved. Maybe I'm old fashioned, but my GP has the knowledge and skills on asthma that can't be replaced." [male 25 years] *Insufficient ease of use.* "I don't want to monitor my symptoms weekly. That would be too much of a time investment." [male, 29 years] "You should not have to go through a complete website in order to gain insight in your actual level of asthma control." [male, 39 years] *Time consuming* "It's [PatientCoach] is a nice system. But I just lack time to use it." [female, 48 years] *Lack of evidence* "I'm willing to use it [PatientCoach], unless it's not clear that a professional with sufficient knowledge has developed it." [male, 20 years] *Lack of security* "This website contains personal data. This requires a very high level of protection." [male, 20 years]
Domain 2 Characteristics of the individual professional	
	Lack of knowledge and skills on asthma management "I often do experience that if you've told your complete story, the professional you're talking too replies with: I have to discuss this with someone else. That is annoying. It should be guaranteed that the professional who is guiding you should have sufficient knowledge and skills." [female, 48 years]
Domain 3. Characteristics of the individual patient	
	Negative attitude towards PatientCoach. "I don't like it at all. I'm not interested in using the Internet. I believe that my GP should handle my asthma." [female, 48 years] *Lack of outcome expectancy.* "My asthma is OK now. I can imagine that PatientCoach could be useful if you are wondering how your asthma is doing, if you are wondering if you are doing the right thing. Then it makes sense. But now, it won't add anything as my asthma is OK." [female, 51 years] "I am afraid about self-confrontation. When you're doing well and start smoking and all your graphs show you're getting worse." [male, 24 years]. *Perception of asthma* "During the summer I usually stop taking my maintenance medication (flixotide), but I tend to wait too long to restart my medication. Since two weeks I'm feeling exhausted when I wake up – and now I'm thinking I should restart it." [female, 37 years] *Difficulties changing routines* "I take my inhalers twice daily and (because of this) I'm doing well. I'm not willing to change this." [male, 20 years]. "PatientCoach depends on self-discipline. I do believe that self-monitoring works, but this self-discipline for regular assessment of asthma control would be a barrier for me." [female, 51 years] *Patient characteristics* "Maybe for elderly people, internet is too complicated, or elderly might not have access to the internet." [female, 46 years]
Domain 4. Characteristics of the organisational context	
	Lack of routine asthma care. "I do not attend my general practice on a regular basis. Only when symptoms get worse" [male, 30 years].
Domain 5. Characteristics of the economic context	
	User fee, "I am not willing to pay for using PatientCoach, or a lung function monitor. It should be covered by the insurance, as it leads to improved outcomes, and therefore cost reduction." [male, 30 years]
Domain 6. Characteristics of the societal context	
	None.

Domain 1. Characteristics of PatientCoach

Almost all patients felt PatientCoach should be used within the context of a patient professional partnership, as in contrast to using PatientCoach without guidance of a professional. Another item that was mentioned by almost all patients is insufficient ease of use: lay-out of the user interface should be straightforward and allow for tailoring to their individual needs, i.e. by adjusting reminder settings for the frequency of monitoring asthma control. Other mentioned barriers included too much time investment and lack of security. Finally, patients identified a lack of evidence on programme content as a barrier.

Domain 2. Characteristics of the individual professional

Our patients suggested that their decision to start using PatientCoach would not be influenced by which type of professional, either a GP or practice nurse, would guide them. However a lack of sufficient knowledge and skills on asthma management of the professional would influence their willingness to use PatientCoach.

Domain 3. Characteristics of the individual patient

Some patients felt that PatientCoach is impersonal and therefore they would not be willing to use it. On being asked what patients would halt from using PatientCoach, most patients mentioned that a lack of potential benefit in terms of symptom reduction would be an important hampering factor. Patients related this to level of current symptoms, and subsequent willingness to change daily routines. Some patients stated they did not perceive sufficient asthma symptoms or do not perceive asthma as a chronic condition, and are therefore not willing to routinely monitor their current level of asthma control. It's noteworthy to mention that the one patient that previously participated in the SMASHING study identified the gained insight in the actual level of asthma control as the main benefit of using IBSM support. Patients mentioned that PatientCoach might not be suitable for elderly people.

Domain 4. Characteristics of the organisational context

During the focus groups, variation in the level of structured asthma care within general practices emerged as a theme. Sometimes asthma care consisted only of obtaining a repeat prescription for

maintenance medication. This is important as PatientCoach has been developed based on a proactive care approach, which requires regular assessment which allows for tailoring of treatment strategies to the individual patient needs.

Domain 5. Characteristics of the economic context

Almost all patients mentioned that PatientCoach.nl should be free of user charge, including the lung function meter.

Domain 6. Characteristics of the social context

No barriers emerged within this domain. Patients liked the functionality of a forum within PatientCoach to contact other patients.

Barriers to implementation of PatientCoach according to professionals.

Among GPs and practice nurses, we identified barriers that we grouped into eighteen categories**.** Table 4 presents transcripts of comments, grouped according to the six domains of the theoretical framework.

Table 4. GPs and practice nurses: barriers to PatientCoach usage, an overview of transcripts

Domain 1. Characteristics of PatientCoach	
	Insufficient ease of use. "What is most annoying is that these programmes are not integrated within our electronic medical registry system. …[..] I don't want to have to type in all lung function or asthma control measurements from this portal (PatientCoach) into this system" [GP, female, 43 years] *Time consuming* "The goal of PatientCoach is to improve quality of asthma care. This does not have to imply a reduction in time investment. However, it should not require too much time investment." [GP, female, 47 years] *Lack of security* "Currently, I am using my email for patient contact. However, this sometimes involves personal information. That is secure. For a programme like PatientCoach I think this should be properly arranged." [Practice nurse, female, 39 years]
Domain 2 Characteristics of the individual professional	
	Negative attitude. "I prefer to see patients in real life. When they're entering my consultation room my observation starts – that's invaluable." [GP, male, 53 years] *Lack of perceived level of benefit.* "If a patient is taking his/her medication on a regular basis, I wonder if internet-based self-management really results in improved outcomes…. [..] in terms of reduced number of exacerbations and in quality of life." [GP, male, 51 years] *Low sense of urgency with respect to asthma care.* "I can't remember if I have had an emergency due to an asthma attack. Asthma is not that severe… apparently the self-management of patients is very good … probably due to the improved efficacy of inhalation therapy." [GP, male, 61 years] *Current work routines.* "I only see patients when they're having an exacerbation, or when I feel that someone is contacting too often for a refill of Ventolin." [GP, male, 57 years] *Lack of perceived self-efficacy.* "It's important to have sufficient knowledge, to be able to explain your treatment advice to a patient. [..]The asthma protocol has to be written. Currently, I would refer patients to a GP as I don't have the knowledge and experience to guide asthma patients." [Practice nurse, female, 49 years] *Characteristics professional* "I am qualified nurse. Luckily, I also received training in diabetes care and pulmonary medicine. It would be very unpractical if I had not received this training." [Practice nurse, female, 34 years]
Domain 3. Characteristics of the individual patient	
	Difficult target group. "Routine asthma care is difficult to organize. Patients do not attend their routine asthma consultations" [Practice nurse, female, 59 years]. "Patients often visit our practice too late, as they think their asthma is doing fine, when it's clearly not." [GP, male, 60 years] *Difficulties changing routines* "Asthma patients are difficult to motivate, both for attending routine consultations as for therapy adherence". [GP, male, 45 years] *Patient characteristics.* "Patients do need certain skills in order to use the Internet. I think it's unsuitable for elderly or first generation immigrants." [GP, male, 53 years] *Characteristics asthma* "If asthma is under control, there's no sense in using it in terms of benefit." [GP, male, 58 years]
Domain 4. Characteristics of the organisational context	
	Lack of routine asthma care. "We do not have a protocol for asthma [..]Currently we are targeting diabetes, cardiovascular risk management in the elderly. Later on we will address COPD and asthma. COPD will be prioritized more highly." [Practice nurse, female, 55 years] *General practice characteristics.* "Our practice is located in a rural setting. Our patients do not use the internet as often as those

	who are living in the city." [Practice nurse, female, 38 years] *Lack of availability of staff, tools and consultation rooms* "Nowadays, more sophisticated tools are available. Unfortunately I do not have them in my back pocket. For example a lung function meter. These are the tools you're looking for that enable patients to monitor their symptoms." [GP, male, 57 years] "If there's only one practice nurse, it's more difficult to guarantee continuity of care." [GP, female, 36 years]
Domain 5. Characteristics of the economic context	
	Lack of financial arrangements "Financial arrangements are important. You need to be reimbursed for your consultation time. A regular control visit lasts 20 minutes, which is hardly enough time." [Practice nurse, female, 59 years]
Domain 6. Characteristics of the societal context	
	Lack of support by colleagues. "I find it hard to arrange routine asthma consultations within my practice; I'm just the only practice nurse." [Practice nurse, female, 35 years]

Domain 1. Characteristics of PatientCoach

GPs and practice nurses mentioned that design and content should be straightforward and easy to integrate into the work routines of professionals. In the Netherlands, all general practices are required to use an electronic medical registry system. A lack of integration of PatientCoach within these systems is perceived as an important barrier to PatientCoach use among professionals. Another emerging theme was that some professionals felt that PatientCoach is impersonal

Domain 2. Individual professional

A lack of a positive attitude towards PatientCoach was identified as a barrier among both GPs and practice nurses to PatientCoach use. This attitude seems to be influenced by the perceived level of benefit and sense of urgency with respect to asthma care. For instance, GPs identified a lack of favourable outcomes of a cost-effectiveness analysis as a barrier. Moreover, GPs demonstrated differing senses of urgency towards asthma care. Among professionals working in practices without structured asthma care a more passive approach towards asthma management was identified. This is in contrast to work routines of professionals in practices with structured asthma care, who vary professional involvement according to the needs of the individual patient – which correlates with the approach of self-management. Practice nurses working in practices without structured asthma care, identified a lack of perceived self-efficacy as a barrier. Additionally, this level of perceived self-

efficacy seems to be influenced by practice nurse characteristics, such as educational level. Those practice nurses with insufficient education reported to feel less confident in providing asthma care.

Domain 3. Individual patient

Both practice nurses and GPs identified asthma patients as a challenging target group: asthma patients do often not attend their routine consultations and patients are often not adherent to their medication regimen. This was perceived as a barrier for PatientCoach use. PatientCoach was not found to be suitable for all asthma patients. In example for patients with a low level of symptoms, elderly patients, or those who are illiterate or do have problems speaking and understanding Dutch.

Domain 4. Organisational context

Practice nurses identified a low level of structured asthma care as a barrier. A low level of asthma care was often illustrated by a lack of a protocol. This lack of structured asthma care was often attributed to a low sense of urgency towards asthma care within their general practice. Some professionals expressed that although they were enthusiastic about PatientCoach, their practice location in a rural setting or in a setting with immigrants would make it difficult to implement PatientCoach. To provide asthma care using PatientCoach, GPs identified that they would need the availability of sufficient equipment and staff.

Domain 5. Economic context

Almost all professionals identified a lack of financial arrangements with insurance companies as an important factor relating to sustained PatientCoach usage.

Domain 6. Social context

Another impeding factor mentioned by practice nurses was lack of peer support from colleagues.

DISCUSSION

This study addresses a variety of barriers to the implementation of an Internet-based Self-Management (IBSM) programme called PatientCoach in primary care, which we developed based on previous research on internet-based self-management support in asthma,. [10]. To our knowledge this is the first study that explores barriers among patient, practice nurses and GPs on internet-based self-management support for asthma within primary care. We identified barriers at different domains of the theoretical framework by Grol and Wensing, [17].

First, at the domain of PatientCoach both patients and professionals identified usability issues that need to be addressed. For patients, this included sufficient functionalities to tailor PatientCoach settings to their individual needs, for instance by adjusting monitoring frequency for measuring asthma control. For GPs, this included integration of PatientCoach within the electronic medical registry system. These findings resemble current literature, in which screen data and context-related factors, like ability to work on a laptop or tablet, [28] colour schemes, [29], and integration with software systems used by health care providers have been reported to influence ease of use,[30]. Perceived ease of use is known to influence acceptance of new technology, [31]. It is noteworthy to mention the method of 'user-centred design', referring to actual involvement of end-users during the design process as a method for developing a health information system, [32- 33]. Another important factor perceived by patients is the need for personal guidance in using PatientCoach. This need for personal guidance was found in studies involving other chronic diseases, like diabetes mellitus and depression, [34-36].

Second, at the level of the individual professionals, GPs indicated that there is uncertainty about the additional benefit of PatientCoach in terms of time investment related to improved outcomes in asthma care, as in contrast with usual routine care. GPs are willing to invest if outcomes are favourable for PatientCoach. Not all GPs experience a high sense of urgency towards asthma care. Among some GPs a more or less passive approach towards asthma care was demonstrated. This seems to be in contrast with work routines of practice nurses – even though not explicitly explored. Indeed, nurses are known to have proactive approach towards patients with chronic diseases, [37] thereby providing the type of care required for guiding patients in conducting self-management activities, [38]. The lack of

structured asthma care observed within this study has been described in previous literature, [7, 39- 40]. Those practice nurses working within practices without structured asthma care identified a low level of perceived self-efficacy towards asthma care. Even though we did not explicitly analyse which practices were successful in delivering of high-quality asthma care, our data suggest that explicit working procedures between GPs and practice nurses is an important factor toward achieving this. This corresponds with findings previously described by Wiener-Ogilvie et al., [41],

Third, at the level of the individual patient, not all patients do expect a benefit of using PatientCoach in terms of symptom reduction. Both patients and professionals found that PatientCoach might not be suitable for those with insufficient control of symptoms, elderly or those with language difficulites. Lack of asthma control has previously been related to willingness to use and outcomes of self-management, [42-43]. Research, on asthma action plans – which are an essential part for self-management – indicates that this could lead to offering novel tools like PatientCoach to a very select population group,. [44]. Recent studies demonstrated that internet-based tools could improve clinical outomes in the elderly population and those with a low socioeconomic status,. [45-46]. GPs and practice nurses identified asthma patients as a difficult target group, which corresponds with current literature, [47]. Patients themselves identified difficulties with changing routines as a barrier, for instance to take medication regularly or to monitor symptoms regularly. Like professionals, some patients found PatientCoach impersonal. Fourth, at the domain of the organisation particularly practice nurses identified a lack of structured asthma care as a barrier. This variation in structured asthma care was also identified among focus groups and inteviews with patients. Other barriers within this domain included availability of staff, [39-40, 48]. Fifth, at the level of the economic context a user fee for PatientCoach usage is perceived a barrier among patients. General practices within the Netherlands are currently not reimbursed for consultations on (internet-based) self-management. This is important as PatientCoach requires an instruction visit which could last 20-30 minutes. Indeed, sufficient financial resources are a known factor for sustained patient-centred care by using information technology, [49]. Finally, at the domain of the social context practice nurses identified a lack of support with other practice nurses or GPs within their practices as a barrier. Practice nurses working in larger practices indicated to have support by colleagues.

Strengths and limitations

Our study includes several limitations. Our sample was obtained within the province of South Holland. Future research might include a broader geographical area. Another limitation is that at the time of this study only a prototype of PatientCoach was available and participants had no experience in using PatientCoach. Therefore, our data are based on their expectations towards PatientCoach usage. Additional insight would be gained from actual user experiences among all participant groups. Currently, internet is most often accessed by mobile phone or tablet, [50]. IBSM support should therefore be available for these devices. In spite of these limitations our study provides in-depth information on barriers to PatientCoach usage, which can be relevant for using internet-based technology in other chronic diseases. Our sample was diverse in terms of variety of practice settings, participant age, level of symptom severity and educational level among patients, level of experience among professionals and educational level of patients. The practice nurses were all female, which reflects this professional population.

Conclusion

This study provides insight in barriers on implementation of internet-based self-management support as provided by PatientCoach among patients, GPs and practice nurses. Insight in barriers is essential for the development of successful implementation strategies for internet-based self-management support in current care. Future research should be focused on assessing the (cost-) effectiveness of implementation strategies in real life settings.

ACKNOWLEDGEMENTS

The authors would like to thank all the patients, GPs and practice nurses who participated in this study. The authors also would like to thank Mirjam Garvelink and Céline van Lint who assisted in conducting focus groups.

CONTRIBUTORS

JG, MB, LB, JBS and JKS were involved in the design of the study. JG moderated FGs and IVs. MB and LB observed FGs. JG performed transcriptions. Coding was conducted by JG and MB. JG drafted the manuscript, which was critically reviewed by all authors. The manuscript has been read and approved by all authors.

CONFLICT OF INTEREST

JG, MB, LB, JBS, JKS have no conflicts of interests to be disclosed. JKS received unrestricted research grants from the Lung Foundation Netherlands, the Netherlands Organisation for Health Research and Development (ZonMW), Fonds NutsOhra, Chiesi NL, GlaxoSmithkline NL.

FUNDING

This work was supported by grants from the Netherlands Organization for Health Research and Development (ZonMW) (award number 80-82315-97-10004 and the Lung Foundation Netherlands (award number 3.4.09.011). Funding for this publication will be obtained from the Netherlands Organization for Scientific Research (NWO) Incentive Fund Open Access publications.

DATA SHARING

All transcripts of interviews and focus groups are available in Dutch. These can be obtained by approaching the corresponding author. Apart from the transcripts no additional data are available.

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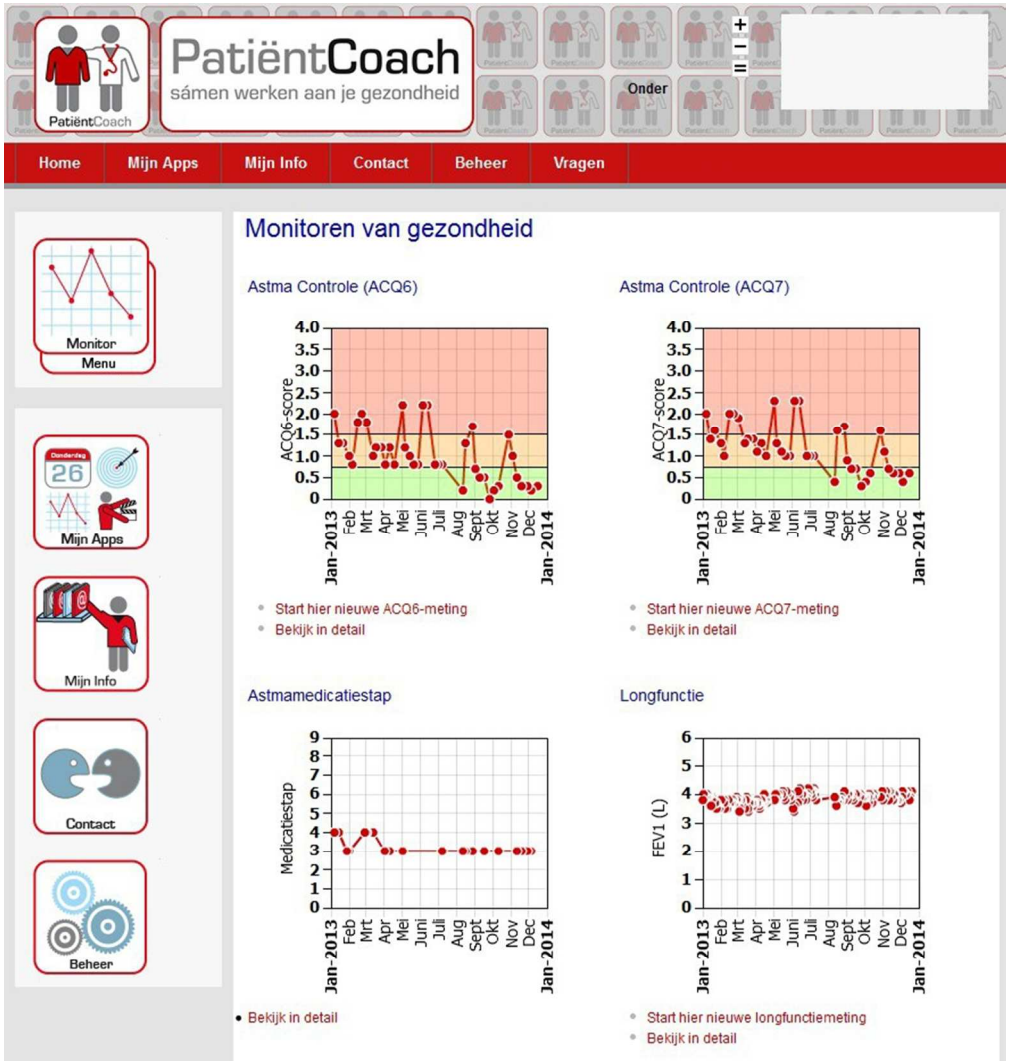

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Supplementary file 2. Topic guide

PATIENTS

Current asthma management

Could you describe how you currently manage your asthma?

Internet-based self-management support (IBSM)

- How do you feel about a web-based tool to support your asthma management?
- Demonstration of internet-based self-management support (PatientCoach) and explanation of functionalities
- How do you feel about PatientCoach?
- Please give your positive and/or negative comments

Internet-based self-management support within general practice

If your general practitioner and/or practice nurse would invite you to use this program, would you be willing to use it?

- If yes, please explain why.
- If no, please explain why. Could you think of any possible solution?

What would you need for using PatientCoach to manage your asthma?

GENERAL PRACTITIONERS AND PRACTICE NURSES

Current asthma care

Could you describe current asthma care for adults within your practice
What is the role of self-management within current asthma care?

Internet-based self-management (IBSM) support

- How do you feel about internet-based self-management support?
- Demonstration of internet-based self-management support (PatientCoach) and explanation of functionalities
- How do you feel about PatientCoach?
- Please give your positive and/or negative comments.

Internet-based self-management support within general practice

- If you would be given the opportunity to use PatientCoach for asthma within your practice would you be willing to use it?
  - If yes, please explain why
  - If no, please explain why. Could you think of any possible solution?
- What would you need for using PatientCoach within your practice?

Interviewer	Johanna van Gaalen	Page 9
Credentials	JG: MD	Page 9
Occupation	JG: research physician	Page 9
Gender	female	
Experience and training	JG: Qualitative Health Research Course, Graduate School, Amsterdam Medical Centre.	Page 9
Relationship established	The moderator and observers had no involvement in patient care, and the participants had no personal background information on the interviewers.	Page 9
Participant knowledge of the interviewer	Both interviewer and observers introduced themselves at commencement of the focus groups/interviews.	Page 9
Interviewer characteristics	Research goals were provided both in the information letter and at the start of the interviews/focus groups: obtaining in-depth information on barriers to implementation of an internet-based self-management support programme within routine asthma care. It was explicitly stated to provide both positive and negative comments, especially for those not willing to use or feeling reluctant to use internet-based self-management support (PatientCoach).	Page 9 Supplementary file 2.
Theoretical framework	Identified factors were coded according to the theoretical model by Grol and colleagues and categorized within the appropriate domains. This model describes different levels of healthcare in which barriers and facilitators for change can be identified: the innovation itself, the individual professional, the patient, the social context, the organisational context, and the economic and political context.	Page 9-10
Participant selection		
	General practitioners were recruited by sending an invitation letter to general practices within the Leiden - the Hague region, which also includes practices from the Leiden general practice (LEON) network. Positively responding general practitioners were asked permission to invite their patients and practice nurses to participate. From thirteen practices (one GP practice covered two separate practices), we randomly selected 10 patients (130 patients).	Page 7-8
Methods of approach	Primarily by means of an invitation letter, positively responding general practitioners, patients and practice nurses were either contacted by e-mail or by telephone to inform on interview/focus group location, date and time.	Page 7
Sample size	21 general practitioners, 22 patients and 13 practice nurses participated	Page 8
Non-participation	Patients: From thirteen practices (one GP practice covered two separate practices), we randomly selected 10 patients (130 patients). In total, 26 patients responded to our invitation, of whom 22 ultimately participated. Reasons for declining to participate not participating were: no asthma symptoms (n=6), lack of time (n=4), Ramadan (n=1), unknown (n=108). Practice nurses: In total, 24 PNs responded positively, of whom 13 ultimately participated (reasons for declining to participate: lack of time (n=1), lack of financial reimbursement (n=1), unknown (n=9). General practitioners In total we invited 150 GPs by information letter, of whom 27 responded positively to participate in focus groups/interviews. 21 GPs participated (participation rate 14%). Reasons for not participating included (no time (n=2), no show (n=1), unknown (n=126).	Page 7-8
Data collection		
Interview guide	Our topic guide was based on a theoretical model developed by Grol and Wensing	Page 7-9
Repeat interviews	General practitioners, patients and practice nurses participated only once in an interview/focus group.	-
Audio/visual recording	All interviews were audio-taped and transcribed verbatim.	Page 9
Field notes	Field notes were obtained during the focus groups or by the interviewer after conducting an individual interview.	Page 9

Duration	Focus groups took 1.5 hours. Interviews lasted 40 minutes.	Page 9
Data saturation	FGs and IVs were conducted until data saturation was reached. This was discussed by JG and MB. . The first three interviews and focus groups were discussed with the complete research team.	Page 9
Transcripts returned	Transcripts were not returned to participants.	Page 9

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INTERNET-BASED SELF-MANAGEMENT SUPPORT FOR ADULTS WITH ASTHMA: A QUALITATIVE STUDY AMONG PATIENTS, GENERAL PRACTITIONERS AND PRACTICE NURSES ON BARRIERS TO IMPLEMENTATION

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2015-010809.R2
Article Type:	Research
Date Submitted by the Author:	30-Jun-2016
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Primary Subject Heading:	Qualitative research
Secondary Subject Heading:	General practice / Family practice, Patient-centred medicine, Respiratory medicine
Keywords:	Asthma < THORACIC MEDICINE, Telemedicine < BIOTECHNOLOGY & BIOINFORMATICS, PRIMARY CARE, ehealth, medical informatics, implementation

INTERNET-BASED SELF-MANAGEMENT SUPPORT FOR ADULTS WITH ASTHMA: A QUALITATIVE STUDY AMONG PATIENTS, GENERAL PRACTITIONERS AND PRACTICE NURSES ON BARRIERS TO IMPLEMENTATION

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Keywords: asthma, self-management, self care, medical informatics, telemedicine, implementation, ehealth, medical informatics, attitude to computers

ABSTRACT

Objectives

The aim of this study is to explore barriers among patients, general practitioners (GPs) and practice nurses to implement internet-based self-management support as provided by PatientCoach. for asthma in primary care.

Setting

Primary care within South Holland, the Netherlands.

Participants

Twenty-two patients (12 females, mean age: 38), twenty one GPs (6 females, mean age 52) and thirteen practice nurses (all female, mean age 41).

Design

A qualitative study using focus groups and interviews.

Outcomes

Barriers as perceived by patients, GPs and practice nurses to implementation of PatientCoach.

Methods

Ten focus groups and twelve interviews were held to collect data: four patient focus groups, four GP focus groups, two practice nurse focus group, two patient interviews, five GP interviews and five practice nurse interviews. A prototype of PatientCoach which included modules for coaching, personalized information, asthma self-monitoring, medication treatment plan, feedback, e-consultations and a forum was demonstrated. A semi structured topic guide was used. Directed content analysis was used to analyse data. Reported barriers were classified according to a framework by Grol and Wensing.

Results

A variety of barriers emerged among all participant groups. Barriers identified among patients include a lack of a patient-professional partnership in using PatientCoach and a lack of perceived benefit in improving asthma symptoms. Barriers identified among GPs include a low sense of urgency towards

asthma care and current work routines. Practice nurses identified a low level of structured asthma care and a lack of support by colleagues as barriers. Among all participant groups insufficient ease of use of PatientCoach, lack of financial arrangements, and patient characteristics such as a lack of asthma symptoms were reported as a barrier.

Conclusion

We identified a variety of barriers to implementation of PatientCoach. An effective implementation strategy for IBSM support in asthma care should focus on these barriers.

STRENGTHS AND LIMITATIONS OF THE STUDY

- This study provides in-depth information on barriers to usage of internet-based self-management support as provided by PatientCoach among patients, GPs and practice nurses. Our findings can be relevant for internet-based self-management strategies in other chronic diseases.
- Our recruitment strategy was designed to include a diverse sample of patients and professionals.
- Our data have been obtained in one province in the Netherlands. Relevance and impact of our findings in other primary care settings are unknown.
- Participants have only been demonstrated a prototype of PatientCoach, data are based on their expectations towards PatientCoach.

INTRODUCTION

Asthma is characterized by variability in symptoms and airflow limitation,[1]. Therefore asthma treatment should be adjusted over time,[2]. Self-management is an important aspect of the treatment in order to achieve and sustain asthma control. Self-management strategies consisting of self-monitoring, education, regular consultation with a professional and provision of an action plan have been demonstrated to improve health outcomes for asthma patients, [3- 4]. However, self-management strategies are poorly implemented within general practice, [5-7]. Internet-technology might offer attractive means for encouraging patients to use self-management strategies within a day-to-day context, [8].This is demonstrated by the increasing number of available apps on asthma self-management, [9]. Previously we developed internet-based self-management (IBSM) support for asthma, consisting of the following components: internet-based asthma monitoring, internet-based goal setting, decision support with a treatment plan, online medical review, and tailored online information and communication with a health care provider, [10], IBSM support was based on focus groups, [11], the Chronic Care model, [12], and known key-components for effective self-management, [3]. The Chronic Care model is aimed at improving healthcare outcomes for patients with a chronic disease by means of a proactive patient-professional partnership by addressing both organizational factors (i.e. decision support systems) and resources (i.e. self-management support). It was developed to support patients in conducting self-management activities and to develop a patient-provider partnership in asthma care, [13]. Recently, we have shown that this IBSM support leads to improved asthma-related quality of life, asthma control and lung function as well as a greater number of symptom free days as compared to usual care.[10]. Moreover cost-effectiveness and long-term outcomes of this study showed that IBSM support is the preferred strategy as compared to current care in terms of a sustained improvement in quality of life with similar costs over a one-year period, [14, 15]. Currently, we aim to implement this IBSM support within primary care. For the purpose of this study we developed 'PatientCoach', which is based on our previous findings on IBSM support. It has been recommended that implementation strategies need to be tailored to factors either hampering ('barriers') or facilitating ('facilitators') take-up, [16-17]. Strategies that address barriers and facilitators at the patient, professional and organizational are the most successful in improving process

and clinical outcomes, [18]. Therefore, the aim of this study is to explore and categorize all potential barriers associated with implementation of PatientCoach in asthma care within general practice as perceived by patients, practice nurses and GPs.

METHODS

Design

We conducted semi-structured focus groups and interviews among patients, GPs (GPs) and practice nurses. Interviews were held for those who were unwilling or unable to attend a focus group. Both focus groups and interviews are effective methods for detecting obstacles to change within healthcare, [19],

Setting

In the Netherlands a 'standard' general practice covers 2,300 patients per GP. The Dutch guideline for general practice on asthma states that medical review should be performed at least once a year, [20]. This guideline is in concordance with current international guidelines, [1]. In the Netherlands all persons are required to have a health care insurance package, which covers primary care. During 2010, approximately 90% of the Dutch households had internet access and approximately 80% had access to high speed internet. [21]. Our participant group was selected within the Leiden – the Hague region, which is located in South Holland, a province in the Netherlands with a high population density, containing both urban and rural settings.

Participant selection and recruitment

We aimed to conduct three focus groups, consisting of 6-8 participants, within each participant group. All participants were invited by using an information letter. We continued to invite until we included sufficient participants. For the purpose of this study we aimed to include GPs and patients with and without experience with IBSM-support guided by a respiratory nurse from the LUMC via a website. Therefore, some of the patients and GPs were sought among the participants of the previously conducted *Self-Management of Asthma Supported by Hospitals, ICT, Nurses and GPs* (SMASHING) study. In this study we demonstrated cost-effectiveness of IBSM support. The SMASHING website included modules for self-monitoring, education and contact with a professional**.** Full details of this study have been published elsewhere, [10, 15]. This was in contrast to the current study, as PatientCoach has been developed for guidance of patients by their own GP and/or practice nurse.

First we selected GPs. To include GPs that previously participated in the SMASHING study we invited GPs from the Leiden general practice network (LEON). Additionally we invited non-LEON network GPs. In total we invited 150 GPs by information letter, of whom 27 responded positively to participate in focus groups/interviews. 21 GPs participated (participation rate 14%). Reasons for not participating included (no time (n=2), no show (n=1), unknown (n=126). Positively responding GPs were asked permission to invite their patients and practice nurses to participate. Unfortunately, we were not able to directly invite patients that participated in the SMASHING study, as informed consent was not obtained to approach patients in future studies. Patient inclusion criteria were: physician-diagnosed asthma, age 18-50 years, use of inhaled corticosteroids and/or montelukast for at least 3 months in the previous two years, access to internet, no serious co-morbid conditions (i.e. terminal illness or a severe psychiatric disease), and ability to understand Dutch. From thirteen practices (one general practice covered two separate practices), we randomly selected ten patients (130 patients) per practice, of whom 22 patients ultimately participated (participation rate 17%). Reasons for declining to participate were: no asthma symptoms (n=6), lack of time (n=4), Ramadan (n=1), and unknown (n=108).

In total, we invited 27 practice nurses, of whom 24 responded positively and 13 ultimately participated (participation rate 48%) Reasons for declining to participate were: lack of time (n=1), lack of financial reimbursement (n=1), and unknown (n=9).

IBSM support

IBSM support consists of both a generic web-based system and an instruction visit for patients. The current generic web-based system is called *'PatientCoach' (www.patientcoach.nl)*. PatientCoach supports self-management of patients with a chronic condition (SUPPLEMENTARY FILE 1). It includes modules for coaching, personalized information (i.e. inhalation technique of medication), self-monitoring (i.e. asthma control questionnaire), reminders, medication treatment plan, (motivational) feedback, e-consultations and a forum. PatientCoach has been developed by the LUMC. During the time of this study only a prototype version of PatientCoach was available. Input of participants of this study has been used for further development of PatientCoach.

Focus groups and interviews

Focus groups and interviews were conducted in 2010. Focus groups were performed at the Leiden University Medical Centre (LUMC) and were conducted separately for each participant group. Focus groups were not hold separately for those who previously participated in the SMASHING study. We used focus group procedures of Morgan et al. to prepare and guide focus groups. [22]. Interviews were held at the LUMC, at the general practice, or at the patient's home.

During focus groups and interviews a topic guide was used. (SUPPLEMENTARY FILE 2). We explained the concept of self-management, background of IBSM support and demonstrated PatientCoach. Hereafter GPs and practice nurses were asked how routine asthma care is currently organized, and how self-management is implemented. Patients were asked how their current asthma care is arranged, and how they felt about self-management. All participants were asked to give positive and negative comments about PatientCoach, and to identify what they would need to start using PatientCoach. To assess whether the content of our topic list required changes, we analyzed data from the first three focus groups prior to further data collection. No major adjustments were deemed necessary on the basis of this analysis.

A trained moderator (JG) and an observer (LB or MB) conducted focus groups. JG is a qualified medical doctor, and has received postgraduate training on conducting qualitative research. The moderator and observers had no involvement in patient care, and the participants had no personal background information on the interviewers. Focus groups lasted 1.5 hours. JG conducted interviews, which lasted approximately lasted 40 minutes. Focus groups and interviews were conducted until data saturation was reached; that is, until no new barriers emerged in three consecutive focus groups or interviews for a given participant group. [23] Focus groups and interviews were audio-taped and fully transcribed. All focus groups and interviews were held in Dutch.

In patients, asthma control was assessed using the Asthma Control Questionnaire, [24, 25]. Lung function was measured as forced expiratory volume in 1 second (FEV_1) using a hand-held electronic spirometer (PiKo1: nSpire Health, Inc, Longmont CO, USA).

Data analysis

Directed content analysis was used to analyze all focus groups and interviews. This method is well suited for research that extends conceptually to a framework. [26]. We used the framework developed by Grol and Wensing. [17] This framework categorizes barriers and facilitators into six domains of healthcare, namely the innovation in this case PatientCoach (e.g. ease of use), the individual professional (e.g. willingness to change), the patient (e.g. perceived benefit), the social context (e.g. support by colleagues), the organisational context (e.g. availability of professionals), and the economic and political context (e.g. financial arrangements). This information can be used to develop a tailored-based strategy, to facilitate implementation of PatientCoach in routine asthma care. We used predetermined barriers of this framework. [17]. New categories were developed for those barriers that could not be categorized within these predetermined barriers. Transcripts were coded independently by two researchers (JG, MB). Coding was compared and discrepancies were discussed until consensus was achieved. After coding, JG and MB independently classified barriers in the appropriate domains of the framework. The first interviews and focus groups were discussed with the complete research team. Analyses were undertaken using the software NVivo; QSR International Pty Ltd. Version 10, 2012. The results have been reported in accordance with the Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist. [27].

Ethics approval

This study protocol was presented to the Medical Ethical Committee of the LUMC. An exception was obtained, as ethical approval for this type of study is not required under Dutch law (project ID 10.048).

RESULTS

Characteristics of the population

Four focus groups were held with patients (n=20), four with GPs (n=16) and two focus groups with practice nurses (n=8). The average number of participants in each focus group is four. Interviews were conducted with two patients, five GPs and five practice nurses. Table 1 and 2 show the characteristics of the patients and professionals that participated in the focus groups and interviews. The participating patients covered a range with respect to age and level of asthma control. The participating GPs and practice nurses covered a wide range with respect to age, years of experience, and a variety in general practice settings. One GP and six patients previously participated in the SMASHING study.

Table 1. Patient characteristics

		N (%) (n=22)
Age (y), mean (range)		38 (20-51)
Gender	Female	55
ACQ[a] score, mean (range)		1.2 (0-2.9)
Prebronchodilator FEV1[b] % predicted, range		94 (79-107)
Level of education[c]	Low Unknown High education	45 10 45
Ethnicity	Dutch	22 (100)

All variables are in % except where indicated.
[a]Asthma Control Questionnaire, range (0) optimal asthma control – (6) uncontrolled asthma;
[b] FEV1 = forced expiratory volume in 1 second; [c]low education = Persons whose highest education level is primary education, junior general secondary education or lower vocational education.

Table 2. General practitioner and practice nurse characteristics.

		General practitioners (n=21)	**Practice nurses (n=13)**
Females		29	100
Age (y), mean (range)		52 (36-60)	41 (27-58)
Years practicing as a GP or PN	5 5-10 >10	0 19 81	54 46 0
Number of GPs working within general practice	≤2	52	31
Setting	Urban Rural	57 43	62 38

All variables are in % except where indicated.

Barriers to implementation of PatientCoach according to patients

For greater clarity, we will describe all found factors as potential barriers for implementation of PatientCoach. We identified a variety of barriers as perceived by patients (Table 3) and grouped them into thirteen categories. All categories are illustrated by a representative remark.

Table 3. Patients: barriers to PatientCoach usage, an overview of transcripts

Domain 1. Characteristics of PatientCoach	
	Lack of a patient-professional partnership "The danger is that the GP is not involved. Maybe I'm old fashioned, but my GP has the knowledge and skills on asthma that can't be replaced." [male 25 years] *Insufficient ease of use.* "I don't want to monitor my symptoms weekly. That would be too much of a time investment." [male, 29 years] "You should not have to go through a complete website in order to gain insight in your actual level of asthma control." [male, 39 years] *Time consuming* "It's [PatientCoach] is a nice system. But I just lack time to use it." [female, 48 years] *Lack of evidence* "I'm willing to use it [PatientCoach], unless it's not clear that a professional with sufficient knowledge has developed it." [male, 20 years] *Lack of security* "This website contains personal data. This requires a very high level of protection." [male, 20 years]
Domain 2 Characteristics of the individual professional	
	Lack of knowledge and skills on asthma management "I often do experience that if you've told your complete story, the professional you're talking too replies with: I have to discuss this with someone else. That is annoying. It should be guaranteed that the professional who is guiding you should have sufficient knowledge and skills." [female, 48 years]
Domain 3. Characteristics of the individual patient	
	Negative attitude towards PatientCoach. "I don't like it at all. I'm not interested in using the Internet. I believe that my GP should handle my asthma." [female, 48 years] *Lack of outcome expectancy.* "My asthma is OK now. I can imagine that PatientCoach could be useful if you are wondering how your asthma is doing, if you are wondering if you are doing the right thing. Then it makes sense. But now, it won't add anything as my asthma is OK." [female, 51 years] "I am afraid about self-confrontation. When you're doing well and start smoking and all your graphs show you're getting worse." [male, 24 years]. *Perception of asthma* "During the summer I usually stop taking my maintenance medication (flixotide), but I tend to wait too long to restart my medication. Since two weeks I'm feeling exhausted when I wake up – and now I'm thinking I should restart it." [female, 37 years] *Difficulties changing routines* "I take my inhalers twice daily and (because of this) I'm doing well. I'm not willing to change this." [male, 20 years]. "PatientCoach depends on self-discipline. I do believe that self-monitoring works, but this self-discipline for regular assessment of asthma control would be a barrier for me." [female, 51 years] *Patient characteristics* "Maybe for elderly people, internet is too complicated, or elderly might not have access to the internet." [female, 46 years]
Domain 4. Characteristics of the organisational context	
	Lack of routine asthma care. "I do not attend my general practice on a regular basis. Only when symptoms get worse" [male, 30 years].
Domain 5. Characteristics of the economic context	
	User fee, "I am not willing to pay for using PatientCoach, or a lung function monitor. It should be covered by the insurance, as it leads to improved outcomes, and therefore cost reduction." [male, 30 years]
Domain 6. Characteristics of the societal context	
	None.

Domain 1. Characteristics of PatientCoach

Almost all patients felt PatientCoach should be used within the context of a patient professional partnership, as in contrast to using PatientCoach without guidance of a professional. Another item that was mentioned by almost all patients is insufficient ease of use: lay-out of the user interface should be straightforward and allow for tailoring to their individual needs, i.e. by adjusting reminder settings for the frequency of monitoring asthma control. Other mentioned barriers included too much time investment and lack of security. Finally, patients identified a lack of evidence on PatientCoach content as a barrier.

Domain 2. Characteristics of the individual professional

Our patients suggested that their decision to start using PatientCoach would not be influenced by which type of professional, either a GP or practice nurse, would guide them. However a lack of sufficient knowledge and skills on asthma management of the professional would influence their willingness to use PatientCoach.

Domain 3. Characteristics of the individual patient

Some patients felt that PatientCoach is impersonal and therefore they would not be willing to use it. On being asked what patients would halt from using PatientCoach, most patients mentioned that a lack of potential benefit in terms of symptom reduction would be an important hampering factor. Patients related this to level of current symptoms, and subsequent willingness to change daily routines. Some patients stated they did not perceive sufficient asthma symptoms or do not perceive asthma as a chronic condition, and are therefore not willing to routinely monitor their current level of asthma control. It's noteworthy to mention that the one patient that previously participated in the SMASHING study identified the gained insight in the actual level of asthma control as the main benefit of using IBSM support. Patients mentioned that PatientCoach might not be suitable for elderly people.

Domain 4. Characteristics of the organisational context

During the focus groups, variation in the level of structured asthma care within general practices emerged as a theme. Sometimes asthma care consisted only of obtaining a repeat prescription for

maintenance medication. This is important as PatientCoach has been developed based on a proactive care approach, which requires regular assessment which allows for tailoring of treatment strategies to the individual patient needs.

Domain 5. Characteristics of the economic context

Almost all patients mentioned that PatientCoach.nl should be free of user charge, including the lung function meter.

Domain 6. Characteristics of the social context

No barriers emerged within this domain. Patients liked the functionality of a forum within PatientCoach to contact other patients.

Barriers to implementation of PatientCoach according to professionals.

Among GPs and practice nurses, we identified barriers that we grouped into eighteen categories**.** Table 4 presents transcripts of comments, grouped according to the six domains of the theoretical framework.

Table 4. GPs and practice nurses: barriers to PatientCoach usage, an overview of transcripts

Domain 1. Characteristics of PatientCoach	
	Insufficient ease of use. "What is most annoying is that this is not integrated within our electronic medical registry system. …[..] I don't want to have to type in all lung function or asthma control measurements from this portal (PatientCoach) into this system" [GP, female, 43 years] *Time consuming* "The goal of PatientCoach is to improve quality of asthma care. This does not have to imply a reduction in time investment. However, it should not require too much time investment." [GP, female, 47 years] *Lack of security* "Currently, I am using my email for patient contact. However, this sometimes involves personal information. That is secure. For PatientCoach I think this should be properly arranged." [Practice nurse, female, 39 years]
Domain 2 Characteristics of the individual professional	
	Negative attitude. "I prefer to see patients in real life. When they're entering my consultation room my observation starts – that's invaluable." [GP, male, 53 years] *Lack of perceived level of benefit.* "If a patient is taking his/her medication on a regular basis, I wonder if internet-based self-management really results in improved outcomes…. [..] in terms of reduced number of exacerbations and in quality of life." [GP, male, 51 years] *Low sense of urgency with respect to asthma care.* "I can't remember if I have had an emergency due to an asthma attack. Asthma is not that severe… apparently the self-management of patients is very good … probably due to the improved efficacy of inhalation therapy." [GP, male, 61 years] *Current work routines.* "I only see patients when they're having an exacerbation, or when I feel that someone is contacting too often for a refill of Ventolin." [GP, male, 57 years] *Lack of perceived self-efficacy.* "It's important to have sufficient knowledge, to be able to explain your treatment advice to a patient. [..]The asthma protocol has to be written. Currently, I would refer patients to a GP as I don't have the knowledge and experience to guide asthma patients." [Practice nurse, female, 49 years] *Characteristics professional* "I am qualified nurse. Luckily, I also received training in diabetes care and pulmonary medicine. It would be very unpractical if I had not received this training." [Practice nurse, female, 34 years]
Domain 3. Characteristics of the individual patient	
	Difficult target group. "Routine asthma care is difficult to organize. Patients do not attend their routine asthma consultations" [Practice nurse, female, 59 years]. "Patients often visit our practice too late, as they think their asthma is doing fine, when it's clearly not." [GP, male, 60 years] *Difficulties changing routines* "Asthma patients are difficult to motivate, both for attending routine consultations as for therapy adherence". [GP, male, 45 years] *Patient characteristics.* "Patients do need certain skills in order to use the Internet. I think it's unsuitable for elderly or first generation immigrants." [GP, male, 53 years] *Characteristics asthma* "If asthma is under control, there's no sense in using it in terms of benefit." [GP, male, 58 years]
Domain 4. Characteristics of the organisational context	
	Lack of routine asthma care. "We do not have a protocol for asthma [..]Currently we are targeting diabetes, cardiovascular risk management in the elderly. Later on we will address COPD and asthma. COPD will be prioritized more highly." [Practice nurse, female, 55 years] *General practice characteristics.* "Our practice is located in a rural setting. Our patients do not use the internet as often as those

	who are living in the city." [Practice nurse, female, 38 years] *Lack of availability of staff, tools and consultation rooms* "Nowadays, more sophisticated tools are available. Unfortunately I do not have them in my back pocket. For example a lung function meter. These are the tools you're looking for that enable patients to monitor their symptoms." [GP, male, 57 years] "If there's only one practice nurse, it's more difficult to guarantee continuity of care." [GP, female, 36 years]
Domain 5. Characteristics of the economic context	
	Lack of financial arrangements "Financial arrangements are important. You need to be reimbursed for your consultation time. A regular control visit lasts 20 minutes, which is hardly enough time." [Practice nurse, female, 59 years]
Domain 6. Characteristics of the societal context	
	Lack of support by colleagues. "I find it hard to arrange routine asthma consultations within my practice; I'm just the only practice nurse." [Practice nurse, female, 35 years]

Domain 1. Characteristics of PatientCoach

GPs and practice nurses mentioned that design and content should be straightforward and easy to integrate into the work routines of professionals. In the Netherlands, all general practices are required to use an electronic medical registry system. A lack of integration of PatientCoach within these systems is perceived as an important barrier to PatientCoach use among professionals. Another emerging theme was that some professionals felt that PatientCoach is impersonal

Domain 2. Individual professional

A lack of a positive attitude towards PatientCoach was identified as a barrier among both GPs and practice nurses to PatientCoach use. This attitude seems to be influenced by the perceived level of benefit and sense of urgency with respect to asthma care. For instance, GPs identified a lack of favourable outcomes of a cost-effectiveness analysis as a barrier. Moreover, GPs demonstrated differing senses of urgency towards asthma care. Among professionals working in practices without structured asthma care a more passive approach towards asthma management was identified. This is in contrast to work routines of professionals in practices with structured asthma care, who vary professional involvement according to the needs of the individual patient – which correlates with the approach of self-management. Practice nurses working in practices without structured asthma care, identified a lack of perceived self-efficacy as a barrier. Additionally, this level of perceived self-

efficacy seems to be influenced by practice nurse characteristics, such as educational level. Those practice nurses with insufficient education reported to feel less confident in providing asthma care.

Domain 3. Individual patient

Both practice nurses and GPs identified asthma patients as a challenging target group: asthma patients do often not attend their routine consultations and patients are often not adherent to their medication regimen. This was perceived as a barrier for PatientCoach use. PatientCoach was not found to be suitable for all asthma patients. In example for patients with a low level of symptoms, elderly patients, or those who are illiterate or do have problems speaking and understanding Dutch.

Domain 4. Organisational context

Practice nurses identified a low level of structured asthma care as a barrier. A low level of asthma care was often illustrated by a lack of a protocol. This lack of structured asthma care was often attributed to a low sense of urgency towards asthma care within their general practice. Some professionals expressed that although they were enthusiastic about PatientCoach, their practice location in a rural setting or in a setting with immigrants would make it difficult to implement PatientCoach. To provide asthma care using PatientCoach, GPs identified that they would need the availability of sufficient equipment and staff.

Domain 5. Economic context

Almost all professionals identified a lack of financial arrangements with insurance companies as an important factor relating to sustained PatientCoach usage.

Domain 6. Social context

Another impeding factor mentioned by practice nurses was lack of peer support from colleagues.

DISCUSSION

This study addresses a variety of barriers to the implementation of of internet-based self-management support as provided by PatientCoach which we developed based on previous research on internet-based self-management support in asthma,. [10]. To our knowledge this is the first study that explores barriers among patient, practice nurses and GPs on internet-based self-management support for asthma within primary care. We identified barriers at different domains of the theoretical framework by Grol and Wensing, [17].

First, at the domain of PatientCoach both patients and professionals identified usability issues that need to be addressed. For patients, this included sufficient functionalities to tailor PatientCoach settings to their individual needs, for instance by adjusting monitoring frequency for measuring asthma control. For GPs, this included integration of PatientCoach within the electronic medical registry system. These findings resemble current literature, in which screen data and context-related factors, like ability to work on a laptop or tablet, [28] colour schemes, [29], and integration with software systems used by health care providers have been reported to influence ease of use,[30]. Perceived ease of use is known to influence acceptance of new technology, [31]. It is noteworthy to mention the method of 'user-centred design', referring to actual involvement of end-users during the design process as a method for developing a health information system, [32- 33]. Another important factor perceived by patients is the need for personal guidance in using PatientCoach. This need for personal guidance was found in studies involving other chronic diseases, like diabetes mellitus and depression, [34-36].

Second, at the level of the individual professionals, GPs indicated that there is uncertainty about the additional benefit of PatientCoach in terms of time investment related to improved outcomes in asthma care, as in contrast with usual routine care. GPs are willing to invest if outcomes are favourable for PatientCoach. Not all GPs experience a high sense of urgency towards asthma care. Among some GPs a more or less passive approach towards asthma care was demonstrated. This seems to be in contrast with work routines of practice nurses – even though not explicitly explored. Indeed, nurses are known to have proactive approach towards patients with chronic diseases, [37] thereby providing the type of care required for guiding patients in conducting self-management activities, [38]. The lack of

structured asthma care observed within this study has been described in previous literature, [7, 39- 40]. Those practice nurses working within practices without structured asthma care identified a low level of perceived self-efficacy towards asthma care. Even though we did not explicitly analyse which practices were successful in delivering of high-quality asthma care, our data suggest that explicit working procedures between GPs and practice nurses are of importance toward achieving this. This corresponds with findings previously described by Wiener-Ogilvie et al., [41].

Third, at the level of the individual patient, not all patients do expect a benefit of using PatientCoach in terms of symptom reduction. Both patients and professionals found that PatientCoach might not be suitable for those with insufficient control of symptoms, elderly or those with language difficulites. Lack of asthma control has previously been related to willingness to use and outcomes of self-management, [42-43]. Research, on asthma action plans – which are an essential part for self-management – indicates that this could lead to offering novel tools like PatientCoach to a very select population group,. [44]. Recent studies demonstrated that internet-based tools could improve clinical outomes in the elderly population and those with a low socioeconomic status,. [45-46]. GPs and practice nurses identified asthma patients as a difficult target group, which corresponds with current literature, [47]. Patients themselves identified difficulties with changing routines as a barrier, for instance to take medication regularly or to monitor symptoms regularly. Like professionals, some patients found PatientCoach impersonal. Fourth, at the domain of the organisation particularly practice nurses identified a lack of structured asthma care as a barrier. This variation in structured asthma care was also identified among focus groups and inteviews with patients. Other barriers within this domain included availability of staff, [39-40, 48]. Fifth, at the level of the economic context a user fee for PatientCoach usage is perceived a barrier among patients. General practices within the Netherlands are currently not reimbursed for consultations on (internet-based) self-management. This is important as PatientCoach requires an instruction visit which could last 20-30 minutes. Indeed, sufficient financial resources are a known factor for sustained patient-centred care by using information technology, [49]. Finally, at the domain of the social context practice nurses identified a lack of support with other practice nurses or GPs within their practices as a barrier. Practice nurses working in larger practices indicated to have support by colleagues.

Strengths and limitations

Our study includes several limitations. Our sample was obtained within the province of South Holland. Future research might include a broader geographical area. Another limitation is that at the time of this study only a prototype of PatientCoach was available and participants had no experience in using PatientCoach. Therefore, our data are based on their expectations towards PatientCoach usage. Additional insight would be gained from actual user experiences among all participant groups. Currently, internet is most often accessed by mobile phone or tablet, [50]. IBSM support should therefore be available for these devices. In spite of these limitations our study provides in-depth information on barriers to PatientCoach usage, which could be relevant for using internet-based technology in other chronic diseases. Our sample was diverse in terms of variety of practice settings, participant age, level of symptom severity and educational level among patients, level of experience among professionals and educational level of patients. The practice nurses were all female, which reflects this professional population.

Conclusion

This study provides insight in barriers on implementation of internet-based self-management support as provided by PatientCoach among patients, GPs and practice nurses. Insight in barriers is essential for the development of successful implementation strategies for internet-based self-management support in current care. Future research should be focused on assessing the (cost-) effectiveness of implementation strategies in real life settings.

ACKNOWLEDGEMENTS

The authors would like to thank all the patients, GPs and practice nurses who participated in this study. The authors also would like to thank Mirjam Garvelink and Céline van Lint who assisted in conducting focus groups.

CONTRIBUTORS

JG, MB, LB, JBS and JKS were involved in the design of the study. JG moderated FGs and IVs. MB and LB observed FGs. JG performed transcriptions. Coding was conducted by JG and MB. JG drafted the manuscript, which was critically reviewed by all authors. The manuscript has been read and approved by all authors.

CONFLICT OF INTEREST

JG, MB, LB, JBS, JKS have no conflicts of interests to be disclosed. JKS received unrestricted research grants from the Lung Foundation Netherlands, the Netherlands Organisation for Health Research and Development (ZonMW), Fonds NutsOhra, Chiesi NL, GlaxoSmithkline NL.

FUNDING

This work was supported by grants from the Netherlands Organization for Health Research and Development (ZonMW) (award number 80-82315-97-10004 and the Lung Foundation Netherlands (award number 3.4.09.011). Funding for this publication will be obtained from the Netherlands Organization for Scientific Research (NWO) Incentive Fund Open Access publications.

DATA SHARING

All transcripts of interviews and focus groups are available in Dutch. These can be obtained by approaching the corresponding author. Apart from the transcripts no additional data are available.

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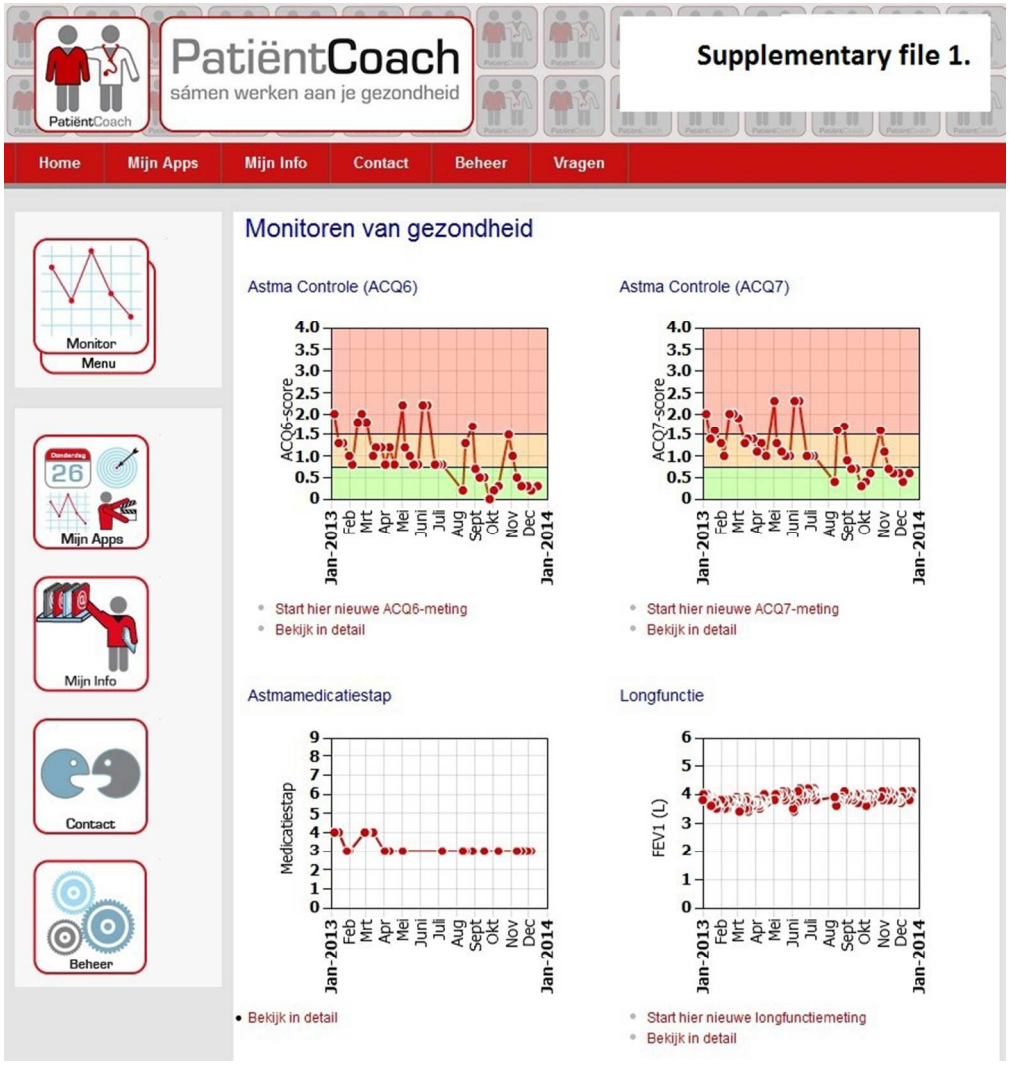

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Supplementary file 2. Topic guide

PATIENTS

Current asthma management

Could you describe how you currently manage your asthma?

Internet-based self-management support (IBSM)

- How do you feel about a web-based tool to support your asthma management?
- Demonstration of internet-based self-management support (PatientCoach) and explanation of functionalities
- How do you feel about PatientCoach?
- Please give your positive and/or negative comments

Internet-based self-management support within general practice

If your general practitioner and/or practice nurse would invite you to use this program, would you be willing to use it?

- If yes, please explain why.
- If no, please explain why. Could you think of any possible solution?

What would you need for using PatientCoach to manage your asthma?

GENERAL PRACTITIONERS AND PRACTICE NURSES

Current asthma care

Could you describe current asthma care for adults within your practice
What is the role of self-management within current asthma care?

Internet-based self-management (IBSM) support

- How do you feel about internet-based self-management support?
- Demonstration of internet-based self-management support (PatientCoach) and explanation of functionalities
- How do you feel about PatientCoach?
- Please give your positive and/or negative comments.

Internet-based self-management support within general practice

- If you would be given the opportunity to use PatientCoach for asthma within your practice would you be willing to use it?
  - If yes, please explain why
  - If no, please explain why. Could you think of any possible solution?
- What would you need for using PatientCoach within your practice?

Interviewer	Johanna van Gaalen	Page 9
Credentials	JG: MD	Page 9
Occupation	JG: research physician	Page 9
Gender	female	
Experience and training	JG: Qualitative Health Research Course, Graduate School, Amsterdam Medical Centre.	Page 9
Relationship established	The moderator and observers had no involvement in patient care, and the participants had no personal background information on the interviewers.	Page 9
Participant knowledge of the interviewer	Both interviewer and observers introduced themselves at commencement of the focus groups/interviews.	Page 9
Interviewer characteristics	Research goals were provided both in the information letter and at the start of the interviews/focus groups: obtaining in-depth information on barriers to implementation of a prototype of an IBSM support system called 'PatientCoach' within routine asthma care. It was explicitly stated to provide both positive and negative comments, especially for those not willing to use or feeling reluctant to use internet-based self-management support (PatientCoach).	Page 9 Supplementary file 2.
Theoretical framework	Identified factors were coded according to the theoretical model by Grol and colleagues and categorized within the appropriate domains. This model describes different levels of healthcare in which barriers and facilitators for change can be identified: the innovation itself, the individual professional, the patient, the social context, the organisational context, and the economic and political context.	Page 9-10
Participant selection		
	General practitioners were recruited by sending an invitation letter to general practices within the Leiden - the Hague region, which also includes practices from the Leiden general practice (LEON) network. Positively responding general practitioners were asked permission to invite their patients and practice nurses to participate. From thirteen practices (one GP practice covered two separate practices), we randomly selected 10 patients (130 patients).	Page 7-8
Methods of approach	Primarily by means of an invitation letter, positively responding general practitioners, patients and practice nurses were either contacted by e-mail or by telephone to inform on interview/focus group location, date and time.	Page 7
Sample size	21 general practitioners, 22 patients and 13 practice nurses participated	Page 8
Non-participation	Patients: From thirteen practices (one GP practice covered two separate practices), we randomly selected 10 patients (130 patients). In total, 26 patients responded to our invitation, of whom 22 ultimately participated. Reasons for declining to participate not participating were: no asthma symptoms (n=6), lack of time (n=4), Ramadan (n=1), unknown (n=108). Practice nurses: In total, 24 PNs responded positively, of whom 13 ultimately participated (reasons for declining to participate: lack of time (n=1), lack of financial reimbursement (n=1), unknown (n=9). General practitioners In total we invited 150 GPs by information letter, of whom 27 responded positively to participate in focus groups/interviews. 21 GPs participated (participation rate 14%). Reasons for not participating included (no time (n=2), no show (n=1), unknown (n=126).	Page 7-8
Data collection		
Interview guide	Our topic guide was based on a theoretical model developed by Grol and Wensing	Page 7-9
Repeat interviews	General practitioners, patients and practice nurses participated only once in an interview/focus group.	-
Audio/visual recording	All interviews were audio-taped and transcribed verbatim.	Page 9
Field notes	Field notes were obtained during the focus groups or by the interviewer after conducting an individual interview.	Page 9

Duration	Focus groups took 1.5 hours. Interviews lasted 40 minutes.	Page 9
Data saturation	FGs and IVs were conducted until data saturation was reached. This was discussed by JG and MB. . The first three interviews and focus groups were discussed with the complete research team.	Page 9
Transcripts returned	Transcripts were not returned to participants.	Page 9