Interactive applications for patient education and behaviour change in asthma

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Abstract

Key-words: Asthma, Patient Education, Interactive Applications (MeSH terms)

Introduction
Asthma is a disease with high prevalence and morbidity all over the world. Additional treatment strategies are necessary to improve the quality of life of asthmatic patients. Patients play an important role in the management of their own disease using a specific plan for asthma control, symptom monitoring and attending regular medical evaluation.

Aim
Summarize the results of published controlled clinical trials evaluating the effect of interactive applications for education of patients with asthma on clinical outcomes in comparison with usual care for this chronic disease.

Methods
A systematic review of published articles in MEDLINE Database, until 2006. From 586 articles found, the 13 articles that reported controlled studies about interactive applications for patient education in asthma and that evaluated clinical outcomes were included and their data was extracted and summarised using Excel tables that contained information about the interactive application in study, clinical outcomes evaluated, results obtained in the intervention and control groups. Subsequent analysis, interpretation and discussion were made to this data.

Results
The more frequent interactive applications were: Interactive computer programs (6; 46%), video games (3; 23%) and web-based education program (2; 15%). About ¾(77%) of the articles, the investigators concluded, interactive applications improved significantly clinical outcomes. Of the articles, 6 in 13 evaluated acquisition of asthma knowledge and 5 of this observed better results on intervention group compared with control group while one did not observed significantly differences.

Discussion
Improvements were mostly observed in asthma knowledge, in the use of medication and school/work absenteeism. Despite this, as for the more practical results, such as asthma severity, quality of life or even emergency visits, there is not, in general, a significant
There was not a strong representation of the whole population with asthma. This limitation does not allow us to establish the usefulness of interactive methods for education and behaviour change of asthma patients. Internet-enabled programs seemed to alter attitude although knowledge levels did not. We concluded that the use of interactive applications has the potential to play a significant supportive role in this process by developing the child's understanding of their condition and promoting a sense of control over their health behaviours.

Introduction

According to the World Health Organisation (WHO), “asthma is a chronic disease characterized by recurrent attacks of breathlessness and wheezing, which vary in severity and frequency from person to person. Recurrent asthma symptoms frequently cause sleeplessness, daytime fatigue, reduced activity levels and school and work absenteeism”[1].

As asthma is a disease with high prevalence all over the world and despite the availability of pharmacological treatment, many patients have undesired clinical outcomes[2]. Therefore additional treatment strategies are necessary in order to improve the quality of life of asthmatic patients. One of these strategies is the patient self-management with based on the establishment of a partnership between the patient and health care professional(s) aims to enable patient’s confidence and information about their disease[3]. This way, patients play an important role in the management of their disease using a specific plan for asthma control together with regular medical revaluation and symptom monitoring[3]. Despite the good results of observed in studies about patient education, implementing it in the routine asthma care services has difficulties and not all educational programmes are conceptually well designed compromising the efficacy of patient self-management. It is now clear that education consisting only of passive transfer of information is ineffective. [4] Furthermore, many times patients and health care professionals are not having an effective dialogue about managing asthma[5]. The use of information and communication technologies (ICT) may provide solutions for some of those difficulties. Interactive applications (IA) using ICT may be defined as “computer-based, usually web-based, information packages for patients that combine health information with social support, decision support, or behaviour change support”. [6]
These IA take the patient as an active factor in the control process of the disease and help asthma patients help themselves to overcome difficulties, without interfering with the pharmacological treatment.

Some studies in different chronic diseases (such as Alzheimer's disease, asthma, cancer, diabetes, eating disorders, encopresis, obesity and urinary incontinence) have shown IA may increase patients’ knowledge and behaviour, clinical results, social support, overall health state and self-efficacy (which is person's confidence in that he is able to achieve an action).[6]

It is clear that there is lack of consistent evidence on the use of IA. Our aim was to summarize the results and evaluate the clinical outcomes from published controlled clinical trials about the use of interactive applications for education of patients with asthma comparing with usual care for this chronic disease.

**Participants and Methods**

*Study design*

This study has a systematic review design. In figure 1 (addenda) a flow chart of the studies methods is shown.

*Data source*

The search terms used were asthma, clinical trials, patient education and interactive applications (see fig. 2 addenda the full queries) in order to identify articles about interactive applications for patient education and behaviour change in asthma.

Using this search strategy, 586 articles were identified (see addenda fig. 3 the methodological steps of selection of participants).

*Inclusion criteria*

Articles chosen must be controlled studies about interactive applications for patient education in asthma. As the aim of this systematic review is to analyse that, articles have to evaluate clinical outcomes.

*Exclusion criteria*

Articles that did not evaluate the efficacy of the use of interactive methods in people with asthma were excluded. Moreover, those in which population was non-controlled were also excluded. The unavailability of the full text of the articles in all the resources
available (PubMed and libraries nearby) was an exclusion criteria. Articles that were not in English, Portuguese or Spanish were not included.

**General procedures for selection of articles**

Abstracts obtained (586) were distributed into six groups of two reviewers who applied inclusion and exclusion criteria defined; 27 articles were selected (see addenda figure 3). From those 27, 17 had their full text available. Then, each was analysed by two reviewers who applied inclusion and exclusion criteria once again; 13 articles were selected. Subsequent disagreement was resolved by a third element in both phases.

**Extraction of data**

Data of the articles was extracted by two reviewers who filled in a Excel database in order to obtain and summarize data considered essential to elaborate the systematic review. This way, articles could be organised according to interventions and variables analysed.

**Definition of variables**

Variables analysed were selected according to the population in study, such as the number of participants, length of the intervention and the attribution of the population. The main variables considered were the type of intervention in study (computer program, video game, Web-based education program, program connected to a home telephone, GSM and SMS) and the clinical outcomes obtained.

**Quality analysis**

A quality analysis was not performed.

**Statistical analysis**

SPSS was the programme used to do the statistical analysis.

**Results**

With a search in PubMed by the application of our query, we found 586 articles that could be of interest, of these only 27 moved to stage two of selection. In stage two, we excluded 4 more articles and of the 23 left, 10 we couldn’t have access to. Table 1 summarizes the information of each of the 13 articles included. In this table we present the general characteristics of the studies, the methods used and the outcomes achieved.
Table 1. General results of studies

<table>
<thead>
<tr>
<th>Article</th>
<th>Interactive application studied</th>
<th>lung function</th>
<th>asthma severity</th>
<th>physician consultations</th>
<th>Medication</th>
<th>hospital admission</th>
<th>emergency visits</th>
<th>school/work absence</th>
<th>self-management</th>
<th>asthma knowledge</th>
<th>quality of life</th>
</tr>
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<tbody>
<tr>
<td>Runge C, et al 2006</td>
<td>Web-based education program</td>
<td>+</td>
<td>+</td>
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<td>+</td>
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</tr>
<tr>
<td>Rasmussen LM, 2004</td>
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<tr>
<td>Ostojic V, 2005</td>
<td>GSM and SMS</td>
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<tr>
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<tr>
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<tr>
<td>Homer B et al, 2000</td>
<td>Computer program</td>
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<tr>
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<tr>
<td>Lieberman DA, 2001</td>
<td>Video game</td>
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<td>Huss K, 2003</td>
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<tr>
<td>Guendelman S, 2002</td>
<td>Program connected to a home telephone</td>
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Three types of interactive applications were more frequently used: computer programs, video games, web-based education program. The following graphic (figure.1) he number of articles by interactive method used.

![Figure 1. Interactive applications used](image-url)
Computer programs \cite{7, 11, 13, 16, 18, 19}.

All the studies about interactive computer programs were randomized, Sundberg R et al, 2005 \cite{11}; and Huss K et al, 1991 \cite{19} had adult populations and Krishna S et al, 2003 \cite{13}, Shegog R et al, 2001 \cite{16}, Holmer C et al, 2000 \cite{18} studied children. The number of patients studied varied from 52 to 228, as it can be seen in Figure 2.

![Figure 2. Number of individuals of the population per study](image)

Several outcomes were evaluated in each study. McPherson AC et al, 2006 \cite{7}, Krishna S et al, 2003 \cite{13} and Homer C et al, 2000 \cite{18} evaluated the knowledge acquired about asthma and Krishna S et al, 2003 \cite{13}, Homer C et al, 2000 \cite{18} also evaluate the number of emergency visits. Shegog R et al, 2001 \cite{16}, Homer C et al, 2000 \cite{18} and Huss K et al, 1991 \cite{19} evaluate self-management and in McPherson AC et al, 2006 \cite{7}, Krishna S et al, 2003 \cite{13}, and Huss K et al, 1991 \cite{19} medication alteration was also evaluated.

Based on this, the outcomes that have the most significantly improvements compared with the control groups are: asthma knowledge (the three studies that evaluate this outcome have significantly improvements), medication (the three studies that evaluate this outcome have significantly improvements), self-management (two of the three studies that evaluate this outcome have significantly improvements and just in one the control group had a better improvement).

The method used to evaluate the outcomes varied from article to article. A questionnaire was used in Sundberg R et al, 2005 \cite{11}, Krishna S et al, 2003 \cite{13}, Shegog R et al, 2001 \cite{16}, and Homer C et al, 2000 \cite{18}. In Krishna S et al, 2003 \cite{13}, Homer C et al, 2000 \cite{18},
and Huss K et al, 1991 \cite{19}, the outcomes were evaluated by observation of the investigator. One last study evaluated the outcomes by self-rating of the patients. The intervention time of the studies ranges from 3 months (Homer C et al, 2000 \cite{18}, and Huss K et al, 1991\cite{19}) to 20 months (Krishna S et al, 2003 \cite{13}), as it can be seen in Figure 3.

<table>
<thead>
<tr>
<th>Authors</th>
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<td>Huss S, 2000</td>
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<td>Datoi C, 2005</td>
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<td>Huss K, 2001</td>
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<td>Lieberman DA, 2001</td>
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<td>Rugge C, et al 2006</td>
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</table>

**Figure 3. Follow up time**

**Video Games** \cite{12}, \cite{15}, \cite{17}

All the articles about these interactive applications were randomized and studied children. The number of individuals studied was between 50 and 171 patients (graph.2). The three articles\cite{12}, \cite{15}, \cite{17} evaluated asthma knowledge, being that was noted significantly more improvements in treatment group than in control group in two of them. Lieberman DA et al, 2001 \cite{15}, and Bartholomew LK et al, 2000 \cite{17} also evaluated self-management and Huss K et al, 2003 \cite{12}, and Bartholomew LK et al, 2000 \cite{17} evaluated lung function. Self-management had a significantly improvement in bout two studies, while lung function have just a significantly improvement in one study being that in the other it is not noted a significantly difference between the intervention group and control group.

In the three articles the outcomes were evaluated by using a questionnaire. The intervention time of Huss K et al, 2003 \cite{12} and Lieberman DA et al, 2001 \cite{15} was similar, 3 and 2 months respectively and the intervention time of Bartholomew LK et al, 2000 \cite{17} was from 4 to 15 months (graph.3).
Web-based patient education program \cite{8}, \cite{9}:

The study by Runge C et al, 2006 \cite{8} was controlled but not randomized while the other, by Rasmussen LM et al, 2005 \cite{9} was a randomized study. The first study was about children and the other \cite{9} about adults. Both studies included a high number of participants, 438 and 300 respectively (graph.2).

The two studies evaluated different outcomes. Runge C et al, 2006 \cite{8} evaluated lung function, physician consultations, emergency visits, school/work absence and quality of life. Rasmussen LM et al, 2005 \cite{9} evaluated also quality of life, and asthma severity and self-management.

On these evaluated outcomes was generally noted a better improvement on intervention group compared with control group.

The way that the outcomes were evaluated in the articles was distinct. In Runge C et al, 2006 \cite{8} the method was collecting data from the patients’ records while in Rasmussen LM et al, 2005 \cite{9} the method was a questionnaire and lung function test.

The time of intervention was similar in these studies round 2 months (graph.3).

Main findings

Only in one study the allocation of patients to control and exposed groups was not random.

Six of thirteen studies evaluated acquisition of asthma knowledge and five of this observed better results on intervention group compared with control group while one did not observed significantly differences. Ten out of the thirteen studies generally concluded that the outcomes of individuals using interactive applications were better than in control groups.

Discussion

After analysing all the articles included, we came to the conclusion that interactive applications often achieve positive outcomes in the target populations. Computer programs is the type of interactive application most investigated. Web-based programs are less studied but have better results in most patients’ outcomes. The results of other interactive applications are inconsistent.

Computer program \cite{7}, \cite{11}, \cite{13}, \cite{16}, \cite{18}, \cite{19}

There is some heterogeneity in the results, but the majority of the cases lead to several improvements. However, since some articles show that the control group had better
results than the intervention group, it is necessary to evaluate this intervention in more studies so as to lead to solid conclusions.

**Video game** [12], [15], [17]

There are contradictory results, so more studies about this method must be performed in order to have a better evaluation.

**Web-based education program** [8], [9]

Although only two articles are currently available, significant improvements were observed in the target population.

**GSM and SMS** [10]

More studies are necessary since the only article with this interactive method reported good results in pulmonary function and self-management.

**Program connected to a home telephone** [14]

Like the previous interactive method, only one article was found, moreover its results were not consistent, with improvements in emergency visits, school absence and quality of life but with negative results as for hospital admissions.

However, in general, the outcomes with more considerable improvements were knowledge about asthma, absenteeism and the need of medication. This can be explained since these applications, by using methods like games that are more attractive to a young population, may allow them to learn more efficiently with this kind of approach.

The adult’s population (Rasmussen LM et al, 2005 [9], and Sundberg R et al, 2005 [11]) is not so open to these interactive methods.

On the contrary, as for the more practical results such as asthma severity, quality of life or even emergency visits, there is not, in general, a significant improvement. This may seem a paradox since the theoretical knowledge has improved.

The theme of this systematic review is a recent subject and still has many limitations: it is necessary to find ways of increasing adherence of participants in the studies and, as interactive applications are widely used by younger people, this can affect the results when we compare studies with adults versus studies with children.

Relatively to the number of participants, on the one hand, there is a discrepancy among some studies, and on the other hand, there is not a strong representation of the whole population with asthma since nine studies were about young children and only four included adults. So, and having in mind these limitations, it is not possible at this time
to establish the usefulness of interactive methods for education and behaviour change of asthma patients.

Moreover, several different outcomes were evaluated in different studies and there was also a high variety in the interactive applications analysed, making it difficult to compare the studies’ results.

Consequently, the results from the articles included in this systematic review are very diverse; therefore more research is necessary to clarify the effect of interactive applications in asthma care.

Despite these limitations, we have achieved similar results in comparison to other systematic reviews that focused on the same subject as ours.

McPherson AC et al, 2005 [21] report that the use of stand-alone games improved significantly the children's asthma knowledge and their self-efficacy for self-management behaviours and talking to friends about asthma. They also refer that children revealed greater feelings of control and that emergency visits were reduced as well as their school absenteeism.

The same article says that Internet-enabled programs did not change knowledge levels, although there was evidence of attitude change – after using the site, the teenagers were more likely to feel that they had friends with asthma that they could relate to and less likely to feel that they knew everything they needed to about their condition. This may make them more receptive to information provided in the future.

However, their work also presented negative results. They found that some children were left frustrated and discouraged because of the program's complexity.

Thus, they conclude that the use of interactive applications has the potential to play a significant supportive role in this process by developing the child's understanding of their condition and promoting a sense of control over their health behaviours.

Wantland DJ et al, 2004 [22] refers that sixteen of seventeen studies revealed that knowledge and/or behavioural outcomes, for participants using the Web-based interventions, improved. They also mention an increase of asthma knowledge treatment.

These authors conclude that the management of any chronic disease should be personalized to an individual, as the person is ultimately responsible for the success of the intervention. Self-management of a chronic condition and contribution to disease management has demonstrated improved results and adherence to treatment regimens.
In conclusion, the use of interactive applications seem to be promising for improving patient education and promoting behaviour change, but more studies on the best options and on its effects in asthma outcomes are necessary. Moreover, more studies about the use of interactive applications that account for the specific needs of each individual could be the purpose of new studies.

Asthma can severely affect the patients’ lives in different manners. In consequence, every effort maid with the aim of improving patient education and promoting behaviour change (increasing self-management) is meaningful and necessary.

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References


