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Perspective

How Information and Communication Technologies can Help Children with Recurrent Abdominal Pain?

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Abstract

Recurrent abdominal pain (RAP) is one of the most common pain problems in children. The condition significantly impacts the daily functioning of affected individuals and is associated with various health problems, including anxiety and mood disorders. Biopsychosocial interventions have shown effectiveness in managing RAP, with psychoeducation being a potential standalone intervention for some cases.

However, challenges persist in the field, including the limited availability of specialized services and the scarcity of health professionals trained in managing chronic pain. To address these challenges, information and communication technologies (ICT) offer unique opportunities. Our team has developed innovative ICT tools tailored to address the needs of children with RAP and their families.

The DAREmpordà project includes an educational website (EW) providing comprehensive information and resources for families, which received accreditation from the College of Doctors of Barcelona. DARWeb, a web-based intervention (WBI), offers a self-directed program based on the cognitive-behavioral model of pain, enhancing coping strategies and promoting the idea that pain does not define one's life. DARApp, a mobile application, is under development to provide tailored information and strategies for children and parents, with three levels of incremental resources.

While ICT offers promising solutions, challenges remain, including the need for evidence-based development, effective transfer to clinical practice, and addressing the high costs associated with ICT tool development. Nonetheless, ICT tools present a cost-effective means to bridge the gap between available research and clinical practice, thereby improving the well-being of affected populations. The advancement of initiatives in this field, including the integration of Artificial Intelligence, holds significant promise for managing pediatric conditions such as recurrent abdominal pain.

Keywords: *Recurrent Abdominal Pain; Information and Communication Technologies; Educational Websites; Web Based Interventions; Apps*

Introduction

The prevalence of chronic pain in children and adolescents is estimated to be between 15% and 38% [1], with recurrent abdominal pain (RAP) being one of the most common manifestations. The specific prevalence varies widely depending on the diagnostic criteria used, but RAP is undoubtedly frequent in children and adolescents.

RAP is a diagnostic category that includes different manifestations but is characterized by abdominal pain that occurs repeatedly (at least three episodes of intense abdominal pain in the last 3 months, interfering with the child's daily activities) [2]. In most of the cases (90 - 95%) [3], no underlying cause can be identified, and these cases are categorized under the diagnostic criteria of "functional abdominal pain disorders" according to the Rome IV classification and criteria [4].

Apart from being quite frequent, RAP has a significant impact on the daily functioning of children and adolescents [5]. It is often associated with anxiety disorders, mood disorders, and other health problems, especially pain, which can persist into adulthood [6-9]. Overall, it places a considerable burden on families and results in high economic costs for society [10].

In this context, biopsychosocial interventions, including professionals from different specialities, have proven to be effective for children with RAP [11]. However, for some cases, simpler interventions, including only psychoeducation (which is usually the beginning of any biopsychosocial intervention) can be sufficient. In fact, a study shows that 30 - 40% of patients with functional abdominal pain improve solely through psychoeducational intervention and follow-up by their primary care pediatrician [12].

Despite the available evidence, the amount of time required for applying psychoeducation and the limited availability of specialized services offering biopsychosocial interventions make it difficult for families to receive the interventions they need. It is also worth noting that the training of health professionals in the management of chronic pain is scarce. For example, on average, medical students in the United States received approximately 10 hours of education about pain [13]. In another recent study, 94% of professionals who manage chronic pain in children acknowledged gaps in their training [14].

In this context, we are convinced that information and communication technologies (ICT) can help facilitate access to evidence based resources for these children and their families; but also to professionals. More specifically, we consider that educational websites (EW), web-based interventions (WBI), and mobile phone applications (Apps), can help those families by providing access to the resources they need [15].

In this paper, we aim to further explain these three types of resources and provide an example of each type for the management of RAP. These examples are based on our work over the past few years. Ultimately, we aim to: 1) share our views, experiences, and perspectives, 2) help healthcare professionals develop and adopt evidence-based interventions for their patients, and 3) increase awareness of the need for adequate management of RAP.

Examples of ICT tools for children with RAP and their families

DAREmpordà: A educational website for families with a children with RAP

EW contains basic information about health issues, providing timely and accessible information. It is important to tailor this information to specific groups, considering the needs and levels of understanding of the different populations they address. Additionally, the design must be appropriate, and ethical principles must be followed in the development of content and the potential management of data.

We have developed the DAREmpordà project [16], which includes a diagnostic and therapeutic protocol, along with an educational website (EW) containing a set of informational materials for families with a child with RAP. This project was created by reviewing the most recent available literature and incorporating the views of professionals and families through various focus groups. The educational website (available in Catalan, Spanish, and a reduced version in English) contains the sections depicted in table 1 and can be accessed here: https://daremporda.salutemporda.cat/.

Sections	Contents
Introduction	Includes information about the page's objectives and introduce the authors
What is DAR	Here, patients and their families can find the definition of DAR, answers to common questions ("Why do I have stomach pain?" "How do I know I don't have any illness?" "What if I have a food allergy or intolerance?"), misconceptions about DAR, basic coping strategies for pain, and links to other relevant websites and literature.
Patient and Family Experiences	Allows patients and families to share their own experiences
For younger ones	This is a specific section with contents for children
Contact authors	Offers a way to get in touch with the authors
Health Care professionals	Contains the diagnostic protocol, therapeutic approach, printable informational brochure, symptom calendar, and an informative letter for schools on how to support students with DAR.

Table 1: *Sections and contents of DAREmpordà.*

In sum, DAREmpordà offers a first psychoeducational approach to families, as well as a high-quality source of information that can be useful for professionals working with families of children with RAP. DAREmpordà is also accessible to anyone who surfs the internet, with the aim of raising awareness among the general population through scientifically validated information.

Our educational website obtained the Accredited Medical Web (WMA) seal from the College of Doctors of Barcelona in September 2019. This seal signifies the value, rigor, and trustworthiness of its content.

DARWeb: A web-based intervention for children with RAP and their parents

Following the seminal work by Barak., *et al*. [17], a WBI is "... a primarily self-guided intervention programme that is executed by means of a prescriptive online programme operated through a website and used by consumers seeking health- and mental-health related assistance. The intervention programme itself attempts to create positive change and or improve/enhance knowledge, awareness, and understanding via the provision of sound health-related material and use of interactive Web-based components". WBI include multimedia materials, and can be totally self-directed or have the support of clinicians.

Along these lines, DARWeb is a WBI designed for children with RAP and their parents. It is a completely self-directed intervention, offering parallel but separate content for parents and children, distributed across seven units each. The intervention is based on the cognitive-behavioral model of pain, teaching families coping strategies to reduce pain impact and disability (e.g. relaxation, changing maladaptive thoughts, pain distraction, and assertive communication). Additionally, there is a strong emphasis on conveying the idea that pain does not define their lives and that the most important thing is to live the life they want despite having pain.

Units are scheduled weekly, with each unit taking about 30 minutes to complete (participants are encouraged to complete each unit over one or two different days). Participants must complete one unit before they can start the next. Parents and children are advised to complete their units separately, though parents are encouraged to supervise their child's progress and motivate them to stay on track.

DARWeb was implemented using the Intelligent Research and Intervention Software (IRIS) platform [18]. The content is interactive and personalized, incorporating the participant's name and other individual details.

In table 2, and schema of the contents included in DARWeb are presented.

Unit	Parents	Children
0	Introduction to DARWeb	Introduction to DARWeb
1	What is pain?	What is pain?
2	Pain and triggers	Pain and triggers
3	Setting goals	Setting goals
4	Parents' responses to child's pain	Relaxation
5	Communication	Communication
6	Parent's responses to their own pain	Thought management
7	Thought management	Distraction

Table 2: *Main contents of DARWeb.*

DARWeb has proven to have positive effects in families, considering both quantitative (pain severity, and quality of life) and qualitative measurements (satisfaction and learning how to cope with pain) [19,20]. The project started in 2012, and taking into account the results obtained, the intervention is still offered to families in need.

DARApp: A mobile phone application for children with RAP and their parents

Mobile applications have a lot of advantages for providing health care contents and interventions. The proliferation of smartphones in the population is enormous, so that represents a great opportunity to offer accessible programs through the so-called apps. Data like those published by the prestigious Pew Research Center show that 68% of the adult North American population had a smartphone in 2015. Among the main advantages of mobile applications, smartphones allow immediate access to the internet and apps almost anywhere, and they are very easy to use for the general population. Additionally, apps can easily send information and reminders to targeted users and provide reinforcement when users perform certain actions.

Taking into account all these advantages, our team is developing DARApp, a mobile application to help children with RAP and their parents. The objective is to promote and enhance family engagement by providing tailored information and strategies to improve the understanding of RAP and coping with it.

The app is going to have two different versions: one for parents and another for children over 12 years old. We have also planned three different levels of incremental resources:

- Level I (for all users): Psychoeducation about the problem, customized to the specific user.
- Level II (for users who need more resources than the ones provided in level I): This will include training in different coping strategies (e.g. relaxation, communication, change of maladaptive thoughts) tailored to their needs.
- Level III (for users who need more resources than the ones provided in level II): In this, the system will recommend the contact with specific professionals.

Level I will be developed with the contents that we already have in DAREmpordà, and level II with the contents we have in DARWeb. All the development process is going to be conducted looking from user's and professionals feedback.

Conclusions

In this paper, we have discussed the use of different information and communication technologies (ICT) for helping children with RAP and their families, by presenting some examples in which we are working on. It is important to highlight that these examples are ones of

the few available worldwide. We encourage other researchers and professionals to leverage resources such as the ones we have described here. As discussed, these children do not receive the best available treatment, and ICT offers us a unique opportunity to bridge the gap between available research and practice.

However, besides the potential of using ICT, it is important to acknowledge also some difficulties. First, available resources are not always developed following the best available evidence, and satisfaction with the available resources could be improved [21,22]. For this reason, it is crucial to create ICT tools by considering users as expert patients in the development process and collaborating with multidisciplinary teams that can bring diverse expertise to the project. Conducting research to test the effects and satisfaction with the developed tools is also fundamental. However, this point is also related to the second main difficulty from our point of view. In the literature, there are many studies developing ICT tools and testing them for different health problems, but ultimately, some of them are not applied in the clinical context. Thus, from our perspective, it is crucial to plan the transfer process effectively to truly make an impact on the well-being of the population.

The third difficulty in the field is the high cost related to the development of ICT tools, which can be substantial. While it is true that the development of these solutions incurs costs, research shows that the developed solutions can be cost-effective [23]. And, we cannot forget that otherwise we are not offering the care people need.

In sum, ICT are promising for the management of different pediatric situations such as recurrent abdominal pain. More initiatives are needed to progress in the field, and the use of Artificial Intelligence needs also to be considered, since it has a great potential to facilitate the care that a lot of children need.

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Conflict of Interest

None to declare.

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