



Parenting: There is an app for that. A systematic review of parenting interventions apps

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ABSTRACT

Background: Technology is widely used by people of various ages and backgrounds. It has become an easy, affordable, and discrete means to learning and development. Parenting apps can be easily accessed through digital distribution platforms, which is both an opportunity and a challenge for technology users when it comes to choosing the right app for their needs. The present review aims at summarizing the characteristics of parenting apps available online and identifying the areas where improvement is needed to deliver the best services for parents in need of guidance.

Method: A systematic search of parenting apps that targeted parents of children aged between 2 and 12 years old was carried out on the Google Play and Apple App stores. The characteristics of the apps were verified based on previously set inclusion criteria in two steps: using in-platform descriptions and by downloading and testing the in-app features.

Results: Out of 522 apps that were relevant to our search, only 53 apps met our criteria to provide parenting interventions. Although 86.7% could be downloaded for free, 32% of them required subscription and payment after the trial version. Most of the apps were dedicated to the assessment of children's development, rewards usage, or behavior tracking. Only a few apps offered features such as personalized content, parent mood tracking, and action planning. Most of the apps relied on behavior therapy techniques or positive psychology and none of the apps employed studies to investigate their effects.

1. Introduction

1.1. Barriers in accessing parenting programs

Many parents face challenges in raising their children and need advice and support. Positive parenting programs have been largely implemented for offering support for the parents in need. Indeed, studies investigating the efficacy of parenting programs documented that they bring comparable improvements for both child externalizing and internalizing disorders (Cartwright-Hatton et al., 2005; Leijten et al., 2019; Michelson et al., 2013; Tarver et al., 2014). Despite the fact that effective parenting programs do exist, many parents are not able to access them.

Time and scheduling factors represent an important barrier in accessing, attending, and completing parenting programs (Cunningham et al., 2000, Heinrichs et al., 2005) with one study reporting a 32%

enrollment increase for every unit decrease in reported time constraints (Dumas et al., 2007). Another investigated barrier in accessing parenting programs is the concern about being stigmatized or judged (McGoron & Ondersma, 2015; Priguda & Burke, 2020). Maternal age poses another barrier to accessing parenting programs, research involving low-income urban mothers showing that the younger the mother, the less likely she is to complete the parenting program (Danoff et al., 1994). Another important factor in parenting programs' drop-out rate is the perceived lack of relevance (Mytton et al., 2014), as many parenting programs reflect middle-class Caucasian values.

1.2. Integration of technology in the therapeutic process

Technological development in recent years created an opportunity to overcome some of the barriers to conventional psychotherapeutic services by facilitating the transportability of evidence-based intervention

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protocols to the community. Thus, implementation of online versions of the parenting programs have started and studies show that they are bringing improvements in both parents' and children's mental health, which are comparable to the face-to-face administered parenting programs (Baumel et al., 2016; Fluja-Contreras et al., 2019; Spencer et al., 2020; Thongseiratch et al., 2020).

Technology can be incorporated in the delivery of parenting programs in a variety of ways. Technology-augmented parenting programs that supplement traditional parenting interventions with technology-based modules, have shown promising results concerning participant engagement, caregiver skill acquisition, and child behavior, while reducing the time a therapist invests in treatment, which can offer more parents the possibility to receive treatment (Rabbitt et al., 2016; Jones et al., 2021). Research shows that the addition of technology to traditional parenting programs can increase treatment completion rate, while providing comparable results (Jent et al., 2021).

Jones et al. (2014) found that technologically-augmented interventions help participant engagement in low-income families, which, in turn, may boost improvements in child behavior. Self-directed digital parenting programs, delivered via digital applications, show promising results as preventive tools and have been found to be suitable and accepted by caregivers (Bert et al., 2008; Ehrensaft et al., 2016). Beyond preventive use, self-directed interventions show medium to large effect size improvements in children's behavioral problems in comparison to no treatment control conditions (Enebrink et al., 2012; Irvine et al., 2015; Sanders et al., 2012).

1.3. Mobile apps: Taking a step further

Online parenting programs can overcome many problems of the traditional parenting programs (e.g., costs, location, stigma) but they face other limitations and obstacles, such as accessing a computer. Moreover, recent statistics show a higher preference for the use of mobile devices in comparison with desktop ones, including situations such as accessing educational resources ("Mobile vs. Desktop Usage in, 2020", 2022). With a 49.89% increase in smartphone users from 2017 to 2022, 83.72% of the population has access to a smartphone ("How Many People Have Smartphones Worldwide (July, 2022)," 2022). Thus, mobile applications (apps) for delivering parenting interventions have emerged that make use of mobile devices (most commonly mobile phones) in helping parents improve their practices.

The attitudes towards the use of mobile phones for mental health monitoring and management are generally positive. A previous study found that 76% of a sample of 525 people expressed interest in the aforementioned tools if the services were free. The results did not vary by gender, age group, mental health, employment or marital status (Proudfoot et al., 2010).

Several previous studies and reviews have pointed out the lack of appreciation for evidence-based support in the development of mental health apps. Donker et al. (2013) could only identify 8 papers, describing 5 mobile apps, that examine the effects of the apps on mental health symptoms or disorders compared to a control group. Recently, Virani et al. (2019) searched on the mobile stores parenting apps offering support during the first year of parenthood and rated their quality. They found a large number of applications (4.300 apps), with most of them being dedicated to pregnant women, infant care, and providing pediatric information for mothers, with only 16 being rated as relevant, quality apps. The relevance of the selected mobile apps was determined by assessing information/features adequacy, ease of navigation, sufficiency of free features, and inclusion of credible information and resources.

In spite of the limited research carried out concerning mental health mobile apps, including those targeted at parents, the literature suggests several guidelines and recommendations for developing qualitative mental apps, that are multidisciplinary derived. Bakker et al. (2016) proposes such guidelines that can be used for general mental health

problems, the following applying and being adapted to parenting apps as well:

1. The use of evidence-based protocols and techniques

CBT-based parenting interventions have received strong support when implemented in traditional settings. They have found to be effective in reducing depressive symptoms and increasing healthy parenting behaviors in mothers, as well as improving child developmental outcomes (including social, motor, problem solving and communication skills), children's internalizing and externalizing problems (Forehand et al., 2013; Husain et al., 2021; Jewell et al., 2022). The CBT parenting protocols seem to translate well into technology-based interventions, research supporting their efficacy in online settings, even for short-term interventions (Cardamone-Breen et al., 2018; Korpilahti-Leino et al., 2022). Moreover, when it comes to general mental health mobile apps that are derived from CBT protocols, evidence supports that such tools help significantly reduce depressive symptoms (Firth et al., 2017) and subclinical anxiety symptoms (Firth et al., 2017).

2. Transdiagnostic approach

Taking into account the high comorbidity rates of psychological disorders, it is important to include transdiagnostic methods for both treatment and prevention of emotional and behavioral problems in parents and children. When it comes to children's emotional problems, high rates of comorbidity between internalizing and externalizing problems can be observed. Willner et al. (2016) observed that 48% children out of a sample of 336 presented comorbid profiles of internalizing and externalizing problems, 89% showing high profile continuity from one year to the next.

3. Personalization

Bakker et al. (2016) emphasizes the important role of tailoring apps in order to better fit the user's needs. This also applies to parenting programs, as tailored online parenting interventions are shown to be effective in improving parenting risk and protective factors for child anxiety and depression (Sim et al., 2020), improving parental acceptance and parental psychosocial quality of life and decreasing levels of parental psychological control (Sim et al., 2022). Eyal and Hoover (2014) identified three main ways to personalize such tools. Self-report measures can be used to assess symptoms and user characteristics, as well as data from self-monitoring features. Lastly, data derived from user's interactions within the app can be used to predict the future interactions and usage needs and preferences.

4. Inclusion of psychoeducation

Psychoeducation is an important component of many evidence-based intervention programs and is defined as an intervention with systematic, structured and didactic knowledge transfer for illness and its treatment (Ekhtiari et al., 2017). Parental psychoeducation, both delivered live or through technology, has been found effective on its own in improving medication adherence and children's ADHD symptoms (Yang et al., 2015), decreasing parental stress (Anderson & Guthery, 2015), and has proven comparative results to live psychoeducational interventions in multi-family group settings for children's and adolescent's mood or anxiety symptoms (Sapru et al., 2018).

5. Online community

A common theme that emerges in multiple mental health apps' reviews, both targeted at parents or the general populations, is the need for community. A qualitative content analysis of consumer feedback concerning apps for bipolar disorder reveals that a quarter of the users appreciate feeling part of a community while using the app (Nicholas et al., 2017). This feedback is in line with end-user perspectives regarding other online interventions, such as an online intervention for parents of children with autism spectrum disorder tested by Hermaszewska and Sin (2021). In this paper, all participants agree that an online community, especially one that included mental health specialists, would be of great value for sharing experiential knowledge and emotional support between parents.

Users, in the current paper focusing on parents, face great challenges in search of good quality mental health apps. Given the state of the field and the potential of the apps in helping parents in need, it is essential to understand the current state regarding apps accessible on mobile stores dedicated to parenting interventions.

2. Methods

2.1. Search overview

Potentially relevant apps were collected from two major digital distribution platforms: Google Play and Apple App stores. In order to fit the inclusion criteria, the app must: (1) be defined as a parenting app; (2) target parents of children aged between 2 and 12 years old; and (3) contain an active intervention. The study sample was limited to English language apps. The search was conducted in June 2021, separately for each platform, and was centered around a combination of terms describing parenting or parenting-related topics such as "parent", "parenting", "training", "education", and "program". The apps were included regardless of app category. Data regarding app titles, descriptions, and links were combined in one document, and duplicates representing apps that were both available in Google Play and Apple App store were eliminated.

An initial number of 522 parenting apps were found by searching the two platforms in June 2021. Out of them, 355 apps remained to be screened after removing duplicates. Furthermore, 34 apps were excluded for practical reasons (technical problems, out of scope, required invitation or a foreign phone number to log in, advertised at parents but targeted at children). After the assessors independently scored the apps on the eligibility criteria on the two-step process, the final database included 53 apps (see Fig. 1 for the detailed filter scheme). Studies carried out in order to assess the effectiveness of the apps were checked for using academic databases (Web of Science, Scopus, Pubmed), with the name of the app as keyword.

2.2. Data extraction and coding

The apps were initially selected based on the descriptions and screenshots provided by the developers. The information available on the platform was in regard to the app developer, app features, and overall summary of the app features and targeted population. User ratings were also available in the form of scores ranging from one to five stars as well as narrative reviews.

Following duplicate removal, apps' eligibility was determined based on previously established inclusion/exclusion criteria in two steps. The first step consisted of the app evaluation based on the descriptions and screenshots available on the platform. The evaluation was carried out separately by two of the authors (I.I. & M.S.), and the agreement rate was 0.85, indicating strong agreement (Mchugh, 2012). The apps that had dissimilar ratings were inspected by the third author (D.O.), whose rating served as a tiebreaker.

The first inclusion criteria to be assessed was the population targeted and children's age range. The apps that were targeting children directly (e.g., games, school monitoring apps for children) were excluded, along with apps that were targeting parents of children younger than 2 or older than 12 years old. The same procedure was followed for the remaining inclusion/exclusion criteria. An app was considered as containing an active intervention if it had at least one instruction for a child-focused activity or included features that facilitated healthy parenting practices such as interacting with and involving oneself in the child's life or parental monitoring (Spera, 2005). Based on the available platform description, 99 apps met all the inclusion criteria. Each app was downloaded by two of the authors (I.I. & M.S.) and the inclusion/exclusion criteria were verified for a second time following the same procedure, this time by exploring the apps in more depth. After assessing all the app features that were available for free, 53 apps were included in

the review.

The actual content of the apps was analyzed and deconstructed into 19 categories. In terms of content coding, depending on the OS of the app, one of the authors coded the features together with the corresponding author. Where disagreements appeared, they were discussed and a final decision was reached.

3. Results

3.1. General feature coding

Several criteria were applied to sort the apps retained for the review. First, the assessors looked at the category where the apps pertained, as assigned by the platforms: parents (37.7%), lifestyle (22.6%), education (22.6%), health and fitness (7.5%), medical domain (3.7%), reference (3.7%), and business (1.8%).

Regarding the download process, two categories of apps emerged: free apps (86.7%) and paid apps (13.3%). Their prices ranged from €0.99 to €3.29 for a one-time purchase giving full access to the app. For some of the apps that were downloaded free of charge, the term 'Free-mium' fits better (West et al., 2012), because 32% of them required a subscription after a short trial period, ranging from €1.99 to €12.99 per month. Some of them offered discounts for longer periods of membership, such as annual or lifetime subscriptions.

User ratings constituted another reference criterion for coding, although a large part of the apps (34%) did not have any reviews. No app received the lowest rating of 1 star, and only 7.5% had a perfect rating of 5 stars. The other apps received relatively good ratings, as the percentages rose while moving to the upper limit of the scale: 2 stars – 1.8%, 3 stars – 16.9%, 4 stars – 39.6%. An important aspect to note about the weight of the ratings is that not all apps had a similar number of downloads. In fact, their distribution was quite extensive, ranging from 5 + downloads (3.7%) to 1.000.000 + downloads (1.8%). There were 18 apps (34 %) that had no reviews available, and given the rough estimation of the number of downloads visible on the platforms, the percentage of the users that left a review after downloading the app ranged between 0.31% and 13%. For a more comprehensive overview, please see Table 1.

Finally, the operating system offering the apps was also recorded as follows: apps found exclusively on Android (52.8%), apps found exclusively on iOS (24.5%), and apps found on both Android and iOS (22.6%).

3.2. Specific feature coding

Regarding the app features, some distinctions were made to capture the dynamism and presentation of their interface. 100% of the apps included text, 54.7% contained images, and 45.2% had some kind of animation. Besides these main categories, other features included video and audio materials, calendars, notifications, and others described in Table 2.

The most used ways to target the interventions were by creating children's profiles (62.2%), assigning reward categories (47.1%), and keeping a goal tracker (37.7%), while the least common expression of the content was conducted via personalized intervention contents, mood tracking, and scheduling (1.8% each).

The apps were further screened for the use of Evidence-Based Techniques by expert reviewers, as few of the apps have explicitly stated the use of specific evidence-based techniques. The screening yielded 5 categories. The most popular approach was Behavioral Therapy (39.6%), followed by Positive Psychology (18.8%). Some apps used the mindfulness techniques (13.2%), and the least commonly used were Acceptance and Commitment Therapy (ACT – 1.8%) and Cognitive Behavioral Therapy (CBT – 1.8%). No apps that were retained in the end for the purpose of this review have studies to support their clinical effectiveness in improving parenting skills.

For a more in-depth nominal description of the app's general and

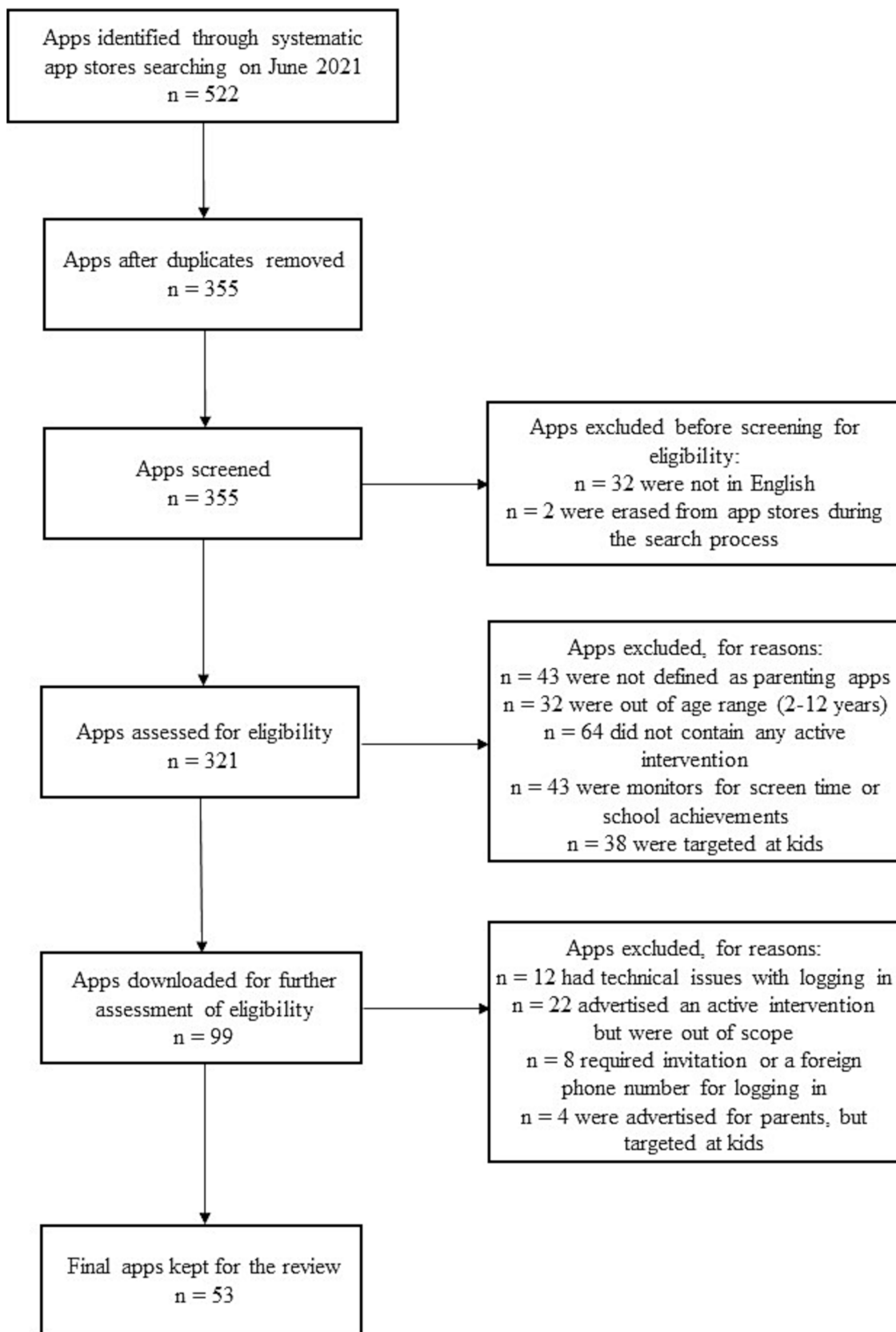


Fig. 1. Filter scheme, Abbreviation: n, number of apps identified.

Table 1
General feature coding.

Variable	N	Percent
Category		
Parents	20	37,7
Lifestyle	12	22,6
Health and fitness	4	7,5
Education	12	22,6
Medical domain	2	3,8
Reference	2	3,8
Business	1	1,9
Paid/Free Download		
Paid	7	13,2
Free	46	86,8
Subscription		
Yes	17	32,1
No	36	67,9
User ratings		
1*	0	0,0
2*	1	1,9
3*	9	17,0
4*	21	39,6
5*	4	7,5
NA	18	34,0
Downloads		
5+	2	3,8
10+	4	7,5
100+	5	9,4
500+	4	7,5
1.000+	6	11,3
5.000+	3	5,7
10.000+	6	11,3
50.000+	4	7,5
100.000+	4	7,5
500.000+	1	1,9
1.000.000+	1	1,9
NA	13	24,5
Operating system		
Android	28	52,8
IOS	13	24,5
Android & IOS	12	22,6

Abbreviation: N, number of apps identified; NA, not available.

specific feature, please consult the Appendix.

4. Discussion

The aim of this study was to explore the range of parenting apps available to parents through digital distribution platforms such as Google Play and App Store and determine their evidence-based status. A secondary objective was to explore and describe the apps' main features and tools.

Out of 522 apps that were relevant to our search, only 53 apps met our criteria to provide active parenting interventions. Although 86.7% could be downloaded free, 32% of them required subscription and payment after the trial version. The interest in this feature stems from previous studies showing a greater interest and willingness to use mental health apps when they can be accessed free of charge or with minimal cost (Mayer et al., 2019; Proudfoot et al., 2010).

There was a high heterogeneity in the usage of these apps, ranging from 5+ downloads to 1.000.000+ downloads (1.8%). Although the apps had a large number of downloads, the reviews seemed to be lacking, given that the highest percentage of reviews was 13%. A tendency for people to download more frequently apps that are highly rated has been observed (Nicholas et al., 2015). The user experience provided in the form of user reviews may be a starting point for parents to choose a particular parenting app, but it might be insufficient to guarantee that the app is actually useful for its intended purposes. When it comes to health apps, there is only a moderate correlation between objective app quality ratings and user ratings. This can be accounted for by users' tendency to leave reviews in situations when they have a notably good

Table 2
Specific feature coding.

Variable	N	Percent
App features		
Text	53	100,0
Image	29	54,7
Audio	6	11,3
Video	8	15,1
Calendar	7	13,2
Animation	24	45,3
Game	5	9,4
Chat	2	3,8
Notification	13	24,5
Alarm	1	1,9
Contents		
Books	2	3,8
Articles	8	15,1
Websites	2	3,8
Personalized sessions	1	1,9
Affirmations cards	1	1,9
Tips	10	18,9
Quiz	7	13,2
Notes for other caretakers	3	5,7
Children profiles	33	62,3
Tasks	11	20,8
Reward categories	25	47,2
Penalties	3	5,7
Goal tracker	20	37,7
Mood tracker	1	1,9
Reports	3	5,7
Timer	7	13,2
Scheduling	1	1,9
Reminders	4	7,5
Reflections	2	3,8
EB techniques		
Behavioral Therapy	21	39,6
Cognitive Behavioral Therapy (CBT)	1	1,9
Mindfulness	7	13,2
Acceptance and Commitment Therapy (ACT)	1	1,9
Positive Psychology	10	18,9
Studies to support		
Available	0	0,0
Unavailable	53	100,0

Abbreviation: N, number of apps identified; EB, Evidence-Based.

or bad experience with the app (BinDhim et al., 2015). Consequentially, the great majority of users' experiences are not taken into account, and the reviews reflect mainly the extreme points of the sample.

Most of the apps were dedicated to the assessment of children development, rewards usage, or behavior tracking. Only a few apps offered personalized content or parent mood tracking and action planning. Most of the apps relied on behavioral therapy or positive psychology inspired techniques, although only a small number of them explicitly stated the intervention approach used. Three of the apps offered psychoeducation in the form of books, articles or research papers, and lessons. In the introduction section, we discussed certain recommendations for the development of parenting apps. We can observe that besides the active component that would translate in features such as reward charts, tasks, goal charts, progress trackers, etc., the personalization and psychoeducational components are lacking. The lack of context for the intervention, that could have been provided in the form of psychoeducation, can decrease the potential efficiency of the intervention. Psychoeducation is an important part of psychological interventions, proving itself valuable for reducing family tension and dysfunction, and fostering more effective use of professional services (Diamond & Josephson, 2005).

Concerning the development of parenting apps, there are certain recommendations to be accounted for, based on the shortcomings identified during the in-depth app evaluation phase. As previously stated, the conception of parenting apps should be anchored in an evidence-based theoretical framework and should be accompanied by proper psychoeducational materials that ground the techniques in a

therapeutic rationale. Furthermore, the use of transdiagnostic techniques would be of great value, especially in a preventive framework. The addition of an online community would also help engage users within the app and increase social support, which is an important aspect in parental stress reduction and increase in life satisfaction (Lu et al., 2018; Martinez & Turnage, 2022). In order to further overcome the limitations imposed by socio-economic and cultural differences in parenting practices, app developers must make an effort to understand the characteristics of the target population (Friis-Healy et al., 2021).

Given the large number of available parenting apps, it is concerning that none of the identified apps had studies to investigate their effects. The user experience could not be completely understood and assessed because of the lack of an appropriate standard measure of the apps' efficiency. In this case, clinical trials where parents can use the apps and track their progress under the careful supervision of a clinician represent an important step in discriminating between a qualitative app and a marketing scam. Because some apps had many downloads, we supposed that they were better construed and more complex, and parents were satisfied with their functionality. But this can not be generalized out of one's own home and family out into the world of research, because other variables play an important role (e.g., a parent using a certain parenting app might be inclined to spend more time with their child, perhaps because that is one of the app's milestones).

Previous reviews of parenting apps have mainly focused on apps targeted at parents of newborns. While the review is the first one to analyze the features of parenting apps available online that are targeted at parents of children aged 2–12, it does not come without limitations. First, the apps included in the sample are available only in English. As there may be many parents who do not speak English, future studies could employ a multilingual international team that can assess apps available in different languages. A second limitation refers to the digital distribution platforms the search was carried out on. Even though Google Play and Apple App store are two of the most popular platforms for smartphone app download (Ali et al., 2017), several parenting apps could be available on other platforms. Moreover, the apps identified by using the aforementioned keywords might not include all relevant apps available on Google Play and Apple App store. We recommend that future studies extend their search to other online platforms and use a greater variation of keywords in order to ensure the identification of a greater number of apps.

Another limitation is that there was no data available regarding users' assessment of selected apps' usability, satisfaction, success, or credibility, and thus future studies are needed to investigate such features of the parenting apps.

App developers have the opportunity to create appealing tools for parents and, in return, encourage their involvement in parenting interventions. Research shows that navigability, interactivity and customization of the applications could be important factors in user satisfaction (Sundar et al., 2012). Based on the results of the current review, we can see that 12 of the evaluated apps had technical problems with logging in, and only one app had the option of personalized sessions, which leaves a lot of room for the improvement of app features.

5. Conclusions

The recent rise in smartphone use offers an outlet for mental health specialists to overcome the barriers deterring parents from accessing resources to improve their parenting practices and their parenting experience. The multitude of available apps poses great challenges for parents in terms of locating and using good quality apps.

In the current review we have identified apps that present promising features, inspired from evidence-based techniques, although the small number of apps that include them shows that there is still a regrettable lack of effort to integrate evidence-based parenting intervention programs into mobile applications or to investigate the impact of the commercial apps that have been released on mobile stores. There is a

great need for the development and release of mobile-based parent intervention that are evidence-based, affordable, attractive, and easy to use by parents in need.

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CRediT authorship contribution statement

Oana Alexandra David: Conceptualization, Methodology, Investigation, Resources, Writing – original draft, Writing – review & editing, Supervision, Project administration, Funding acquisition. **Ioana Alexandra Iuga:** Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization. **Ionela Simona Miron:** Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.chidyouth.2023.107385>.

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