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# CALM & CARE: A CHILD-CENTRED DIGITAL THERAPY PLATFORM FOR MENTAL HEALTH

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**ABSTRACT**

Mental health, as critical as physical well-being, has gained significant importance during the COVID-19 pandemic. Moreover, pandemic-induced lockdowns have exacerbated mental health issues, including suicides, spousal violence, and domestic bullying. Consequently, the demand for digital therapeutics has surged, manifesting as mobile and web applications and facilitating remote access to support. However, children have been underserved in this category despite their vulnerability to the emotional consequences of school closures and caregiver distress. This study's objectives and methodology encompassed developing a child-centric digital therapy mobile application, conducting usability testing for optimal user-friendliness, creating content compliant with industry standards, gathering user feedback for improvements and providing ongoing maintenance for the application's effectiveness. The resulting 'Calm & Care' prototype empowers parents to authorise counselling sessions and motivational content for their children at home. Ten families participated in user testing, yielding positive feedback praising the vibrant interface, child-friendly visuals, and simplified language for an enhanced user experience. 'Calm & Care' can enable local clinics to accept mental health patients with lower infection risks and increase treatment success. This research underscores the pivotal role of digital solutions in addressing children's mental well-being during the pandemic.

## INTRODUCTION

Mental health is technically defined as a person's ability to handle daily stress, work well, and benefit others. Linguistically, it refers to an individual's cognitive, behavioural, and emotional well-being, which affects human thinking, feeling, and behaviour. It encompasses enjoying life, balancing activities, and being psychologically resilient. Meanwhile, mental illness is a wide spectrum of mental health problems influencing a person's mood, reasoning, and conduct. Mental health disorders include, but are not limited to, depression, anxiety, bipolar, eating disorders, schizophrenia, and obsessive-compulsive disorder (OCD). Biological variables, including deoxyribonucleic acid (DNA) and brain chemistry, significantly contribute to mental health. Also, life experiences and family history may affect a person's mental health.

Our way of life has become more complex and advanced than it was previously. Every day, we get more modernised, leading us to embrace a computerised yet tangled way of living. Human life can be compared to a roller coaster full of ups and downs, especially regarding emotional well-being. Any mental health complication can harm a person's quality of life. Regarding living a well-balanced lifestyle, mental health requires more quality assistance than physical health, especially for specific age groups or stages of one's life. Unfortunately, with the rise of the COVID-19 pandemic, many teenagers and children were also found to be suffering from mental illnesses. COVID-19 has drastically changed our day-to-day lives. People from every age group have suffered from many unbearable physical and mental health conditions since the beginning of this pandemic. Youngsters may experience more prolonged adverse effects than adults (Shen et al., 2020). According to Singh et al. (2020), there are over 2.2 billion children, roughly 28% of the global citizens. Meanwhile, teenagers aged between ten and nineteen comprise 16% of the population worldwide. Fong et al. (2021) highlighted that before the lockdown, more than half of the children participated in extracurricular activities such as tuition classes or therapy sessions, and the lockdown seized their ability to continue doing so.

Before the pandemic started in early 2020, the World Health Organization reported that countries only addressed mental health with less than 2% of resources allocated from the health segment, and they were struggling to satisfy the needs of different population groups. However, Panchal et al. (2021) reported that when the pandemic began to escalate in May 2020, 29% of parents were informed of the worsening emotional conditions of their children. The percentage of the same concern increased to 31% from subsequent research conducted in October 2020 (Panchal et al., 2021). They further described youngsters as showing increased signs of petulance, attachment, distress, difficulty sleeping, and taking scarce food. These statements showed that mental health issues were increasing widely due to the pandemic. Table 1 describes different mental health issues children experience.

**Table 1**

*Types of Mental Health Issues Children Encounter*

| Mental health issue | Description |
|---|---|
| Anxiety disorders | Anxiety disorders in children are persistent concerns, worries, or anxiety that interfere with normal age-appropriate social interactions. Diagnoses include social anxiety, generalised anxiety, and OCD. |
| Attention-deficit/ hyperactivity disorder (ADHD) | ADHD patients have trouble maintaining attention, impulsive conduct, hyperactivity, or a combination of these issues. |
| Eating disorders | An obsession with an ideal body type, unhealthy eating and dieting patterns characterise eating disorders. Bulimia, anorexia, and binge-eating disorder are among eating disorders that can lead to emotional, social, and physical problems. |
| Depression and other mood disorders | Depression is characterised by continuous sorrow and loss of interest that impairs a child's capacity to learn and socialise. Meanwhile, bipolar disease is diagnosed with dangerous mood swings between extreme sadness and elation. |

According to the report by Panchal et al. (2021), the Kaiser Family Foundation discovered through a health-tracking poll in July 2020 that the pandemic damaged adults' mental health and well-being. Of all respondents, 36% had sleeping issues, 32% had decreasing appetite, 12% were involved in increased use of intoxicating substances, and another 12% testified deteriorating chronic illnesses. As the pandemic worsens, ongoing and mandatory efforts by the government to keep the virus under control have also exposed the citizens to situations associated with deprived mental health, such as being socially isolated and losing their source of income. This condition may lead to the findings of Al Dhaheri et al. (2021), who reported that although quarantine has been effective in containing epidemics, it was not generally preferable. Constraints on movement, separation from family or friends, and limited freedom emerging from this mandate can all contribute to poor psychological effects.

However, adults may have better access and exposure to mental health treatment than children. Furthermore, mental suffering among children may not be easy to notice, notably for those still learning to speak or express their problems clearly. Consequently, it may lead to an unsupportive environment that will hamper a child's healing process or worsen the condition over time. The objectives of this study are as follows:

1. To explore the impact of the COVID-19 pandemic on the mental health of children and parents.
2. To investigate the accessibility and effectiveness of mental health treatment for children.
3. To assess the potential of interactive digital platforms in addressing pandemic-related mental health challenges for children and parents.

Therefore, the author shed light in this paper on the helpfulness of interactive and digital platforms for children and parents suffering from pandemic-related challenges that affect their mental health. The author has designed a child-centred digital application based on insights gleaned from prior literature. The structure of this paper is as follows: First, we delve into the impact of the pandemic on the mental health of children and parents. Next, we explore the accessibility and effectiveness of mental health

treatment for children. Finally, we assess the capacity of interactive digital platforms in alleviating pandemic-related mental health challenges for both children and parents.

## LITERATURE REVIEW

The literature research portion of the paper will primarily investigate how other applications have been implemented. When conducting a literature review, there are four main objectives: surveying the literature, synthesising it, conducting analyses, and presenting the findings. It is essential because the features and functionalities can be provided for the proposed application if done correctly. The literature review highlights the critical need for child-centred digital applications that cater to the unique mental health challenges faced by children and parents during the COVID-19 pandemic. Existing applications primarily designed for adults may not fully address the requirements of these specific user groups. The impact of the pandemic on mental health further accentuates the urgency of accessible and effective digital solutions. The literature underscores the potential of digital platforms in filling the gap in mental health services and supporting children and parents during these challenging times.

There have been increasing efforts to spread awareness among researchers, psychologists, journalists, and organisations on the psychological impact of the pandemic on children and parents. UNICEF (2021) reported that approximately one in every seven teenagers aged between ten and nineteen years old around the world lived with mental illnesses. On top of that, suicide was among the highest five mortality factors within the age group, with about 46,000 deaths. These numbers show that mental health issues among young people should not be taken lightly, especially in this pandemic. The prolonged lockdown, quarantine, and school closure greatly demotivate children, and it hampers their psychological growth and balance.

Furthermore, Liu et al. (2020) mentioned that young people have fewer resources to effectively cope with the sudden shifts in lifestyle and routines caused by the virus outbreak. Existing guidelines recommend that parents discuss and explain the reasons behind the restrictions and situation to their children as accurately as possible. To address the situation, adults play a crucial role in preventing further psychological trauma by explaining the reasoning behind the changes and discussing the children's take on the situation (Dalton et al., 2020). From these reports, it can be deduced that the pandemic also impacts children's mental health. For this reason, parents and guardians or caregivers should be more attentive to children since the impact can lead them to encounter traumatic experiences which will further harm their future. Due to the poor distribution of mental health facilities and counselling centres in our communities, mental health disorders may continue to be pervasive. Even if these centres increase, the pandemic will impede face-to-face treatments due to the standard operating procedure (SOP) and the fear of infection. The condition may also be deteriorated by the lack of awareness, contributing to society's judgemental attitude towards mental illnesses. Consequently, afflicted individuals cannot cure it or share their condition's state, which worsens.

In this circumstance, a digital therapeutics (DTx) platform can assist individuals in maintaining a stable mental state, offering a transformative approach to mental health support. The hypothesis regarding the effectiveness of DTx in mental health was supported by Wang et al. (2018), who emphasised that mobile DTx products have the potential to be valuable tools for monitoring and treating mental illnesses. By providing individuals with accessible and user-friendly applications, DTx apps empower them to

engage actively in their mental health management. These applications not only serve as tools for self-monitoring but also facilitate the work of mental health professionals.

Caplan and Braun (2021) highlighted that DTx apps can seamlessly integrate with traditional face-to-face treatments and office visits, creating a comprehensive and holistic approach to mental health care. Furthermore, they enhance post-session support, ensuring individuals continue their mental health journeys beyond therapy sessions. The significance of DTx is further underscored by Truschel and Tzeses (2021), who predicted that these platforms would play an increasingly important role in the future of psychotherapy. They offer modern self-management alternatives for individuals grappling with mental health conditions, fostering independence and putting the tools for recovery directly in the hands of those who need them.

These advancements provide individualised mental health support and empower individuals to take an active role in their mental well-being. DTx platforms offer the potential to bridge the gaps in mental health care by enhancing accessibility and continuity, thereby revolutionising how mental health services are delivered and experienced. In a rapidly evolving digital landscape, integrating DTx solutions in the mental health care ecosystem is a promising approach to address the unprecedented challenges brought about by the COVID-19 pandemic and beyond.

**Analysis of Existing Mental Health Apps and Their Suitability for Children**

Creating many mental applications is commendable for extending accessibility to the mental health sector. Nevertheless, such applications, primarily developed for adults, have some serious drawbacks that could make them inadmissible concerning child use, as explained in Table 2 below:

**Table 2**

*Drawbacks of Existing Mental Health Apps*

| Drawbacks | Explanation |
|---|---|
| Content and Language Complexity | Many mental health apps incorporate complex terminology and concepts that are challenging for children to grasp. This creates a substantial comprehension barrier (Smith et al., 2022). Language and content designed for adults may not effectively convey therapeutic messages to children (Doe & Johnson, 2021). |
| Lack of Child-Focused Design | Most mental health apps lack a child-centric design, failing to incorporate engaging visuals, interactive features, or gamification essential to captivate and retain the attention of young users (Johnson, 2020). Such design elements are precious for children's mental health applications (Brown & White, 2019). |
| Privacy and Safety Concerns | Ensuring child privacy and safety is paramount in mental health applications for children. These apps often do not sufficiently address young users' unique privacy and security concerns, such as parental controls, adherence to child online safety regulations, and data protection practices (Jones et al., 2021). |

| | |
|---|---|
| Inadequate Customization | Existing apps may not offer the level of customisation required to adapt interventions to children's distinctive developmental stages and needs (Smith et al., 2022). A lack of flexibility in content and therapeutic strategies hampers the ability to cater to the diverse mental health needs of children (Doe & Johnson, 2021). |
| Limited Child-Centric Resources | Mental health apps may rely on resources not tailored to children's developmental stages. This includes therapy techniques, content, and exercises that are more appropriate for adults, thus limiting their effectiveness for children (Brown & White, 2019). |
| Legal and Ethical Concerns | Adult-designed mental health apps may not entirely adhere to legal and ethical requirements concerning children (Smith et al. (2022); Johnson (2020) has argued that these rights must encompass elements such as consent, confidentiality of information, and reporting requirements necessary for ensuring children's well-being. |
| Interactivity and Engagement | Mental health apps' gamification and interactive features are often less engaging for children. The absence of child-friendly elements, such as interactive games, rewards, and age-appropriate challenges, can affect the application's appeal to young users (Jones et al., 2021). |
| Parental Involvement | Many mental health apps encourage self-help, but they may not provide sufficient mechanisms for parental involvement, which is often crucial when addressing children's mental health issues (Doe & Johnson, 2021). |

As a result, the majority of the current mental health applications have been proved unsuitable for children mainly because they do not conform to the unique designs required for the young ones or there do not exist safety, privacy, and customisation features geared towards meeting the particular demands of children's In order to overcome the shortcomings; there is a need for development of digital services that target children which would take into account all the said requirements enabling the vulnerable group have access to requisite mental health support in an efficient, effectual as well as enjoyable manner.

**Reliance on Digital Platforms for Mental Health**

The use of devices, the internet, and mobile applications is expanding and becoming more innovative. It includes the usage of mobile applications for DTx. Different software developments have been designed specifically for people with direct or indirect experience with mental issues such as depression and anxiety. As presented in the literature review, since the understanding of child-centred platforms is limited, this paper aims to identify and design a practical mobile application that is appealing and user-friendly from the psychological perspective of a child-parent. A selection of mental health mobile applications and websites has been chosen, examined, and analysed for this project. According to the findings, many relevant design and content characteristics can be detected and recognised; however, only a few are genuinely child-centred and focus on parent-child mental bonding. It is hypothesised that a child-centred digital platform's design and content characteristics can reduce mental health suffering and maintain well-being while engaging in digital activities.

**Necessity of a Healthy Relationship Between Child and Parent**

A good and healthy relationship between parents and children is one of the most cherished relationships in this world. Good parenting of a child makes him a good person and assures a better future for that

family. A strong bond is necessary, not only in this challenging pandemic but also in regular life. A renowned psychologist, Bowlby (2003) elaborated in his book 'A Secure Base' how male and female labour committed to the production of material commodities was perceived as a positive indicator in all of our economies, whereby dedication to happy, healthy, and self-sufficient children in their own homes was considered irrelevant in a fast-turning world.

Parents who balance their needs, careers, and parenthood without external resources find quarantine very stressful. In these situations, they are prone to distress, which can later impede their performance in providing and supporting their children as caregivers. Regarding this issue, Spinelli et al. (2020) proposed that impacts on the mental health of families must be considered when constructing quarantine regulations, thus preparing and standardising supporting actions for both the long and short term. The lack of assistance may severely worsen youngsters' psychological state.

**The Need for a Child-and-Parent-Centred Platform**

Utilising mobile applications is a component of digital life, which can promote mental resilience. According to Chan et al. (2015), mobile phones have become an ordinary and universal tool; they have already been used for psychiatric treatments among patients, including chronic sufferers. The applications eased access to a wide range of psychiatric-related assistance; they can track their symptoms, monitor their condition, manage themselves, and attend therapy sessions, most without obligatory and frequent visits to health care providers, due to their adaptability as a digital platform. In the context of this paper, digital platform refers to mobile applications used to treat medical conditions. This application category intends to provide evidence-based therapy treatments to patients using high-quality software programs to prevent, manage, or treat medical ailments or diseases.

According to Netscribe (2021), there have traditionally been only two primary options for treating mental health and behavioural illnesses: medicine and psychotherapy or behavioural therapies. With the emergence of DTx, doctors now have a third alternative: inducing patient behavioural changes through digital health equipment, software, and applications. Vara (2021) supported this idea by stating that digital health tools can provide mental and behavioural health support, particularly during pandemics such as COVID-19, and detect future problems. Besides mobile applications, websites were also used as a DTx platform for treating mental health. However, as mentioned earlier in the literature review, there is a lack of platforms for children to consult with therapists or psychologists even though they are also negatively impacted by the pandemic in terms of their mental. Also, due to the stress of quarantine and lockdown, increasing numbers of familial issues heavily affected children as well. Moreover, the COVID-19 condition has complicated the process of going to the clinic for treatments. Thus, a digital platform developed wholly based on children's perspectives and parents' needs can help children address their mental health issues while strengthening the bonding between their family members.

The critical need for Dtx applications that cater to the unique mental health challenges faced by children and parents during the COVID-19 pandemic can also be further elaborated as follows:

1. Child-Centred Approach: Children have distinct emotional and developmental needs that necessitate a specialised approach to mental health support. The pandemic's disruptions, including school closures, social isolation, and uncertainties, have affected children's emotional well-being (Sprang & Silman, 2013). Child-centred digital applications are essential in addressing these unique challenges.

2. Early Intervention and Prevention: Child-based apps offer a window for early prevention and intervention in mental health issues. Kleinman et al. (2020) argue that such apps could offer personalised resources and activities that would assist in developing emotional resilience, coping-with-life skills, and emotional literacy among children. The proactive approach helps reduce the chances of facing serious problems related to mental health later.

3. Accessibility and Engagement: Digital applications are highly accessible to children, making it easier for them to seek help and support. Child-centric design, featuring interactive games, child-friendly visuals, and simplified language, enhances engagement and ensures children are more likely to participate in mental health activities (Coker, 2021).

4. Parental Involvement: Child-oriented applications admit that parents are critical for any child's psychological well-being. Most of these applications come equipped with functionalities that enable parents to track their child's progress, converse with psychological counsellors, or participate in therapeutic sessions and self-help pursuits (Jones & Smith, 2019).

5. Privacy and Safety: Children are a particularly vulnerable demographic, and child-centred apps are designed with their safety and privacy in mind. These applications adhere to strict regulations regarding child data protection and online safety. They often incorporate parental controls, ensuring that children can safely access resources and support (Doe et al., 2020).

6. Developmental Stages: Child-centred applications consider children's diverse developmental stages. They offer content and activities suitable for specific age groups, ensuring that support aligns with a child's cognitive and emotional development (Brown et al., 2018).

7. Tailored Therapeutic Techniques: These applications have therapeutic techniques tailored to children's needs. Whether it is storytelling, play therapy, or art-based interventions, child-centred apps offer a range of strategies that resonate with young users (Kaiser et al., 2021).

8. Crisis Support: Child-centred apps can provide immediate crisis support, addressing issues such as anxiety, depression, or exposure to domestic conflict. The pandemic has increased the prevalence of these problems, making timely assistance crucial (Merkel et al., 2021).

Therefore, digital child-centred applications are crucial in meeting the unique mental health needs of children and parents during the COVID-19 pandemic. These applications have several advantages, such as early interventions, age-appropriate content, parent involvement, and improved safety and privacy policies. They focus on providing specialised support and resources for children to cushion the psychological effects generated by the pandemic in the minds of the little ones and ultimately enhance a general feeling of self-worth among them.

# METHODOLOGY

The methodology used in this research involved the user-centred approach for the design process and the User Acceptance Test (UAT) for the evaluation process. The approach was chosen to ensure that the final product application would be a good one addressing children's and parents' specific psychological problems related to the COVID-19 pandemic lockdown times. User and expert inputs are integrated into a methodology for developing an all-inclusive and intuitional mobile application designed to meet the heterogeneous requirements of the target population. Here are the details of the procedure and the thoughts that led to the creation, testing, and development of this 'Calm & Care' prototype.

**The Design Process**

The design of the mobile app for child and parent-centred digital mental health applications followed a user-centred design approach, placing children and parents at the core of the design process. This approach involves several critical steps, as explained in Table 3 as follow:

**Table 3**

*Critical Steps for User-Centred Design Approach*

| Key Steps | Explanation |
|---|---|
| Needs Assessment and User Research | • Engaged with child and parent focus groups and mental health professionals to understand the target users' specific needs, preferences, and challenges during the COVID-19 pandemic.<br>• Conducted surveys and interviews to gather insights on user expectations, including their visual preferences, interactivity, and content requirements. |
| Child-Centric Visuals | • Recognized that children are highly visual and engaged users. Therefore, the app's design incorporated vibrant and child-friendly colours to create an inviting and cheerful atmosphere. Visual elements were carefully selected to be age-appropriate and relatable.<br>• We utilised playful and engaging illustrations, graphics, and animations to capture children's attention and foster a sense of enjoyment and involvement. |
| User-Friendly Interface | • Designed an easy-to-navigate and intuitive user interface. For instance, the app interface had a minimalist design to guide children and parents through pages to access the required resources.<br>• We implemented large, easily clickable buttons and interactive elements, recognising that children may not have the same dexterity as adults. |

| | |
|---|---|
| Age-Appropriate Content | • Collaborated with child psychologists and experts to create content that resonates with children. The content was tailored to different developmental stages, ensuring it was not too advanced or overly simplistic.<br>• Developed engaging storytelling elements, games, and interactive educational and fun exercises. |
| Child-Centred Interactivity | • The app recognized the importance of interactivity in keeping children engaged. It integrated gamification elements, rewards, and achievements to motivate children to participate actively in therapy or self-help activities.<br>• Encouraged children to express themselves through interactive tools like drawing or voice recording. |
| Privacy and Safety Features | • Implemented stringent privacy and safety features to protect children and their data. This included robust data encryption, parental controls, and child online safety regulations compliance.<br>• Prioritized user consent and data protection, reinforcing trust in the app's safety. |
| Parental Involvement | • Recognized the crucial role of parents in a child's mental health journey. The app allowed for parental involvement and monitoring.<br>• Developed a Parent Dashboard that enables parents to monitor their children's progress, liaise with mental health professionals, and participate in their children's therapy sessions. |
| Iterative Design and Usability Testing | • The design process was iterative, involving multiple design and usability testing rounds. After creating initial design concepts, user feedback was gathered through testing sessions.<br>• Based on this feedback, the design was refined to align with user expectations and preferences. |
| User Feedback and Improvements | • We continued to gather user feedback during the pilot testing phase, assessing how well the design elements resonated with the users and whether any further adjustments were needed.<br>• Based on this feedback, we made ongoing improvements to the app design, ensuring that it was tailored to the evolving needs and preferences of children and parents. |

Essentially, the development of a mobile platform for child—and parent-centred digital mental health programs embraced an all-inclusive approach centred on empathy, research, and endless user engagement. This was done to create a conducive environment where both children could express themselves effectively and confidently without any fears.

**The Evaluation Process**

This study's purpose was to understand better the parent-child relationship and interaction as well as their experiences with digital mental health platforms. Ten family volunteers from Dhaka, Bangladesh, with their children from 4 to 10 years old, participated in this study. All participants had a similar level of digital knowledge and exposure. Some of them had faced financial issues and other chaos during the pandemic. Some parent users stated that they have seen behavioural changes in their children during

the pandemic. The authors collected primary data using a mixed-methods strategy that included online interviews and face-to-face observation. The interview was conducted casually and structured to ascertain and communicate their requirements. Hence, the interview questions for this study were derived from carefully considering the research objectives, the demographic characteristics of the participants, and the nature of the data to be collected. Table 4 explains the steps for formulating the interview questions.

**Table 4**

*Steps to Formulate the Interview Questions*

| Steps | Information Provided |
|---|---|
| Identify the Research Objectives | The primary research objective is to understand better the parent-child relationship and interaction, as well as their experiences with digital mental health platforms. |
| Demographic Characteristics of Participants | • The participants are ten family volunteers from Dhaka, Bangladesh.<br>• The children's age range is from 4 to 10 years old.<br>• All participants have a similar level of digital knowledge and exposure.<br>• Some participants have faced financial issues and other chaos during the pandemic.<br>• Some parents have noticed behavioural changes in their children during the pandemic. |
| Data Collection Methods | • The authors collected primary data using a mixed-methods strategy, which included online interviews and face-to-face observation.<br>• The interviews were conducted casually and structured to ascertain and communicate the participants' requirements. |

Based on the above information, the interview questions were formulated to address the following key areas:

1. Parent-Child Relationship and Interaction: The questions were designed to probe the dynamics of the parent-child relationship, understand how they interact, and assess how this interaction has been impacted during the COVID-19 pandemic.
2. Experiences with Digital Mental Health Platforms: Questions aimed to gather insights into the participants' experiences with digital mental health platforms. This involved asking about their usage, preferences, and challenges encountered.
3. Demographic and Situational Factors: Questions inquired about the participants' demographic characteristics, such as age, family structure, and children's ages. Financial and pandemic-related challenges were explored to understand their impact on the parent-child relationship.
4. Behavioural Changes in Children: Specific questions were tailored to address the observations of behavioural changes in children during the pandemic. This could include asking parents to describe these changes and their perceived causes.
5. Digital Knowledge and Exposure: Questions were framed to assess the participants' level of digital knowledge and exposure, as these factors can influence their experiences with digital mental health platforms.

6. Data Collection Methods: Given that online interviews and face-to-face observations were used, questions were developed to understand the participants' comfort and experiences with these data collection methods.

The interview questions were meticulously designed to align with the research objectives, participant characteristics, and data collection methods. They aimed to gain comprehensive insights into the parent-child relationship, digital mental health experiences, and the unique challenges encountered during the COVID-19 pandemic. Among the questions were the following:

1. During the COVID-19 pandemic, what is the efficacy of mental health applications in reducing anxiety and depression symptoms in children and adolescents?
2. How do parents perceive the usability and acceptability of mental health apps as a management aid for their child's mental health during the pandemic?
3. What are the most effective mental health app features and interventions for addressing pandemic-related stress and mental health problems in children and adolescents?
4. How do the prevalence and duration of mental health app usage by parents and children correlate with mental health outcomes during the pandemic?
5. To what extent do cultural and socioeconomic factors influence parents' and children's access to and utilisation of mental health applications during the pandemic?
6. In terms of treating child and adolescent mental health issues during the pandemic, how do mental health applications compare to traditional therapeutic interventions (such as in-person therapy or counselling)?
7. How can these concerns be addressed to ensure the well-being of young app users during the pandemic?
8. What are the long-term effects of using applications for mental health on the mental health outcomes and resilience of children and adolescents beyond the pandemic?
9. How can applications for mental health be integrated into existing healthcare systems to provide comprehensive and coordinated care for children and adolescents with mental health issues during the pandemic?
10. As part of a comprehensive approach to addressing child and adolescent mental health during the pandemic, what strategies can be employed to increase awareness and adoption of mental health applications among parents and healthcare professionals?

During the ongoing COVID-19 pandemic, these research questions can guide studies and investigations into the efficacy and impact of mental health apps on child and adolescent mental health issues. After completing the basic design, the User Acceptance Test (UAT) was administered, and participants were asked to provide feedback during the test. It began with (1) inviting the anticipated guests for testing, (2) allowing them to navigate the system, (3) asking them questions and explaining the flow, (4) requesting that they use the features, and (5) calculating the time required for each activity, before (6) concluding the test and (7) gathering feedback. The prototype was revised in response to the feedback, resulting in a high-fidelity prototype. The final prototype underwent a second user acceptance testing (UAT) round.

**The Analysis of User Acceptance Test (UAT)**

The User Acceptance Test (UAT) result was analysed through a structured process involving the following steps:

1. Inviting Participants for Testing: The first step was identifying and inviting anticipated prototype users. These participants were selected to represent the target user group.
2. Navigation and Exploration: During the UAT, participants were allowed to navigate the system freely. They explored the prototype and interacted with its features to gain hands-on experience.
3. Questioning and Explanation: While participants interacted with the prototype, they were asked questions to gather insights into their understanding of its flow and features. This step aimed to assess how intuitive and user-friendly the prototype was.
4. Feature Usage and Time Measurement: Participants were asked to use the various features of the prototype. The time required for each activity was calculated, which helped us understand how efficiently users could perform tasks within the prototype.
5. Test Conclusion: The UAT session was concluded after participants had the opportunity to explore and interact with the prototype thoroughly.
6. Gathering Feedback: Participants were asked to provide feedback on their experiences after the UAT session. This feedback could include comments on usability, design, functionality, and any challenges or issues encountered during the test.
7. Prototype Revision: The prototype was revised based on the feedback received. This involved making necessary improvements and refinements to address the issues and concerns raised by the participants. The objective was to enhance the application's usability and user satisfaction.

The revised prototype, which included changes based on participants' feedback from the initial User Acceptance Testing (UAT) round, was transformed into a high-fidelity version. Subsequently, this enhanced prototype underwent a second round of UAT to evaluate usability and user satisfaction. The insights from the second UAT round informed additional refinements and improvements made to the application before its implementation.

To elaborate, the UAT analysis involved observing user interactions, measuring task completion times, collecting participant feedback, and utilising this information to enhance design and functionality. This iterative approach ensured that user input was incorporated effectively to create a more user-friendly and efficient final product.

**Physical Design of Proposed Software System**

Figure 1 illustrates the app's navigation flow to the parent user. The parent must sign in or create a new account and create the account on behalf of the child. After registering, existing users can sign in using a password or fingerprint. Then, the user will be directed to the landing page and view available features, including the profile, a list of available counsellors, a history of the appointment sessions, a helpline, settings, and notifications.

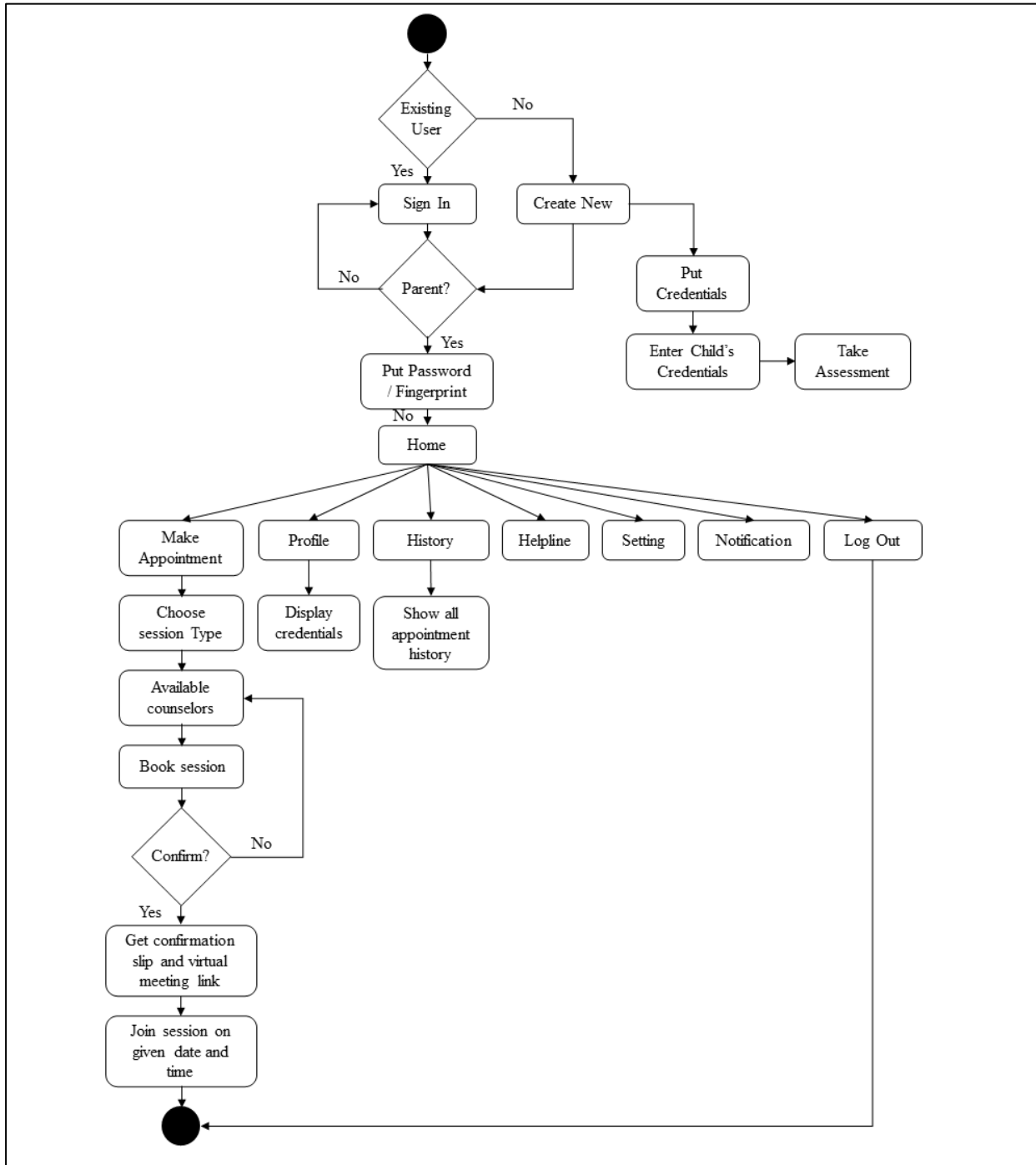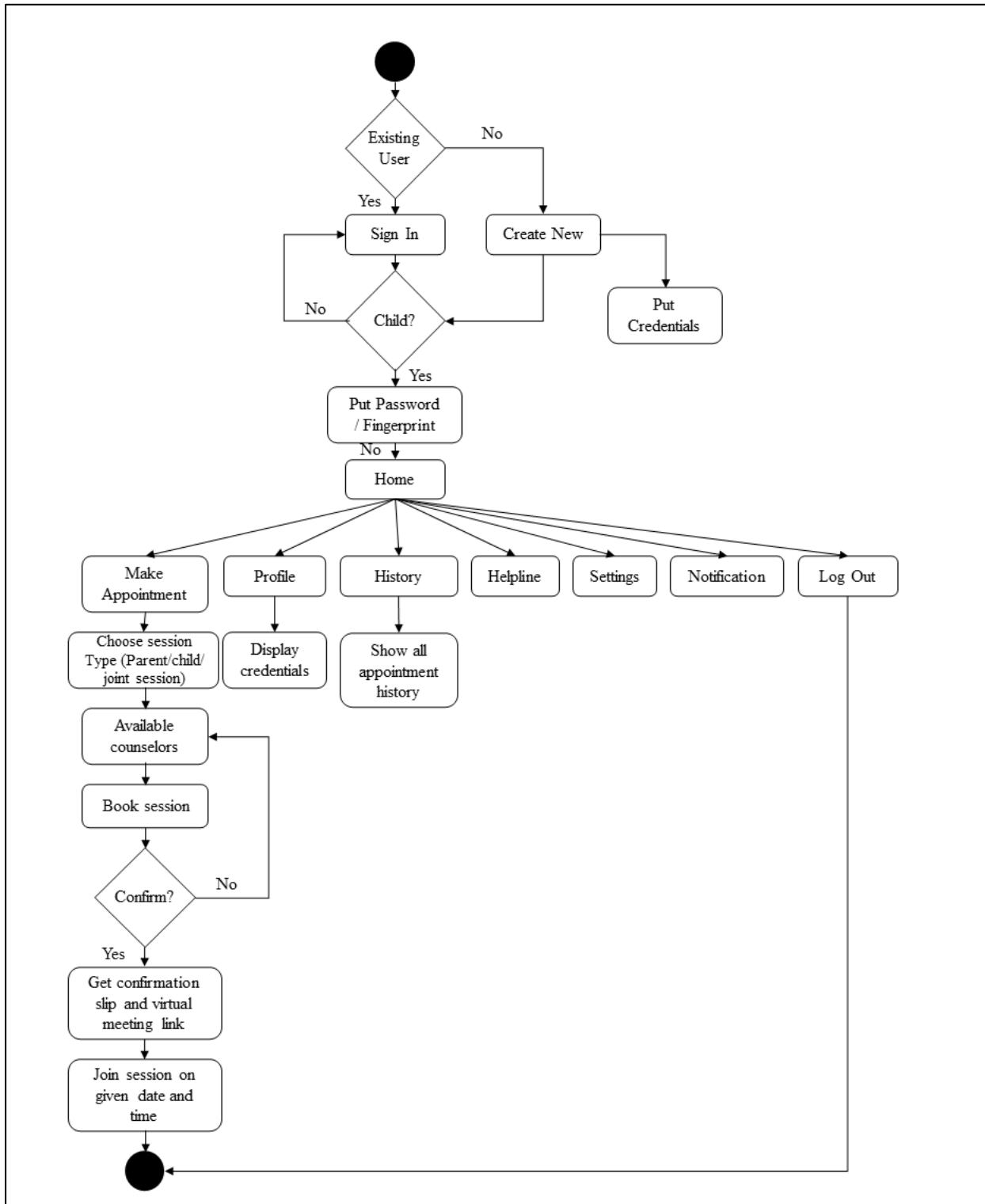**Figure 1**

*Parent User Activity Diagram*



Figure 2 illustrates the app's navigation flow for the child user. Similar to an adult user, existing users can sign in by password or fingerprint after completing registration. Then, the user will be directed to a landing page with the same features as in the adult version. The child can use this app with the help of a parent.

**Figure 2**

*Child User Activity Diagram*



**User Interface and Interaction Design**

Figure 3 (a) displays the user's User Interface (UI) and User Experience (UX) when accessing the 'Calm & Care' application's home page. The whole application was designed with child-friendly colours and

illustrations. Figure 3 (b) shows the assessment page for a parent to take the assessment regarding the child. The elaborative answers on this page will be visible to the counsellors so they can have a brief idea about the patient's mental state when conducting any session.

**Figure 3**

*(a) Calm & Care's Homepage    (b) Calm & Care's Assessment Page*



As seen in Figure 4 (a) below, the user has to choose the type of session they need on the booking appointment page. A child or parent can attend the session individually or join it together. Meanwhile, Figure 4 (b) shows the available counsellors' page customised according to the patient's mental condition. User can book their preferred counsellors based on their needs and convenience in time.

**Figure 4**

*(a) Calm & Care's Available Counsellors Page  (b) Calm & Care's Book Sessions Page*
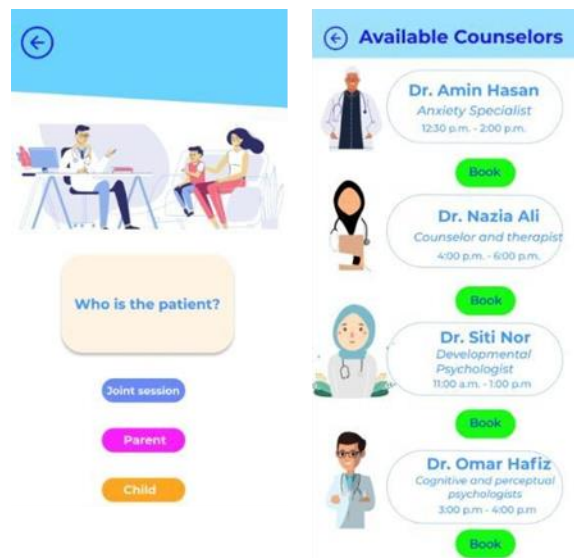
## EVALUATION AND RESULTS

After the initial User Acceptance Testing (UAT), participants suggested minor improvements, including colour choices and font size adjustments. Following these recommendations, the prototype was upgraded for the final UAT. During this phase, the author received overwhelmingly positive feedback from parents and their children. The children displayed excitement and a keen interest in using the application. 90% of the children found the application highly engaging, with 85% expressing willingness to continue using it. Moreover, 95% of the older parents reported that the application's user interface was intuitive and easy to navigate, greatly assisting them in caring for their young ones.

In addition, children born in the digital era quickly grasp how to use the application. They were particularly impressed by the images accompanying various features and pages, which aided their understanding of buttons and pages, even when they did not fully comprehend the text. The generous use of white space and the large button size further contributed to the children's development of fine motor skills, enabling them to interact with the interface accurately. As a result, the 'Calm & Care' prototype was deemed a success and is recommended for broader implementation among private and public healthcare providers to connect, support, and serve local communities. 'Calm & Care' can increase mental health awareness, improve treatment access, and facilitate healing, all while minimising the risk of COVID-19 transmission through physical appointments. Furthermore, this platform may have a positive economic impact by reducing the time and cost associated with families' travel to receive regular treatment. Improved mental stability among treated families may also enhance their contributions to society through occupations. A better psychological state often correlates with better physical health, potentially reducing clinic or hospital admissions. In sum, 'Calm & Care' holds substantial promise and stands to benefit both healthcare providers and local families.

## CONCLUSION

In this paper, the development of child and parent-centred digital mental health applications, with a focus on addressing the unique challenges posed by the COVID-19 pandemic, has been discussed. A user-centred design approach was adopted, incorporating vibrant and child-centric visuals, age-appropriate content, an intuitive interface, and stringent privacy measures. The methodology encompassed a needs assessment, extensive user research, content creation, and iterative testing, ensuring the application aligned with children's and parents' diverse needs and preferences. User feedback collected through User Acceptance Testing (UAT) was instrumental in refining the application, resulting in a high-fidelity prototype. The importance of digital therapeutics (DTx) in addressing mental health challenges during the pandemic was emphasised, concerning studies by Wang et al. (2018), Caplan and Braun (2021), and Truschel and Tzeses (2021). These findings hold significant implications, as the user-centred design approach ensures that the mobile application offers a welcoming, engaging, and safe environment for children and parents, promoting their mental health during the pandemic. In addition, the methodology prioritises the specific needs of the target users, creating a tailored application that addresses their unique challenges and experiences.

However, it is essential to consider certain limitations. For instance, this study focused on families from Dhaka, Bangladesh, which may restrict the applicability of its findings to other cultural and geographical settings. Additionally, the paper does not provide specific data or statistics regarding the

effectiveness of the prototype. This calls for further research and evaluation. Consequently, future endeavours could expand the prototype's scope to accommodate a more diverse range of cultural backgrounds and age groups, thus enhancing its outreach and impact. Moreover, conducting extensive research to gather data on how this prototype affects mental health outcomes among children and parents would also be beneficial.

In conclusion, this paper highlights the development of a child—and parent-centred digital mental health application that addresses the challenges posed by the COVID-19 pandemic. The user-centred design approach and methodology, backed by UAT feedback, have resulted in an application tailored to the specific needs and preferences of its users. Although there are limitations, the significance of these findings lies in their potential to provide effective mental health support during challenging times. Subsequent research could expand the reach and impact of such applications.

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