



Microlearning-Supported Telehealth Approach for Addressing Developmental Disorders in Children: Challenges and Opportunities in Pakistan

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Abstract

The aim of this paper is to explore the potential of microlearning-supported telerehabilitation as an effective means of building the capacity of caregivers of developmentally disabled children in Pakistan. Due to the global spread of the COVID-19 pandemic, telehealth has become a vital tool for delivering healthcare services remotely. However, in many developing countries, such as Pakistan, the lack of high-speed internet and infrastructure presents significant challenges for the implementation of telehealth. To address this issue, we developed "Sehat Agahi", a telehealth platform that provides asynchronous interactions between therapists and caregivers in Pakistan. Our approach utilizes microlearning, focusing on teaching the most relevant skills tailored to the needs of the child-patients and the capacity of the caregivers. Bite-sized lessons are delivered in a flexible learning style, ensuring maximum engagement and retention of knowledge. We adopted a participatory action research methodology, which involved members of the marginalized community to understand the barriers and knowledge gaps in learning. To illustrate the potential of our approach, we present several hypothetical cases based on observations made during the participatory research.

Keywords: Microlearning; Telerehabilitation; Participatory Action research; Caregivers; Developmental disability

Introduction

The COVID-19 pandemic has led to a global increase in the use of telehealth services for pediatric health care, especially for Development Disorder (DD) patients [1]. However, this has also intensified inequalities, particularly in Low- and Middle-Income Countries (LMICs) with poor infrastructure, as parents without access to the necessary technology or internet connectivity are at a greater risk of losing therapeutic services for their children. Telehealth, especially, is difficult to implement in such contexts, as language barriers and lower education levels prove to be a hurdle [2]. This results in parents having to take on greater responsibility for their child's daily educational and therapeutic plans [3], leading to increased anxiety and depression among caregivers of children with DD in Pakistan [4].

Around 1.8 million children in Pakistan suffer from some form of developmental disorder, [5]. These children need support in the form of various therapies to attain developmental milestones and fight challenges associated with the disorder. This support is

traditionally provided in special schools, as well as special centers and hospitals, where physiotherapy, occupational, behavioral, or speech experts offer therapies and support services [3].

Pakistan has a population of 220 million; with almost 70% reside in rural areas. The country has a weak healthcare system and related infrastructural facilities are poor [6,7]. Implementing resource-intensive programs is difficult for countries like Pakistan [8]. Around 15% of children in Pakistan suffer from DD, but there are no policies or reforms at the government level to support these children [3]. The rehabilitation centers are mainly concentrated in urban settings, and many rural areas suffer a shortage of resources to build new units or care facilities [6]. With inadequate service centers and support, the child is usually cared for by parents at home [3,6].

WHO recommends that such caregivers can and should be specifically supported so that they can enhance their existing competencies as well as learn new skills to handle challenges

associated with home-based therapy [9]. Literature shows that such interventions and programs can be effective in helping parents care for children with behavioral difficulties, communication problems, challenging attitudes and overall developmental disabilities [10]. The caregivers require skills and knowledge needed to help the children at home [9]. These skills could aid in getting better child developmental outcomes when they are getting therapy within their family context. Research suggests that supporting parents to learn therapy is a pragmatic and important step [10]. Traditionally, caregivers learn the skills by interacting with therapists at therapy centers. The learning unfolds during in-person services that occur during therapy sessions [11].

However, the caregivers face many hurdles in their learning. Most of the caregivers belong to low socioeconomic segments of society. They have poor educational backgrounds and health literacy [3] making learning challenging for them. They face many problems such as costly travel, cultural problems, associated stigma, complex family structures, and poor economics, which push regular education out of reach for them [6]. Also, privacy issues, low doctor to patient ratio [7] and challenging behavior of the child all add to hindrances in knowledge transfer and learning during in person interactions [12]. With health emergencies like COVID-19, socioeconomic, geographical and cultural widened the access to care.

The service delivery mode in telerehabilitation makes it difficult for these caregivers to perform the instruction/exercises of the therapist with the child-patient. Also, other learning barriers over the internet prevail, like additional role taking, competing homework priorities and fear of losing child's progress. However, the caregiver's familiarity with modern technology and access to smart phones [3,6,13] is an opportunity. The microlearning supported telerehabilitation web app can be a promising avenue for these children and their caregivers. Microlearning can help to support lifelong learning in changing technological and socioeconomic conditions (Mohammed et al., 2018), especially those arising after the global COVID-19 Pandemic. This paper aims to develop and understand the use of appropriate telerehabilitation using microlearning for the capacity building of caregivers of developmentally disabled children in Pakistan.

Literature regards microlearning as 'pragmatic innovation' [14] As compared to traditional learning that takes place during in service interactions, microlearning has more benefits as it aids in managing individual caregiver's learning capacity, helps in controlling the speed of knowledge absorption and retention [15] leading to improved learners' ability [16] and more motivated learning [17]. Microlearning's link to e-learning, along with the use of microcontent helps in improving caregivers' motivation to learn [15]. Conforming to the learners' profile in informal lifelong training, microlearning based telehealth for caregivers, presents itself as a suitable solution.

Since microlearning seems to be an attractive solution, we

decided to develop a telehealth tool for imparting microcontent-based learning to the caregiver. We developed an app called "Sehat Agahi", meaning "Health Awareness", using Participatory Action Research (PAR). This study was conducted in a government run setup in Karachi. The app was developed and later trialed on a sample of caregivers visiting the setup. Our evaluation shows the suitability of microlearning in helping skill development in the caregivers. This paper describes the lessons learned from the development and trials of this microlearning based telehealth app.

The structure of the paper is as follows: The methodology section describes the participants, data collection and data analysis process. The next section describes microcontent and different features of the content. A few hypothetical case examples are also discussed that are observed during the participatory observations to illustrate the potential application of the microlearning design using the web app. The last section reports the findings and discussion related to the study.

Methodology

Participatory action research

We employed participatory action research for the development of microcontent and a web app to support telehealth-based caregivers' learning called Sehat Agahi. Literature suggests using PAR to improve usability of the end product and engagement of different stakeholders. The app was designed to complement service therapy sessions by delivering evidence-based content as a parent-focused intervention at home. Sehat Agahi is aimed at caregivers' capacity building, which can eventually help in overcoming health disparities in Pakistan.

PAR is a framework that is based on three principals at its core. These include reflection, data collection and action [18]. In PAR, action is taken in an iterative cycle whereby all stakeholders take part in data collection, and reflection and then take action to improve their experiences. The action results are studied to complete the cycle [18]. PAR creates an equal partnership between all the stakeholders to co-design a sustainable solution relevant to the socioeconomic needs of the participants [19].

Any intervention must be provided in a family context ensuring that it is frequent and administered throughout the daily routine [20], making parent participation in the study imperative. Community participation to strengthen skill-based learning and increasing the learning capacity of caregivers is significant [21]. This would allow them to play a direct and active role in the design and development of a resource that is culturally sensitive [22]. Most parents and children with special needs in LMICs are part of the marginalized and less privileged community [23]. Without their involvement, the design decisions can create intervention-generated inequalities [24].

Participatory research establishes open communication and relationships with the development team, making the telehealth solution scalable and sustainable [21,25,26]. Training-based innovative ways would help empower the locally affected

communities to identify their problems associated with childcare [20] and in turn take actions to overcome the health inequities [27]. Hence, helping them improve their own circumstances and children’s health outcomes [19].

Participants of the study

As outlined in the PAR methodology, collaborative partnerships were formed between key stakeholders (i.e., participants), including parents of children with CP and delayed milestones,

health professionals, and researchers. Parents, who have been visiting the center for more than a year, were invited to provide knowledge and feedback regarding post-diagnostic support. Most of the caregivers were mothers (n=12), and there were a few (n=3) fathers as well. Table 1 describes the caregiver’s detail. A total of 7 senior health professionals in the occupational therapy field belonging to the same rehabilitation facility were requested to participate in an advisory group for the development of this resource. Of these health professionals, all 7 agreed to participate.

Table 1: Caregivers’ detail.

Sr#	Caregiver Gender	Caregiver Age	Child’s Age	Child’s Diagnosis	Current Residence	Frequency of Visiting	Language	Barrier
1	F	20-25	2.5	CP	Karachi	Irregular	Sindhi	Belief in spiritual healing
2	F	>30	5	CP	Karachi	Very regular	Urdu	none
3	F	20-25	1.5	CP	Karachi	Regular	Urdu	none
4	M	>30	6	CP	Karachi	Very regular	Urdu	none
5	F	>30	11	CP	Karachi	Irregular	Urdu /Balochi -area Liyari	Diagnosed at the age of 7- (late diagnosis) Illiteracy
6	M	>30	2	CP- hemiplegic	Quetta	irregular	Persian	travel to Karachi frequently (First time visit) Language barrier
7	F	35-40	8	CP- hemiplegic	Karachi	Very regular	Urdu /Balochi	Extreme poor socio-economic conditions
8	F	<20	12	CP	Karachi	regular	Urdu	Complex family structure
9	F	<20	<10 months	Delayed Milestone	Larkana	irregular	Sindhi	Travelling Language Training required to use smart phone
10	F	>35	4	CP	Karachi- Li-yari	Very regular	Memoni /Urdu	Gender discrimination – need for permission
11	F	20-25	<1	Microcephalic	Karachi	regular	Urdu /Balochi	none
12	F	>35	3.5	CP-Spastic	Karachi	Very regular	Urdu	none
13	M	>35	5	Spina-bifida	Karachi	Very regular	Urdu	Gender discrimination – believed wife is incompetent
14	F	22-25	<1	Delayed Milestone	Karachi	Very regular	Urdu	none
15	F	>35	7	CP	Karachi	irregular	Urdu	none

This pilot study was conducted in regular therapy interactions between caregivers and occupational therapists in a government-run rehabilitation center in Karachi. PAR was considered a rational choice for this study because the target population of caregivers belonged to a marginalized community. Most of the children visiting the facility belonged to low-income households from the nearby areas with poor living standards like Kharadar, Ram swami, Lyari, or Malir Khokarapar and from the rural part of Karachi city also. The setup is also visited from other cities and rural areas of Sind and Baluchistan provinces. We used Participatory Action Research (PAR) to plan and design the microcontent and use of technology to support telehealth because the participation of

the target population (caregivers belonging to a marginalized community) was necessary.

The study started with an understanding of the barriers to in-person therapy. For this, we conducted at least fifty participatory observations with patients and their caregivers. This led us to understand the caregiver’s profile as a learner, problems associated with in-person learning, and the designing of microcontent that can help in skill development and associated barriers to informal learning. Also, the use of PAR helped in the development and evaluation of the web app for telehealth purposes. To demonstrate the flexibility needed for effective engagement, PAR employs a

range of quantitative and qualitative data collection methods including surveys, participatory observation, semi-structured interviews, and focus groups.

Phases of PAR

Phase 1: Planning

The first phase was conducted between July 2020 – March 2021. Initial participatory observation and semi-structured interviews were held with the caregivers of children with CP

(12 mothers and 3 fathers). All the participants signed a consent form. The research and development team included 3 members. A few of the observations were also video recorded to understand techniques adopted by the therapist to promote caregiver learning, barriers associated with in the learning process, how the therapy is administered, shortening the length of the therapy to extract important pointers, planning multiple short burst of videos related to a milestone of the patient and preparing the microcontent items with the therapists during a therapy.

Table 2: Learning and knowledge transfer barriers and use of telehealth and microlearning.

Learner’s Profile	Barriers to in Person Learning	Quotes	Microlearning based Telehealth
Stress/ challenging behavior of the child-patient	Too much knowledge together to absorb and retain	The moment my son enters the center, he starts crying, learning is difficult for me while his therapy is underway (Caregiver A.R.).	Avoids cognitive overload
Low education/ poor health literacy	Complex nature of knowledge	Most of my patients, they are from nearby villages in interior Sind, for them learning and remembering 4-5 activities during face to face therapy is difficult (Therapist, F4).	Bite size chunk with multiple time viewing
Multilingual/ Cultural	Language /comprehension issues	This couple is visiting from Quetta, with both the parents not knowing Urdu. These recorded videos will help them comprehend as they view again (Therapist, F1).	Microcontent using videos, audios, text based instructions
Dynamic conditions	Travelling issues, no frequent meet ups with the therapists	It was important to have a mechanism to keep these therapists aware of the child-patient conditions at home (Therapist, M1).	Regular basis memorable learning
Overwhelming responsibilities	Complex family structures/ Stigma	With a family of eight brothers and sister, my mom cannot come every time for exercise, we sister accompany Q.M. (Caregiver Q.M.)	Fast Learning/ with multiple caregiver access
Poor socio-economic conditions	One smart phone/ accessibility issue-	I can only access phone once my husband returns (Caregiver A.M.) Most of my clients donot carry smart-phone, as they usually have one phone/ family (Therapist, F5)	eLearning/tech basis Any time

Two therapists took part in an individual, audio-recorded, semi structured interview conducted face to face in the facility to understand knowledge transfer barriers and how microlearning can mitigate these barriers to enhance caregiver learning. Using a narrative style of qualitative interviews, these therapists were asked to describe a reflective experience related to our study aim.

Phase 2: Design and testing

The phase started in January 2021. There were multiple iterations until we developed a high-fidelity product in August 2021. A demo and a design workshop were conducted in phase 2, in February 2021. Later, a detailed discussion regarding the design and functionality was conducted with the head of the occupational department. Another Focus group was conducted in June 2021 with all the therapists. Data was also collected through

surveys from the therapists separately. These interactions helped in the design of the required microlearning features, to mitigate the barriers in traditional learning. A total of 23 participants engaged in Phase 2, which consisted of caregivers (n=13), health professionals (n=7, occupational therapists), and researchers (n=3), with the majority being female.

Phase 3: Training and observation

The training and observation period was between August 2021 – October 2021. At the time of the start of this phase, the facility was completely closed due to COVID-19 restrictions, therefore group meetings with health professionals and researchers (3 researchers, 7 occupational therapists) were conducted online. An online training session was also held with the therapists.

Once the facility became fully functional after the pandemic in September 2021, a total of 13 caregivers were trained to use the app during their regular therapy sessions. In this way, the therapists also actively participated in designing the new learning mechanism. Amongst the caregivers, a few mothers were hesitant to get training, therefore fathers were trained instead, who were usually present in the waiting area. A total of 23 participants were involved in Phase 3.

Phase 4: Evaluation

The evaluations were carried out between October 2021 – November 2021. Semi structured interviews were conducted with two therapists individually, and 1 focus group was conducted with the other 5 therapists. The 13 caregivers that participated in the training sessions were interviewed regarding different aspects of learning and the use of web apps. Three of the interviews were audio recorded.

Field notes were collected from the phases of planning, design and testing. Data were collected from the initial wireframe-based demo, design workshops, and one on one interviews, lastly findings from the focus group added to the evolution of the final prototype of the learning app. Suggestions were gathered from both the caregivers and the therapists to improve the microcontent items and “Sehat Agahi” web app portal. Screenshots from the logs and error reports were used to improve the items and the web app. Weekly reports and notes from the Jira development board helped to keep track of development tickets, bugs, releases and future plans.

Data analysis

The identification details were removed from the field notes, interviews and focus group data. The collected data were then analyzed using thematic analysis. After data familiarization, the corpus was re-read to identify preliminary codes. We then grouped codes into relevant sub-themes. Table 2 describes the data analysis process in detail. The thematic analysis [28] helped us understand 1) the challenges associated with the current in-person communications 2) how to design microcontent that can be plugged in to overcome in person challenges and help in efficient and effective skill development at home 3) the needs and requirements of the end users for the microlearning based web app development.

Microlearning

This telehealth app facilitates skill development and capacity building of caregivers using therapist provided microcontent. It uses technology as a learning mechanism, along with regular therapy meetings with the therapist, to translate evidence-based content into practice. This low-cost, distance-learning, self-paced solution involves a microlearning based targeted approach. This allows caregivers’ flexible learning at home any time, with

multiple time viewing option to equip with relevant everyday skills with confidence. These skills are related to child’s current milestone attainment goals like neck holding, grabbing things, sitting, standing.

Microlearning assists in individualized lesson planning. This multimedia content consists of vital knowledge as per the needs of the child-patient and caregivers’ learning capacity, leading to better comprehension, retention, and absorption of the knowledge with convenience and flexibility. This allows caregivers to understand knowledge with minimum cognitive load with short burst of knowledge, and later apply the in the dynamic environment. This helps in caregivers’ two level of learning; knowledge transfer effectiveness and absorptive capacity [29] as well as attaining positive outcomes related to child positive development.

The microcontent included important activities of daily life that can help in the attainment of the milestone. Let’s take the example of a video, teaching the caregivers about the attainment of helping the child to stand up using the support of a stool or chair. The next few related videos can help caregivers with the same goal, but with more family-centered interactions with the child, including verbal communication like color recognition, object recognition, and snacking with one hand while standing with support. Also, teaching parents about inculcating positive behaviors by paying attention to non-verbal cues of the child-patient helps to reduce the challenging attitude in the child. All these activities help the caregivers towards family-centered approaches in child caring, support in minimizing stigma associated with the upbringing of these children, and most importantly facilitate the attainment of the goals related to the current milestone.

These 2-3 minutes related videos combine to form a track related to the attainment of a particular milestone. Therapists can create a track as required according to the child’s need and caregivers’ learning level as gauged during a regular therapy session. In a 30 minutes therapeutic session, usually 5-6 easy exercises out of 8-10 exercises are taught to the caregivers for home intervention. In this session at first a collaborative planning with the caregiver takes place, after this discussion the therapist plans a strategy based on the child’s condition and needs. Each week’s track is part of an incremental micro lessons series to be shared every week as child-patient therapies progress. These tracks do not expand to a timeframe of 15 minutes.

The tracks are combinations of items that are stored in a particular format by the therapists to be accessed by all in the database library saved. Tracks are goal focused, based on a single identifiable objective, towards the skill training activity related to the child’s milestone. The purpose of the track is to support the weekly training at the therapy center. The home-based intervention track addresses multiple pointers including educating parents to incorporate the intervention practices into the family’s daily routines, how to communicate and engage

with the child, how to manage the child's challenging behavior, how to make the child inclusive and involved in family activities etc. There were many key elements considered while applying microlearning principles, few are listed below.

Features of microcontent

They are a few important things related to the microcontent items that form a track. These are

1. With the use of participatory research during rehabilitation interactions, with at least fifteen interactions video recorded, this lesson/therapy session is condensed according to the needs of the child-patient and the learning capacity of the caregivers.

2. The occupational therapists helped prepare videos of 2-3 minutes to one goal per video as per the milestone. Each segmented video explains one activity at a time, related to child milestone attainment.

3. All similar videos/multimedia content combine to form a track for the attainment of a milestone goal attainment like standing with support or neck holding.

4. Tracks are a combination of video/items.

5. Voice over the videos explaining the purpose of the activity, what goal attainment is expected, and how it can be used in dynamic conditions and natural environments.

6. Library of videos containing expert-recorded evidence-based knowledge for different milestone attainment. The voice in the videos helps in understanding the purpose of the exercise. This can help caregivers devise their own strategies for their changing conditions every day, leading to two levels of learning.

7. Digital tagging of multimedia content for database management of the content. A digital tag is assigned to each item in the form of the type of condition of the child-patient, milestones name, and activity name and later saved in the library of best practices of all the therapists. Also, if the child has unique conditions, new items are recorded, tagged, voiced over, shared with parents. These all items are saved in the library with the consent of the parents.

8. Writing down important instructions (in the native or English language) can help in reinforcing what needs to be done and how many times in a week.

9. Sharing of related documents and notes for two levels of learning of the caregivers.

10. Supporting training along with monitoring using feedback mechanisms.

The use of digital support in the form of web app for telehealth purposes, based on microlearning design help mitigate the

knowledge transfer barriers and facilitate patient-centered care in a local family context. To sum up, there are a few features that add novelty to the learning outcomes that is knowledge transfer as required for the child -patient and later apply that knowledge in the dynamic context of changing everyday situation. For caregivers for example, (1) A library of best practices videos and content shared by different therapists and (2) Voice-over in the video-based exercises teaching how it can be applied in everyday situations. (3) Written instructions for comprehension and remembrance of the caregivers. (4) Feedback and reflection mechanism at the caregiver's end also. This appropriate telehealth support for the community already facing many challenges, along with the use of microlearning serve as a technological learning mechanism. Sehat Agahi is a support to share these microcontent based items/tracks.

Sehat Agahi Web App

Sehat Agahi, a flexible telehealth learning solution, is an easy-to-use web app, to increase the usability and acceptability from the target users. Figure 1 describes the features of the web app at both the therapists and caregiver's end. The caregivers' end features are kept simplified as shown in Figure 2. Using participatory research, the following features were added at the caregiver end:

Caregivers' end dashboard

This app has two dashboards; the therapists' dashboard is designed in English. Due to language barriers, it was suggested by the caregivers and therapists to have caregiver's dashboard in their native language 'Urdu'. Also, the voice-over in the videos is also done in Urdu language. The instructions can be in any language suitable for the caregivers. "Many caregivers visiting the facility do not speak Urdu even; they usually accompany someone to talk to the therapists (Therapist F5)".

Only few features were added in the caregiver's dashboard to make things easy to do. A flow of activities at the caregiver's end is shown in Figure 2.

Alert for privacy and safety

As the micro lessons-based tracks are specific to each child's condition and needs, and also according to the caregivers' capacity, therefore a ticker on logging appears in Urdu. This alerts about not sharing or trying the content of the app to any other child-patient. The content of the ticker has been written with the help of a lead therapist and a legal advisor, to ensure privacy.

Progress monitoring

Furthermore, it also motivates the caregiver to administer therapy to their child punctually by showing them their child's progress and allowing them to self-reflect on their child's improvements.

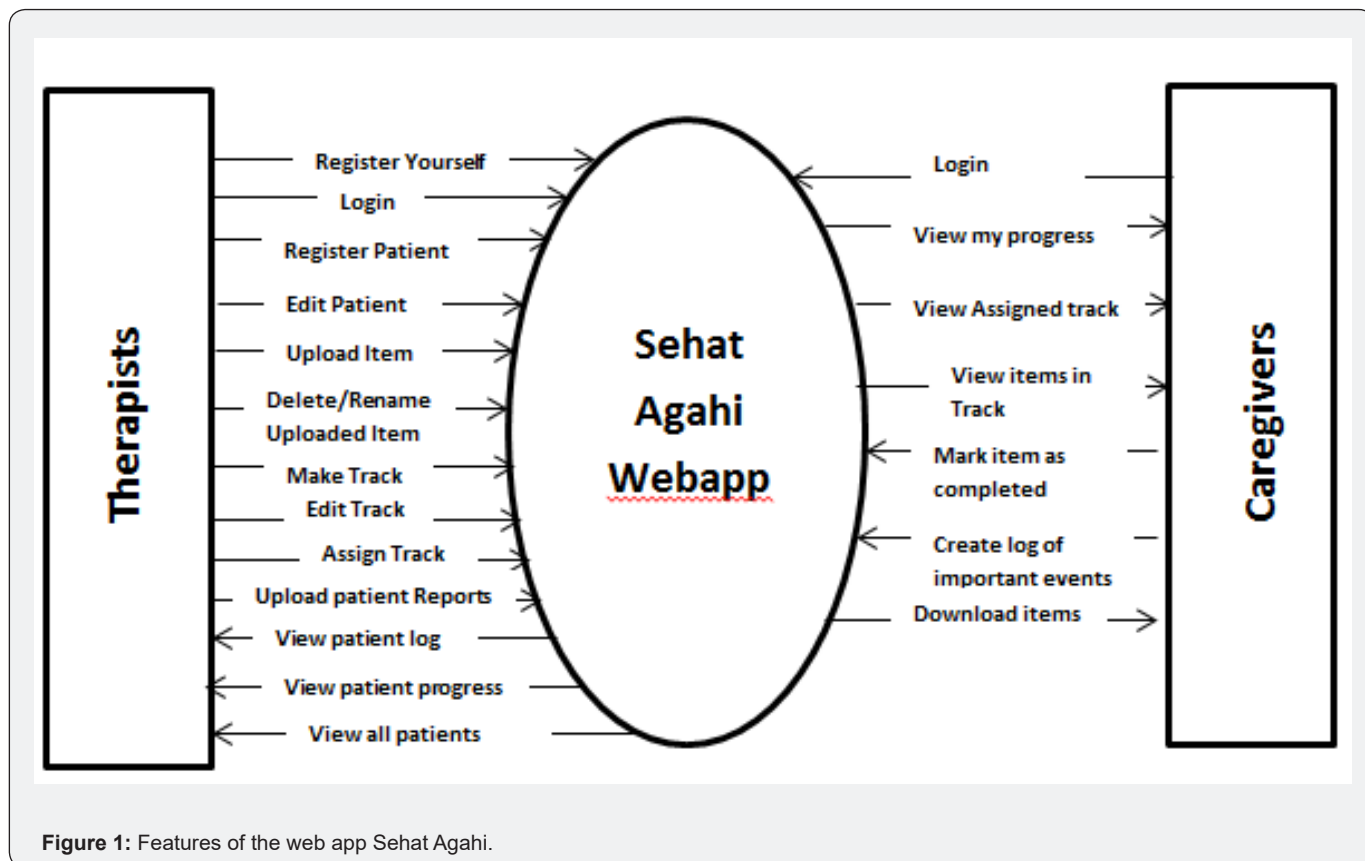


Figure 1: Features of the web app Sehat Agahi.

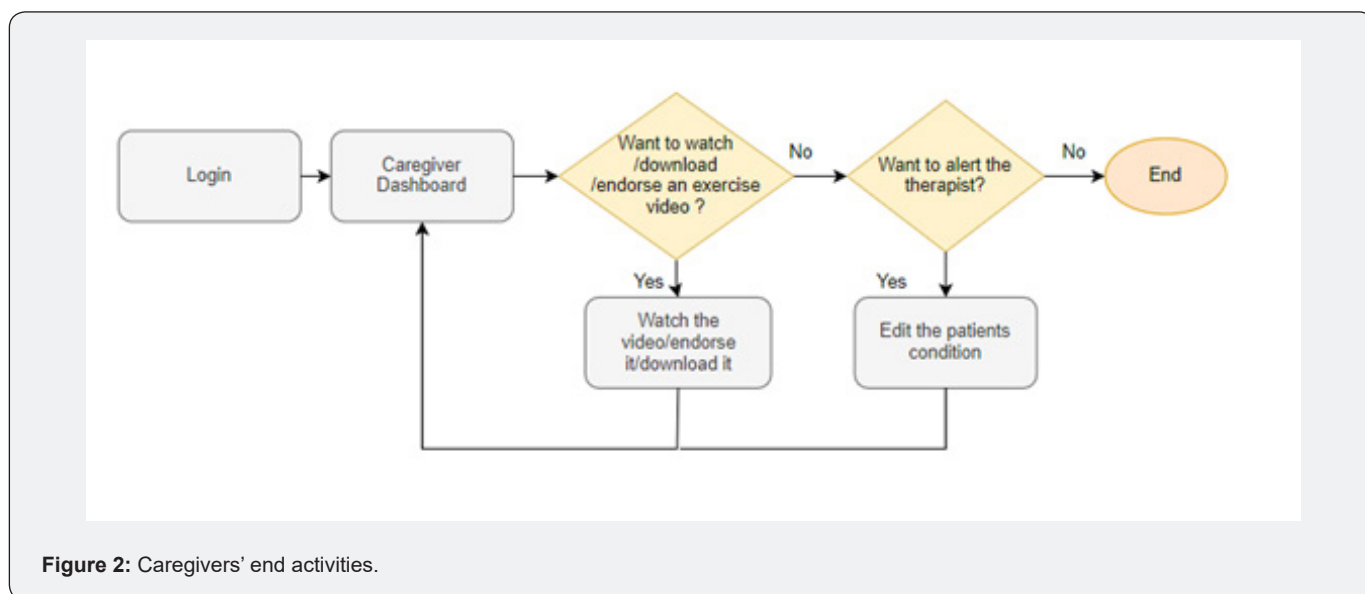


Figure 2: Caregivers' end activities.

Generating notifications and alerts

Likewise, it also establishes a connection between therapists and child-patients, by therapists being constantly informed about the child's condition. "The patients would disappear for months, for us being unaware of the absence, these notifications will keep us alerted and informed (Therapist M1)."

Supervision of caregivers' activities

Since the caregivers are assigned minimum features, the monitoring of the activities are maintained with ease of use. With an automated timestamp feature of the software to supervise therapies administered at the caregiver's end.

Below are few hypothetical cases as observed in the therapy center. These cases describe the how tele-therapy concept using microlearning was used to support the caregiver's learning.

Case Examples

Here, we discuss a few typical case examples as seen during the participant observation part of the planning phase of our research. These examples help us depict the ground realities and show how technological and micro learning approaches can help caregivers.

Case 1 Disability due to sickle cell Anemia

Who we will call A.M. is a seven-year-old boy diagnosed with sickle cell anemia - a genetic blood disorder. There were similar cases in his paternal family. A.M. was brought in a poor condition at the start of rehabilitation, with no physical movement in the body, except the eyes. With the help of rehabilitation, A.M. was able to stand up with support. After the pandemic, A.M. lost his progress and rejoined after a break of seven months - the reason being the birth of a younger sister in the family. The family participated in the development of 'Sehat Agahi', where A.M. was video recorded for 'standing with support' milestone. The therapists and experts helped in the development of a track of related videos of standing with support.

- a. The standing posture guidance with the setting of support, feet, hands and the back.
- b. Reiteration of the previous posture guidance related to standing with support, later sharing engagement techniques while standing.
- c. Reiteration of posture balancing while standing with support, teaching communication cues like holding an object, color recognition.
- d. The standing with support help, sharing non-verbal cues like holding snacks, touching or playing with toys, or looking around.
- e. The standing with aid, teaching family centered activities with other siblings like TV watching, Dinner time activities and others.

All videos were 2-3 minutes each, with the voice-over technique followed. There were written instructions for remembrance and reiteration to the caregivers' comprehension for e.g., repeating activity one thrice a day, while focusing on child's communication. This adds flexibility to the caregivers' education program. Since a mother of a newly born child, she can also take care of A.M. therapies with convenience, with two ways feedback system incorporated.

Case 2 Hemiplegic cerebral palsy

A.R. is an eight-year-old boy suffering from mild spastic hemiplegic cerebral palsy. His right arm is affected more than

his leg. He avoids using his right arm, therefore the activities at rehabilitation and home are focused on using the right side, so it can be mobile. He speaks well, but his voice is not very clear. A.R. visits a nearby special school, therefore, cannot visit his rehabilitation program thrice a week. Therefore, his family participated in the design and development of 'Sehat Agahi' to get A.R. program via technology, adding flexibility and convenience.

The A.R. needs support in 'Right side of the body, while creating a balance'. This milestone currently focuses on 2-3 minutes exercises focusing on achieving the said milestones at home using telehealth for flexibility at the caregivers' end, while revising the already achieved milestones.

- a. Teaching activities while sitting on the floor with legs closed.
- b. Teaching activities while sitting on the floor with legs closed and adding further balance using sandbag (instruction for making a sandbag at home, alternate for sandbag).
- c. Iterating sitting on the floor with legs closed activity, taking it to another activity balancing both the feet on the ground while sitting.
- d. Activity for using right hand only like playing with pegs, kneading flour, picking objects using right hand only.
- e. Standing with balanced posture with correction of back, neck, feet.

Discussion

Sehat Agahi helps in digital capacity building of the caregivers, therapists and the healthcare system. The problems in access to care and healthcare disparities with the developmentally disabled children and their caregivers are highlighted during the pandemic across the country. Sehat Agahi is an effort to support these children by helping caregivers in skill development programs using telehealth and microlearning applications. Below are few pointers on how Sehat Agahi is supporting the caregivers learning using home-based interventions along with the therapists' caregivers' interactions.

Sehat Agahi aids in caregivers' learning and capacity building

Using an incremental approach, microlearning based lessons aids in caregivers' learning and capacity building. Using Sehat Agahi, each week, the caregivers are shared with a track of knowledge related to the child-patient's milestone, with a single identifiable goal for the learners [16]. This track is clear and focused, containing small bursts of knowledge, helping the caregivers with enabling activities that can lead to the child's positive outcomes. These increments of the tracks are maintained in the library at the caregivers' end, helping in deep understanding of the child-patient's whole process of the care journey. Since this knowledge is related to achieving milestones, the tracks are

connected to the previous assigned tracks, like connecting puzzle pieces, leading to increase in absorptive capacity and two levels of learning [29]. This knowledge is also reinforcement to what was learned during in person learning at the therapy center.

Sehat Agahi aids in therapists' and healthcare capacity building

Sehat Agahi also helps in capacity building of the therapists and the healthcare system. The therapists can digitize their explicit and tacit knowledge using microlearning concepts in a constructive manner [30] in the form of a digital library. Each time a session ends with a patient, a track is shared from the multimedia content library by the therapist using this web app. This jurisdiction depends on the individuality of each child's condition and needs and according to the caregivers' ability. Also, if the child is in a unique condition, new items are recorded, voiced over, shared with parents and saved in the library with the consent of the parents. These items like video recorded exercises, audios, text, documents are evidence-based knowledge prepared by the therapists themselves. Microcontent based items are assigned special digital tags according to the type of condition of the patient, milestones name, and activity name. As a therapist appreciated the concept of library of items, "Not only these items will be a help to the caregivers, this will aid the junior therapist in training also. The digital library will be a future support to the organization" (Therapist, M1).

Sehat Agahi helps in long term memory of the caregivers

The therapists can share content in different multimedia forms like video, audio, text, documents which allows 95% more retention for these learners [30]. This telehealth app using microlearning warrants the use of audios, videos and associated voice over. These different multimedia content helps in better engagement and understanding of the caregivers. This specifically help in developing knowledge base and transferring knowledge from working memory to long term memory of the caregivers [31]. It helps in answering questions like how to perform exercises in everyday family context, what alternative tools/resources available at home that can be used, what else can work, no. of times therapy to be exercised, how the previous track is linked to the current track leading to better understanding of the care journey. While a poor family was visiting from Quetta, with their son hemiplegic, therapists suggested in a video while she was using a sandbag, "Please prepare one at home. You can use old jeans-pants to prepare a sandbag easily at home" (Therapist, F1).

Sehat Agahi supports by individualized learning

Telehealth concept using microlearning supports by personalized learning content sharing [32] and in native language. The software interface was simplistic, with no cost and training required to use the software. The caregiver's dashboard was in native Urdu language. It was ensured that the dashboard and the content can be translated or voiced over into local languages if

required. This is because that Pakistan Bureau of Statistics states that only 7.57% people speak Urdu as their mother tongue, with most of the people speaking Punjabi (44.15%) followed by Pushto (15.42%). In rural Sindh, Khyber Pakhtunkhwa, and Baluchistan only 1.62%, 0.24% and 0.21% speak Urdu as their mother tongue. The Therapist end dashboard was in English for the ease of use to therapist.

Sehat Agahi with a purpose

We found that there are problems related to stigma and taboos within communities related to the birth and treatment of the child-patient. A study conducted in 2020 on 1470 adults in Karachi found a higher rate of stigma associated with mental disorders. It is perceived that people with mental disabilities have unchangeable conditions and this leads to stereotyping and stigmatizing [33]. Few caregivers reported taking their children to the spiritual healers as a reason for their absence from rehabilitation services. In Pakistan there are multiple traditional healing approaches to treating mental disabilities, including "Jinn", "Peeri/Faqeeri", "JaduTona" and "Tawiz". A study conducted in Pakistan in 2019 on 50 patients to assess the beliefs, attitudes and social stigmas related to mental health found that 86% of the patients had received some sort of traditional healing prior to receiving mental health services. Using telehealth and micro learning has a purpose [16,34], our app inculcates positive care systems and cooperation within families. Through this app, multiple users can learn how child-patient can be bought up in a family centered environment. The tracks contain small chunks of instructional material, suitable for learners of different education levels and all ages.

Sehat Agahi supports competing work and home priorities

Some family structures do not permit spending sufficient time with the child with developmental disabilities. Some caregivers find it hard to give time to children with disabilities due to domestic and other child-care responsibilities [33]. This telehealth approach is designed to help caregivers in a typical, complex family structure, using the micro learning approach by providing easy access to small instructional videos [32]. Adult learners must juggle with competing work and family priorities, therefore small bursts of informational learning are a support to such caregivers. Also, the ability to view content multiple times at their convenience can facilitate caregivers, especially mothers, since mothers have unpredictable schedules, and are usually responsible for care taking in Pakistan [6]. The mothers or caregivers can easily report unusual activities and also reflect on the activities on the track.

Sehat Agahi supports learning with minimum cognitive load

A similar study in Iran with the parents of disabled children in the Behbahan city, found that parents of children with disabilities had higher levels of stress, mental pressure, increased risk of

psychological problems and interruption of family functioning compared to parents of children without disabilities [35] Children with physical and mental disabilities require more care, attention and concentration that might lead to more responsibility on the parent, with less time for learning. Therefore, during the study, we found parents cannot focus on all the exercises, due to the challenging behavior of their child but also due to multiple children in the therapy area. The micro learning supported app allows adult learners to learn with minimum cognitive load [10,30]. It helps the parents to keep track of missing pointers during the therapy session, As one of the mothers quoted, "I get the smart phone at night when my husband returned from work. I go back through the track to understand and connect the missing dots (CG, F11)". Since microlearning affords distance learning [30] those visiting on a monthly basis or less, can have a track prepared, that can help as distance education for these contemporary learners [14].

Sehat Agahi aids distance learning

This app minimizes travelling problems for those children who require a special wheelchair but cannot afford one. It was found that many children cannot reach therapy center frequently due to travelling costs and barriers. Transportation to healthcare facilities is a major issue in Pakistan. According to a study, people in rural areas have to travel more than 40 kilometers to nearby cities for treatment. Private transport is expensive and public transport is sometimes delayed. Many patients suffer during the journey [6]. Using the platform can keep track of and can receive a child planned activities for the current week and can keep the therapists updated about the child. Telehealth allows distance and focused learning for this marginalized community learners.

Sehat Agahi assist in multimodal learning

We found geographical, social and cultural obstacles dominating the care journey of these children. We found gender matching (therapists/ caregivers) issues. Also, we found some mothers do not have permission from their families to travel out of the house unaccompanied [6]. The proliferation of the smart phone has led to a multimodal learning with changing learning cultures, especially for informal learners. Using telehealth and microlearning, the evidence based, family centered short therapies provided via the app can be a promising delivery system to outreach patients and caregivers in learning needs. Overall, the microlearning and microcontent can be a suitable strategy to support the informal learning in different faculties like agriculture, health and education in LMICs including Pakistan.

Conclusion

'Sehat Agahi', a telehealth app using microcontent and microlearning, is a great support to the weak healthcare infrastructure in Pakistan. As discussed in the literature, the use of smartphones in a telehealth-based solution can be used to educate, supervise, and observe the healthcare of special needs children. Sehat Agahi is an appropriate telehealth platform that provides

asynchronous interactions between therapists and caregivers in developing countries' contexts. The use of bite-size, flexible learning, and focusing on the most relevant skill development as per the needs of the child-patient and caregivers' capacity. This helps in addressing various socio-economic barriers faced by both the caregivers and the therapists during the provision of therapy to developmentally disabled children. The use of PAR methodology assisted in the creation of a solution that is sustainable and directly serves the stakeholders involved, including therapists, caregivers, and patients. The use of smartphone-based solution can help bridge the gap in the healthcare delivery system in Pakistan.

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