Planning for FamilyBloom: Helping ADHD children and Family Co-Regulation through Tracking and Reflecting

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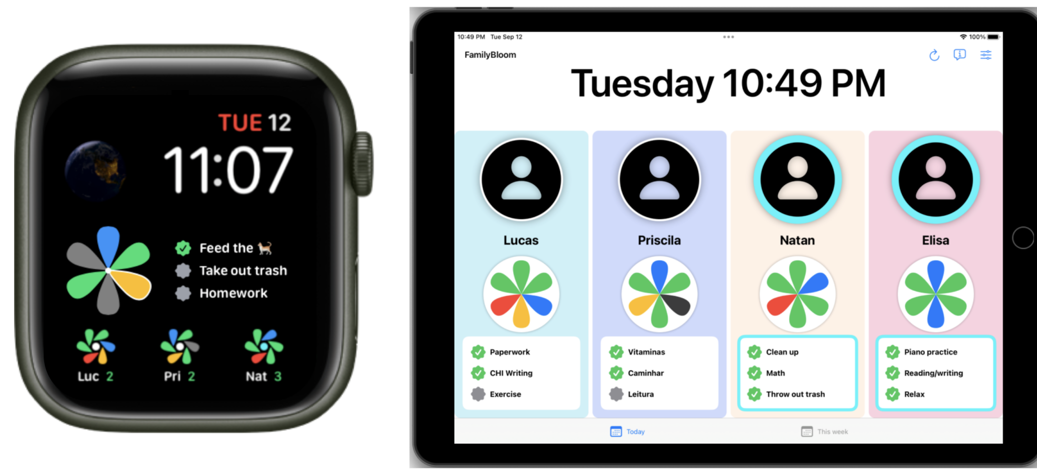

Fig. 1. FamilyBloom Supports tracking moods and three goals a day on both a smartwatch and in-home display. Tracked moods are shown in the form or colored petals.

ADHD children can have challenges related to setting goals and maintaining efforts to reach them. They can also have challenges with regulating emotions, which can lead to mental health issues. Parents and other members of the child's care ecosystem can help by co-regulating behaviors, such as helping them set and focus on goals, and support coping, understanding, and managing emotions. Personal and family informatics that leverages wearable technologies can potentially support both children's self and collaborative regulation. By helping ADHD families track behaviors together, they can help each other monitor and reflect on their moods and their efforts toward achieving goals. Smartwatches are well positioned to help both behavior tracking and delivery of health interventions for ADHD children due to their body-mounted nature, a characteristic that makes them convenient and frequently available devices. A family informatics approach to technology design can bolster mutual support and collaboration for better well-being. To explore this area, we have designed FamilyBloom, a multi-device system that leverages smartwatches and a family ambient display in the home for tracking moods and goals. In this short research summary, we detail the motivation, FamilyBloom's design, and the planned study procedures of the deployment. I am excited to receive feedback and ideate ways that family and ADHD assistive technologies could incorporate aspects of cognitive personal informatics. In dealing with ADHD challenges, as well as reflecting on the stigma and risks of health interventions for this

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1 INTRODUCTION

Children with Attention Deficit Hyperactivity Disorder (ADHD) may have differences in attention, activity level, and impulse control compared to same-age peers [7]. ADHD is considered the most prevalent childhood psychiatric condition affecting around 9.4% of children in the United States [1, 8] and 7.2% worldwide [33]. Children with ADHD may be more sensitive to stress, pressure, and fatigue [12]. As a result, managing emotions and impulses can be more challenging for them, and often children with ADHD can additionally suffer from anxiety and depression [3, 9]. When faced with these challenges, their behaviors may come across to others as aggressive or rule-breaking [12]. ADHD can additionally pose challenges to planning and achieving goals, as children may face increased distractions and struggle with self-monitoring skills to assess the progress of their efforts [26]. Supporting children in developing self-regulation skills can empower them to manage challenges and promote positive social and emotional wellbeing [6]. Caregivers, such as parents, play an important role in collaborating with children to support them in developing and using self-regulation skills, through role modeling, establishing boundaries, helping them set goals and refocus, and helping them reflect on their efforts [17, 24]. While research across fields like CSCW, HCI, and behavioral psychology has explored technology to support either parents or children with ADHD [4, 16], there has been less focus on designing for family cooperation for regulation [31].

There has been growing interest in how children with ADHD can be supported by technology and digital health interventions to improve their health [16], well-being [5, 32], and self-regulation [5]. Smartwatch technologies have strong potential as an accessible platform to provide helpful support to children with ADHD across different environments and may extend co-regulation with caregivers [27]. By having tools available at their wrist and with different sensors, smartwatches may offer self-monitoring support for reflecting on behaviors and convenient aids customized to their needs as they navigate various contexts. Furthermore, smartwatches are well suited to promote physical exercise, which can benefit managing ADHD symptoms such as leading to decreased impulsiveness, increased information processing capacity, and increased attention skills [18]. However, smartwatches are mostly personal devices and may lack integration within the family. Prior research has pointed out that wearables can be useful for monitoring and supporting children's exercise and chores, but can be challenging for children to use to review their data and alongside parents [19]. Although the use of smartwatches can support parents and children with ADHD to co-regulate routine goals, there is a need for further ways to promote family joint-reflection for assessing and adjusting regulation efforts [27]. Furthermore, there is a need to promote co-regulation alongside children's gradual independence and contribution to the family at large [27, 31].

Integrating data from smartwatches into shared views or ambient displays may facilitate collaboration in ADHD families, an approach we explore in this work. Previous work has made use of shared dashboards and ambient displays in the home to promote sharing and collaboration for certain aspects of health management and to promote family wellbeing. Ambient displays have been noted to facilitate regular and situated personal tracking and self-reflection [2] about moods [13, 29], physical activity [10], and on behaviors for health recovery [14]. When targeting family use, family displays have been a means of increasing awareness about family member's sleep [20] and each other's snacking habits [25]. Shared digital dashboards have similarly shown promise to improve family's engagement with physical activity [22] and to improve bedtime and morning routines [30]. Children's and parent's health can be interconnected [21] and jointly reflecting on health data can make a life-long impact on behavior for everyone involved [34]. When more than parents are involved and there is collaboration between multiple family members, family health management is improved by distributing burdens [21], empowering children [32], and sharing care efforts [11]. This previous work suggests that families with ADHD children could benefit from similar tools to support co-regulation by integrating information tracked through the smartwatch and sharing between family members. We therefore designed FamilyBloom, a family system to support ADHD families with sharing of moods and goals.

2 FAMILYBLOOM DESIGN

Through co-designs and prototyping, we have designed FamilyBloom to integrate family tracking and sharing of moods and goals. FamilyBloom is a multi-device system consisting of a smartwatch and tablet apps. Moods and goals can be tracked via the smartwatch app. FamilyBloom positions every family member as an equal user, with same features and sharing happening equally for every family member. Still, tracking is not automated and users may choose what and when to make inputs with the watch app (Figure 2).

For mood regulation, we lean on the *Zones of Regulation* framework [15]. In addition, our co-design and iterative prototyping process led us to the following set of design principles for FamilyBloom:

Center self-regulation on the watch and avoid comparisons: Showing side-by-side moods could lead people to make comparisons and feel it is a competition. To avoid this, visualization for mood should be granular per family member. For the smartwatch, the larger area of the home screen should display personal data for self-regulation. Centering the personal data could also encourage personal data engagement, serving as a reminder for tracking and reflection.

Allow flexible configuration of visualization for multiple family members: families have multiple shapes and sizes, and in addition to avoiding leading to comparison, FamilyBloom should allow organizing the visualization of data from all of them. Systems should also allow a detailed view of each member. In the watch, this can be in the form of using circular widgets per family member. Still, the maximum number of circular complications (4 in the largest configuration) is a limitation to display data from larger families.

Avoid nudging report of a preferred emotional state: to minimize report bias, the system should not reward reports of an ideal emotional state. For example, if the visualization took the form of a character, the user might be tempted to input a "happy" emotion not because they are feeling happy, but to make their character look happy. For this reason the app should avoid using characters.

Depict progress of time, even if not granularly: granular mood visualization, such as by the hour, can be useful for a detailed depiction of events. However, it can be overwhelming, especially on the smartwatch and counter to its glanceability benefit. Still, representations should convey a sequence of mood states, even if aggregated by the day's period or grouping of hours. This serves to give personal and family awareness beyond a momentary state at the time of visualization.

As a result, FamilyBloom supports glanceable visualizations by family member on both the watch and the in-home display (Figure 1). To facilitate quick understanding of mood data, we use a visualization of a flower and petals to depict data over time (Figure 3 left). In addition, users can see each family member's data in more detail on the shared display, such as clicking on a person to see granular data and reading notes (Figure 3 right).

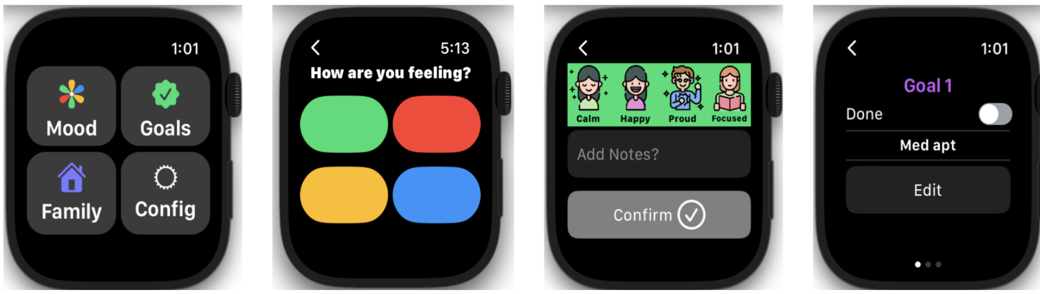

Fig. 2. FamilyBloom on the watch supports manual input of moods and three goals. Users can use voice-to-text to add notes to moods or describe goals. Mood representation follows the *zones of regulation* [15] framework, which is commonly adopted in educational settings.

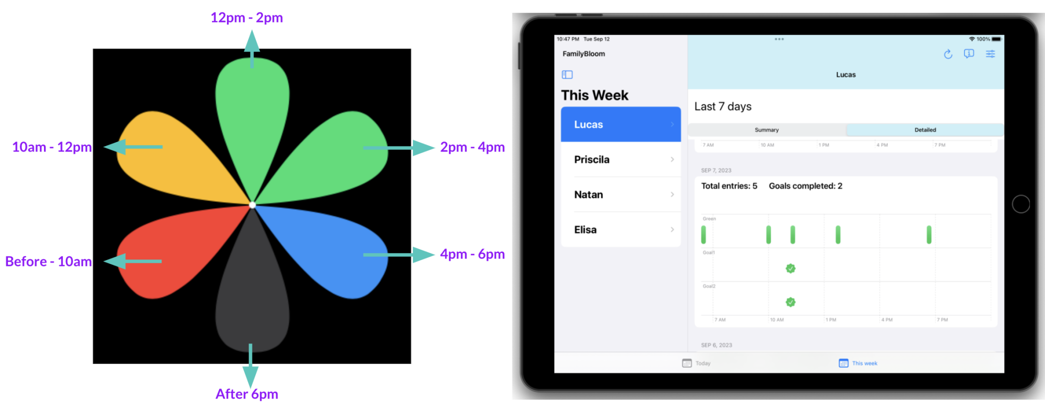

Fig. 3. Mood glanceable visualization follows a flower and petal abstraction (left). Detailed data view can also be navigated on a secondary view of the family display, showing more granular data over time (right).

3 PILOT PHASE AND FUTURE EXPERIMENT DEPLOYMENT

We have piloted FamilyBloom with two families for around a month each. In addition to feedback on usability improvements, pilot families reported exciting preliminary uses of FamilyBloom. They said that they perceived increased discussions situated in the home around their moods and regular goals. Some discussions were prompted by the natural glanceability of the home display. Some reported challenges are some children remembering to charge or use the watch, or sustaining system use after many weeks.

We plan to run a within-subject study design to evaluate how each device component of FamilyBloom is affecting the family. In all conditions, the smartwatch is present as a collection instrument for users to input their mood and goals. In condition A, the use of the smartwatch additionally will have other family member's data in the home screen. In Condition B, the smartwatch will only show self-regulation data (i.e., the rectangular widget and no circular widget) and only the shared display will show every family member's data. Finally, in Condition C, both the smartwatch's home screen and the shared display will be used to show every family member's data.

Fig. 4. Two families have piloted FamilyBloom for about four weeks. They helped identify usability issues but also reported promising results of family co-regulation mediated by the system.

The experiment hypothesis is that there is a difference between self and family co-regulation based on shared or personal displays. As such, we will be evaluating how conditions affect self-regulation (e.g., self-monitoring), family functioning (e.g., communication, affect expression), and family co-regulation (e.g., support with emotional learning and goals). Families will stay in each condition for 3 weeks. We will randomly assign participant families to one of two groups. These groups will alternate the starting condition between A and B to mitigate order effects. We chose to have both groups finish with Condition C (i.e., seeing family data on watch and tablet) so that they finalize the experiment with the full experience instead of being deprived from one of the devices/apps before a final interview. Families will be interviewed every 3 weeks. We will be collecting daily reports of family discussion and use several survey instruments to evaluate ADHD symptoms after prolonged system use (e.g., BASC-3 [23]) and family functioning (e.g., [28]).

3.1 Workshop Participation

We are excited to receive feedback and ideate ways that family and ADHD assistive technologies could incorporate aspects of cognitive personal informatics. Currently, our system only leverages manual tracking and we plan to ask about automation during family interviews during the study deployment. In dealing with ADHD challenges, as well as reflecting on the stigma and risks of health interventions for this population, we are also interested in the ethical discussions about automated tracking and sharing of cognitive personal informatics and the implications for assistive technologies research, like FamilyBloom.

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