

Understanding Parent-Pediatrician Interactions for the Design of Health Technologies

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ABSTRACT

The Well Child Visit between a parent and a pediatrician is one of the fundamental means to ensure the healthy development of young children. In this paper, we present the results of a qualitative, formative study aiming to understand the nature of the interactions between parents and pediatricians and the structure of Well Child Visits. The purpose of the study is to inform the design of health technologies for parents and pediatric care. To understand this interaction, we observed 16 Well Child Visits with 8 families and 2 pediatricians over the course of 3 months, conducted interviews and a focus group with parents and pediatricians, and surveyed 43 parents. We discuss the fundamentals of the visits, including visit length and wait times, topics discussed, and the people involved. Our results show that parents and pediatricians perceive one another favorably, but there are still a number of tensions and inequalities which could be addressed by technology. We also provide a discussion of the major issues and design opportunities for interactive technology to improve pediatric care.

Categories and Subject Descriptors

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous, K4.2 :Computers and Society: Social Issues, J.3 Computer Applications: Life and Medical Sciences

General Terms

Design, Human Factors

Keywords

Health, medicine, health informatics, medical informatics, families, pediatrics, pediatricians, doctors, children.

1. INTRODUCTION

A child's first few years of life are crucial to their development, and thus many health organizations recommend that a child have frequent, regular visits to a pediatrician's office during this stage of development [2]. The purpose of these visits, often called Well Child Visits, is to ensure that the child is developing and growing normally, check the child's overall health and wellness, administer recommended vaccinations, and allow parents to ask questions of the pediatrician and seek advice on parenting

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strategies. For first time parents, this is often a new experience where they are first learning how to care for their child's health, and thus they may not be equipped to ask the right questions or understand which matters are important. Even for parents of multiple children, each child could be unique in their development cycle, and thus these visits are important to ensure that they fully understand whether there are reasons for concern about their young child's development.

The activities at these visits are often the first indication of any abnormal development, illness, or disability and are a good source of information sharing between new parents and their pediatrician. The relationships that parents establish with a pediatrician can have profound impacts on a child's life [27], and thus it is a worthwhile area of study for the field of health informatics and human-computer interaction. Although there are a number of technologies being designed for new parents (e.g., [[19][26],[28]]), there are few that explicitly support parent-pediatrician interaction. Thus, we believe there are potential opportunities for technology to support this interaction and the information exchange that happens between the parent and the pediatrician.

In this formative research, we had the explicit goals of studying Well Child Visits to uncover the nature of parent-pediatrician interaction and discover the types of information sought from and shared with each other in these settings. These findings help establish design guidelines for computing technologies that can make this process more useful and efficient. We used a triangulated approach to study the nature of Well Child Visits, including observation of two different Well Child Visits for eight different families visiting a pediatrician practice consisting of four doctors, interviews and focus groups with parents and pediatricians, and a survey with 43 parents designed to uncover the breadth of experiences from a more diverse population. We then conducted an in-depth analysis to uncover themes and tensions and make design recommendations for how technology can support this type of interaction. The main contributions of this work are 1) a detailed description of the nature of Well Child Visits and parent-pediatrician interactions and 2) descriptions of design opportunities that could support parents and pediatricians in ensuring the best treatment for children.

Although others have explored the nature of patient-doctor communication and how technology might support it [8],[16],[25], we are interested in studying this specific interaction, as it is fairly unique in nature. First, Well Child Visits are typically much more frequent than other patient-doctor visits, such as with general practitioners or specialists. The American Academy of Pediatrics recommends seven Well Child Visits in the first year of life and four in the child's second year [2]. Second, in these settings, the child patients are typically too young

to speak for themselves, and thus cannot communicate directly with the pediatrician. In that case, the parent must become an advocate for their child's healthcare. In some cases, parents may even be a stronger advocate for the health of their child than they are for themselves. Third, the nature of Well Child Visits is largely preventive, though parents often rely on pediatricians to help identify any potential concerns and make recommendations and referrals to specialists if there are any problems. Finally, because the first years of a child's life are so critical, there is pressure to identify and treat illnesses and developmental delays as early as possible to minimize their outcome on the rest of the child's life. These differences call for an in-depth formative study to ensure that technology for parents and pediatricians is designed appropriately for this space, rather than just applying general health and technology guidelines.

The rest of this paper is organized as follows. First, we begin with a discussion of related work in the areas of design requirements and technology for health and families and studies of patient-doctor interactions. Next, we describe the details of our study, the analysis methods, and the results and themes that emerged from the analysis. We then discuss the findings and opportunities for potential technology designs. Finally, we conclude and provide future directions for this work.

2. RELATED WORK

In this section, we outline related work in the areas of studying design requirements for families, the computing technologies for families, and studies of the patient-doctor interaction and communication. We discuss how our work builds upon and complements the existing literature.

2.1 Design Requirements for Families

A recent focus in the Human-Computer Interaction community has been to work toward technologies that support families with young children. Foucault [11] conducted interviews and a cultural probe with families with very young children, and in our own previous work [20], we conducted a formative study to identify the design requirements for tracking developmental progress in young children. We sought to expand the findings of these two studies by focusing on and going to deeper into parent-pediatrician interactions. Jeong et al. [18] conducted a formative study with parents to help understand how technology might play a role in helping parents track general health data. Though our work has a similar goal, it is focused on a study of both parents and pediatricians in the specific context of Well Child Visits and how they might be supported. Finally, Grimes et al. [13] conducted a qualitative study with 15 families that explored how technology might be used to share health information. Our work focuses on families with much younger children and how data may be shared specifically with pediatricians.

2.2 Computing Technologies for Families

More generally, others have sought to investigate how technology could be developed to play a role in strengthening relationships and supporting families with children. The goal of Hutchinson et al.'s technology probes work [17] was to understand how new technology might fit into the lives of families. Specific examples of technologies designed to support families are photo and event sharing systems [9], family video collaboration tools [1], digital calendars to help busy families organize different activities [24], and a "smart bag" for helping families manage their everyday activities [21]. Many of these tools focus on sharing sentimental

or everyday information between family members. Our eventual goal is to develop and deploy technologies with families as these projects have done, but in our case, we aim to support families by focusing on children's health and supporting the sharing of information with pediatricians, rather than other family members. There have been specific technology designs to support young children. Baby Steps [19] supports record-keeping to track developmental milestones for finding developmental delays earlier, ENSURE [26] helps parents organize their child's health data, and Child's Play [28] uses sensors to automatically record children's play behaviors. We believe our work helps strengthen the need for these types of systems and can inform future designs.

2.3 Studies of Patient-Doctor Communication

There have been numerous researchers that have explored how technology can be used to support aspects of health, such as cancer [15] or diabetes [23], but a full review of this area is beyond the scope of this paper. Thus, we focus on the body of literature that is most related to our work, which is how technology might play a role in supporting communication and interactions between patients and doctors. Most closely related to this work is that of MacKean et al., who conducted a qualitative study to understand the parent-doctor interaction in family-centered care [22]. The focus of this work was to determine whether the shift of family-centered care from clinics to families was desirable. Our research differs from this work, in that we specifically studied Well Child Visits and how technology could support them. Others have studied how telemedicine and video conferencing [25], the use of computers during outpatient visits [16], and the use of the internet by patients [8] affect the interactions between doctors and patients, as well as seek to generally understand doctor-patient communication [3][4] and how to improve it [14]. This research builds upon these previous findings and seeks to combine both an understanding of the nature of parent-pediatrician interactions as well as the notion for how general technology design might be able to support it.

3. STUDY METHODS

In this research, we conducted a mixed-methods approach to gain a broad, triangulated understanding of the nature of parent-pediatrician interactions. Below, we describe the different methods, participants we recruited, and our techniques for analyzing the data we collected. All studies were reviewed by university-based research ethics boards.

3.1 Observation of Well Child Visits

Our first goal in understanding parent-pediatrician interactions was to study in detail what goes on at Well Child Visits. We recruited a suburban private practice pediatrician's office consisting of four doctors to participate in this study through a mailing list of health practitioners in the area. We visited the practice and conducted interviews with three of the doctors who conduct Well Child Visits. We then recruited eight families who were current patients of the practice to participate in the observation by mailing letters and a screener survey to approximately 90 of their patient families with children under the age of two who had upcoming Well Child Visits over the next several months. From the 28 returned screener surveys, we ended up selecting eight families based upon their availability and to diversify as much as possible. While there were four pediatricians at the practice, we were only able to observe visits with patients of two of them. One of the other two only saw sick children and did not well-child visits and the other had plans to move to a different

Table 1: Family participants for the Well Child Visit observations and interviews. Children in bold are those whose Well Child Visits we observed for the study. The parent column contains their age, current occupation, and the highest level of education completed (H.S. = High School).

ID	Child Data	Mother	Father	Income	Doctor
1	M (12 months) , M (14 years)	42, Homemaker, A.S.	33, Firefighter, H.S.	\$50-\$100K	P1
2	F (9 months)	34, Contract Analyst, B.S.	34, Realtor, B.S.	\$50-\$100K	P2
3	M (9 months) , M (9 years)	37, Business owner, B.S.	39, Business owner, B.S.	Above \$150K	P1
4	M (15 months) , F (3 years)	34, Pub. Relations Dir., B.S.	35, Computer Eng., B.S.	\$100-\$150K	P2
5	M (12 months) , M (4 years)	38, Homemaker, B.A.	39, Attorney, J.D.	Above \$150K	P1
6	M (9 months)	34, Graphic Design, H.S.	37, Self-employed, B.S.	\$50-\$100K	P2
7	M (9 months) , F (3 years)	36, Choir Director, B.S.	37, IT Manager, M.S.	\$100-\$150K	P1
8	M (15 months) , F, (4 years)	30, College Student, H.S.	37, Technical Support, H.S.	\$50-\$100K	P2

the practice before the end of the study. In total, we observed 16 total visits (2 per family spaced approximately 3 months apart). Table 1 shows an overview of the families, and Table 2 shows the pediatricians we studied. Each of the Well Child Visits was audio-recorded and one researcher attended from start to finish and took detailed notes on topics discussed, procedures followed, questions asked by the doctor, questions asked by the parent, and any other topics of interest.

Immediately following the first round of observations, we had the parents and pediatricians complete a rating scale for the experience they just had with the Well Child Visit to get an understanding of the strength of their interactions. The rating scale we had parents complete was a modified version of a standardized scale called the Patient-Doctor Interaction Scale (PDIS) [6]. The scale consisted of 21 Likert scale questions, where parents could agree or disagree with a series of statements on a scale from 1 to 5 (5 always indicating a positive interaction). The modifications we made to the scale made the language more appropriate for parent-pediatrician interaction. For example, we changed the question, “My doctor treats me with respect” to “My pediatrician treats my child and me with respect.” For the pediatricians, we created a similar scale for the pediatricians to rate the parents, where we kept the topics the same, but reversed the roles and removed any questions that did not make sense. Overall, the parent-completed survey had 21 questions and the pediatrician-completed survey had 18 questions.

3.2 Interviews and Focus Groups

To gain a deeper understanding of parent-pediatrician interactions, we interviewed members of each of the families and the pediatricians who we observed in the Well Child Visits. We also conducted a focus group with the pediatricians following the interviews to allow for a collaborative discussion on the issues faced by pediatricians during their visits. The interviews were

Table 2: Pediatrician participants for the Well Child Visit observations (O), interviews (I), and focus group (FG).

ID	Gender	M.D. Year	Years at Practice	Participation		
				O	I	FG
P1	Female	1982	7 years	✓	✓	✓
P2	Female	1990	7 years	✓	✓	✓
P3	Female	1985	2 years		✓	
P4	Female	1997	< 1 year			✓

semi-structured in nature and lasted between 30-60 minutes on average. The questions in the interview guide for the parents focused on information they seek from the pediatrician, their thoughts on their pediatrician’s bedside manner, and what they like and dislike about the Well Child Visit process. We also asked them to provide us with insight on their child and their thoughts on how he or she might be developing. We asked the pediatricians about their current practices and habits, strategies for keeping track of so many individual families, and any problems they see facing examinations and their interactions with parents and children.

3.3 Online Survey

The observations, interviews, and focus group were intended to provide a deep understanding of individual interactions. However, because the families we studied were limited to one pediatrician’s practice in one area of the United States, we conducted an online survey for parents of children 6 years old and under to ask similar questions to a broader population. We recruited survey participants via word-of-mouth, Craigslist.org online classified ads in a number of different cities in the United States, and postings on parent-centered Internet forums. The survey was entirely anonymous, and no compensation was offered. In total, we had 43 participants from 12 U.S. States complete the online survey (see Table 3).

The survey we created consisted of 10 statements that parents could agree or disagree with on a 5 point scale, which were similar in content to the PDIS we distributed to parents following the Well Child Visits. It also consisted of questions such as how long they spent during their visits, the number of visits they have attended, who typically attends the visits, the topics discussed, and the types of questions they ask. The survey asked several open-ended questions, such as to describe a particularly positive or negative experience during a visit. Finally, it asked basic demographic questions including income, insurance coverage, age, marital status, location, and education level.

3.4 Analysis Methods

The different methods we used produced a large amount of data. All Well Child Visit observations, parent and pediatrician interviews, and the focus group were fully transcribed, for a total of 28 transcripts. To analyze the qualitative data, researchers individually coded the transcripts for each data type. For the Well Child Visit observations, we coded for 1) Questions asked by pediatrician, 2) Questions asked by parent(s), and 3) Topics discussed during visit. For interviews with parents and

Table 3: Summary of participants who completed online survey, including demographics and family composition.

Number of Participants	43
U.S. States Represented	California, Colorado, Georgia, Iowa, Kentucky, Michigan, Mississippi, Ohio, Pennsylvania, Texas, Virginia, Washington
Participant Genders	Females (79%), Males (19%)
Participant Ages	21 or under (11%), 22-27 (11%), 28-33 (28%), 34-39 (33%), 40-45 (14%)
# of Children in Family	1 (56%), 2 (35%), 3 (5%), 4 (2%)
Children's Genders	Male (35), Female (29)
Children's Ages	Under 1 (9), 1 to 2 (14), 2 to 3 (9), 3 to 4 (8), 4 to 5 (7), older than 5 (7)
Income in U.S. Dollars	Below \$25K (16%), \$25K-50K (9%), \$50K-75K (14%), \$75K-100K (14%), Above \$100K (35%), No Response (12%)
Highest Educational Degree in Family	Some high school (2%), High school degree (10%), Some college (10%), College degree (24%), Some graduate education (10%), Graduate or professional degree (40%)
Medical Coverage	No coverage (5%), Minimal coverage (16%), Average coverage (7%), Good coverage (33%), Excellent coverage (40%)
Marital Status	Married (88%), Single (9%)
Occupations	Teacher, Homemaker, Transcriptionist, Student, Researcher, Receptionist, Fast Food Employee, Store Clerk, Student Doctor, Nurse, Advertising Producer, Physical Therapist, Bank Supervisor, Purchasing Agent, Software Engineer, Professor

pediatricians and the open-ended survey questions, we conducted a grounded theory affinity analysis [[5],[12]] of the quotes where we identified and clustered related items to help extract themes from the comments. For the quantitative data from the surveys, we calculated descriptive statistics and present the results to complement the qualitative data obtained via the observations.

4. RESULTS

In this section, we describe the findings from the observations, interviews, focus group, and the online survey. We provide an overview of the procedure of the Well Child Visits we studied, people attending the visit, specific interactions, topics discussed, timing and waiting, parent and doctor questions, tensions, and then general themes we extracted from the data. The findings here are intended to provide a detailed description of the settings, which can be used by application designers for this space.

4.1 General Procedure

The Well Child Visits we observed all had a very similar procedure. First, parents would arrive at the visit with their child and check in at the front desk. They would then stay in the waiting room for their child's name to be called. Once called, they would go back to the examination room, where a nurse or medical

assistant would measure the baby's weight, length, and head circumference. The nurse then handed the parent an information sheet that they could look over that describes their child's visit for this age range and any vaccinations they would receive. The parents waited in the exam room for the doctor to arrive. Once the doctor arrived, she greeted the child and the parent and talked to the child on his level to make him comfortable with her. She asked the parent if he or she had brought back the developmental milestone questionnaire they were supposed to complete, and then scored the questionnaire. In some cases, parents would make reference to the survey or ask questions. The pediatrician would then ask a series questions relating to topics such as nutrition, sleeping, general development, or behaviors. She then did a physical examination of the child, checking their eyes, ears, mouth, genitals, general movements, and if the child was talking, try to ask him or her a few questions. The doctor finished the visit by asking if the parent had any questions they could answer, though questions were encouraged throughout the visit. Although parents were encouraged to ask questions throughout the visit and exam, what we witnessed in our Well Child Visit observations was that the visits were largely pediatrician driven. Many parents would respond to the pediatrician's questions and wait until the end to ask any additional questions they may have had. They would occasionally ask clarification questions about something a doctor said, however. In describing her routine, one pediatrician said:

PI: "My little routine is I sit down and I talk to them about their growth. I find that that's a good way to walk into it, and I go over their growth chart with them and, you know, how much weight they've gained... then that usually leads into a discussion of feeding and how they're doing with that, and then talking about... any changes for the next between now and the next time they come in, and then the routine stuff."

The other pediatricians reinforced the use of routines and believed they helped put parents at ease and to help themselves remember to cover each of the topics they wanted to discuss.

4.2 Well Child Visit Attendees

We found that the mother was the primary person to attend the Well Child Visit in all families we observed. In Family 1, both the mother and father attended both Well Child Visits we observed, and in Family 8, the mother attended the first visit while the father attended the second visit. For several families, the siblings also attended the Well Child Visits (Family 4 and Family 5). In the online survey, all 43 participants (100%) reported that the mother typically attends visits, 20 (47%) reported the father typically attends the visits, and 9 (21%) reported that siblings typically attended the visit. One survey participant stated that a nanny also attended the Well Child Visit. These findings about pediatrician attendees are in line with some of the related work from the pediatrics research community [10].

In visits where siblings attended, the pediatrician made an effort to include that child in the exam by talking to her. However, in one visit we observed where the older sibling was present, the mother seemed more distracted, asked fewer questions, and the visit was shorter (Family 4, Visit 1). We observed that the nurse is with the parent and child for a short amount of time before meeting with the doctor to take the physical measurements and then returns after the visit to administer any vaccinations. When the pediatrician was with the parent, they were always alone.

4.3 Parent-Pediatrician Interactions

We assessed parent-pediatrician interactions using the modified PDIS and by analyzing the interview transcripts. When we interviewed the parents, we found that parents are generally happy with their pediatricians, but also saw some room for improvement. For the PDIS, we averaged the scores for all of the questions to obtain an overall rating (5 indicating the most positive interactions). The parents and pediatricians generally rated each other highly on the 5 point scale, with most items receiving a 3, 4, or 5 and overall averages of 4.44 for parent ratings of doctors and 4.51 for pediatricians rating parents (see Figure 1). In most of the cases, parents and pediatricians rated each other similarly. However, there were a few cases where there seemed to be a noteworthy difference in how the pediatrician rated the parent and vice versa. For example, in the case of Family 1, the parent rated the pediatrician highly at 4.6, but the pediatrician only rated the parent at a 4.06. The opposite effect occurred in Family 2, where the pediatrician rated the parent fairly high, but the parent rated the pediatrician at a lower overall score. While we do not know why this imbalance happens, we suspect that well-prepared parents may receive high ratings from pediatricians when compared to other parents, but these parents also have higher expectations of their pediatricians.

When asked to describe their ideal interaction, parents reported qualities such as listening to their concerns, being friendly and playful with their child, and making recommendations while providing careful explanations and rationale that they could understand. In the interviews with pediatricians, they stressed the importance of good interactions with the parent and the ability for them to establish trust and rapport. Because of the frequency of the visits, pediatricians remembered some patients well, especially those with concerns, but some help with recalling issues brought up at a previous meeting could be useful. They described how they felt more comfortable with patients they had been seeing regularly, because they know their history and progress and have a good sense of how the parents are doing. They expressed difficulty in assessing progress when a parent transitions frequently between pediatricians or does not regularly make meetings. Two pediatricians offered the following comments:

P2: “You get to know them well. I mean, I had patients that are...in high school that I’ve known since they were born.”

P3: “Do I trust the judgments that she’s making, and do I feel like I’m communicating with her well? I think that’s a good thing to think about.”

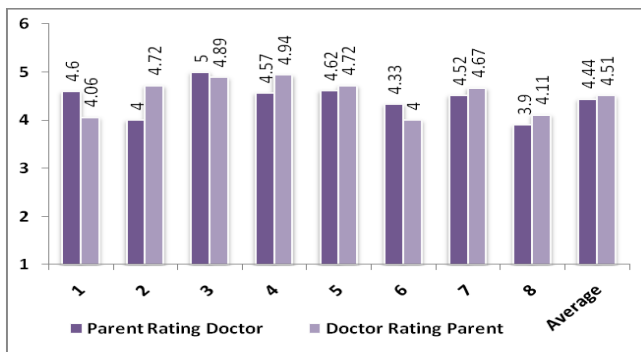


Figure 1: Average ratings of parents and pediatricians across all items on the modified Patient-Doctor Interaction Scale. Highest rating is 5.0, indicating positive interactions.

4.4 Topics Discussed

We used the affinity diagramming of the observation transcripts to identify the topics discussed during Well Child Visits. The purpose of this analysis is to have a good understanding of the types of information shared between pediatricians and parents and how we might build technology to help parents be better prepared for these discussions. Below, we show the most frequently discussed topics within the Well Child Visit. The numbers in parentheses represent the percentage of visits in which the survey participants reported discussing that particular topic.

- **Developmental Milestones (91.9%):** This topic typically centered on a questionnaire parents were asked to complete prior to their visit [6]. This included discussions on the topics of gross motor, fine motor, social and emotional skills, problem solving skills, and communication.
- **Food and Nutrition (62.2%):** Pediatricians asked how much and what types of food the child was consuming. This included switching to solid foods, breastfeeding and weaning, and transitioning to bottles or drinking cups. Also included discussions about how much the child was urinating and defecating.
- **Vaccinations (94.6%):** Pediatricians explained which vaccines their child receives and when. Parents were concerned about potential side effects and frequency. This also included questions about optional vaccines, such as flu shots.
- **Questions or Concerns (91.9%):** Parents were given the opportunity to ask questions. This often centered on reducing anxiety, such as whether the baby was “normal” physically or whether it was okay if they were not talking or walking yet. It often centered on parenting advice, such as dealing with tantrums or fussiness.
- **Sleep and Nap Schedules (62.2%):** Pediatricians asked how often and for how long the baby sleeps at night and takes naps. They also asked about quality of sleep and methods for getting the child to go to sleep (e.g., nursing before bed, rocking to sleep). This topic also addressed how to handle child when he/she wakes in the night.
- **Illness or Injury (64.9%):** This included discussion about any illness (e.g., cold, ear infection) or injuries (e.g., broken bones) the child has had since last visit and how to handle it.
- **Safety Issues (45.9%):** Pediatricians reminded parents of safety issues, such as car seats, use of sunscreen, drowning prevention, and choking hazards.
- **General Wellbeing (73.0%):** Pediatricians asked parents about the overall health of child, how they feel child is progressing, and how other siblings and the family is doing to get more holistic view of health.

To support the observation data, parents who completed the online survey also listed which of the topics they discussed during their Well Child Visits. In the survey, we also had the option for “Other,” where only two parents responded. They both reported that their pediatrician also discussed the parents’ wellbeing and how they are handling being parents. This was discussed in the Well Child Visits we observed, but we grouped them into the General Wellbeing category.

4.5 Timing and Waiting

Parents frequently referred to the amount of time spent at the pediatrician's office. Parents visit the pediatrician often, and thus many of them become very aware of how much time it takes. During our observations, we took notes on the different aspects of the visits, including the time in the waiting room, the time spent with the nurse, the time waiting for the pediatrician in the exam room, the time with the pediatrician, and the time checking out of the doctors' office following the visit. The observations of the entire visit from start to finish took approximately 90 minutes. In general, we found that times visiting with the doctor ranged from 9 minutes, 35 seconds (Family 4, Visit 1) to 31 minutes, 39 seconds (Family 6, Visit 1), and the average visit lasting 19 minutes, 40 seconds. Families were fairly consistent in how long they spent with the doctor across their two visits. Figure 2 shows an overview of the time parents spent with the pediatricians. For Family 6, the parent was a first time mother with a young child who worked at home while simultaneously watching her child. She had become overwhelmed with a full time job and full time childcare, and sought much advice from the pediatrician on how to best handle her situation. The shortest visit was from Family 4, who had brought along the older sibling for the visit. The sibling had become restless and wanted to leave well before the doctor arrived in the exam room, so the visit became rushed. In general, parents in the observations felt that the meeting time with the doctor was sufficient, as judged by their high level of disagreement with the item on the PDIS that stated "*The doctor seemed to rush.*" (Avg. = 4.38).

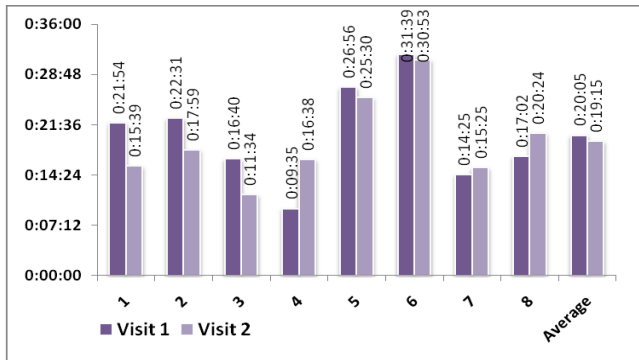


Figure 2: Time each family we observed spent with the pediatrician.

For the online survey, participants also estimated the amount of face-to-face time they have with their doctor and were generally slightly shorter than the visits we observed. Just over half of the respondents estimated between 10-20 minutes (51.6%), while most others lasted between 6 and 10 minutes (30.2%). A number of parents from the survey listed waiting or the short time of the appointment for a particularly negative experience they have had with their pediatrician. In fact, their responses to "*The doctor seems to rush me through my appointments*" had more of a negative response than the parents we observed (Avg. = 2.81). However, parents also acknowledged that if they expect the pediatrician to spend a long time with them, they probably have to endure a good amount of waiting, so to them they saw it as a trade-off. Parents and pediatricians had the following comments on timing and waiting:

P-1: "*[the wait] is going to last longer because there are shots to be given. There's nursing prep time. But I'd say face to face time with the patient is probably going to be*

about 15 minutes on average. Sometimes a little shorter if we're getting bombed, you know, and it's an easy well visit and you know the family."

Survey Respondent: "*I wish there was less waiting. I also wish that we could spend even more time. I do recognize that these two desires would actually work against each other.*"

Survey Respondent: "*He is very efficient, but also very hurried. I feel a little pressured to get through my questions quickly or he will be gone.*"

4.6 Parent and Doctor Questions

Most visits consisted of questions asked back and forth between the parent and pediatrician. We coded the interview transcripts to identify the questions that both pediatricians and parents asked of each other through questions. Across the 16 Well Child Visits, we coded 551 questions (Avg. = 34.4, σ = 12.3) asked by pediatricians to the parents and 165 questions (Avg. = 10.3, σ = 9.3) asked by parents of the pediatricians. The number of questions varied greatly from parent to parent, with some parents coming with a list of questions on a sheet of paper to ask the pediatrician, and others asking only one or two clarification questions throughout the visit. The doctors would often encourage questions and the number of questions a parent had often dictated the length of the visit. Figure 3 shows a person-by-person breakdown of the questions asked during Well Child Visits.

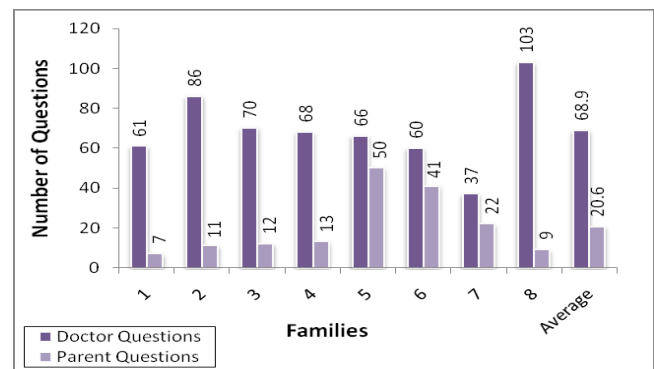


Figure 3: Total number of questions asked by pediatricians and parents across the Well Child Visits observed.

Questions in the observations asked by the pediatricians focused on addressing each of the discussion topics listed above, such as the number of hours the child sleeps per day, what types of food the child is eating, and how many diaper changes per day the child needs. Parent questions mostly focused on clarifications of what the doctor was asking, but some parents went through a list of questions they brought with them, and included questions such as when to switch to solid foods, when the baby should be sleeping through the night, and if it was okay to allow the child to watch television. Of the parents who responded to the survey, 26 (74.3%) stated that they brought a list of questions with them. We also asked parents who completed the survey to list the types of questions they asked of their pediatrician. Below are some of the responses parents from the survey gave, which were similar to the questions asked by parents during our observations:

- *What is the best way to get her to sleep through the night?*
- *My child's lip seems slightly drooped on one side, is that a problem?*
- *What are the best ways to begin potty training?*

- *What could be causing increased tantrums and emotional outbursts?*
- *Is a flu vaccine appropriate?*
- *When is it okay to stop breastfeeding?*
- *Do you have any concerns about his development?*
- *How expensive are the vaccinations?*

Several participants mentioned a level of comfort with asking their pediatrician these types of questions directly, rather than trying to find the information on their own. We did observe several instances where parents mentioned to the doctor looking up something on the Internet or asking a friend or family member for advice. Thus, they would ask the pediatrician to confirm whether or not the advice they received was sound.

4.7 Tensions

Many parents reported having positive interactions with their pediatrician, but we still observed some tensions between parents and pediatricians that came out of our analysis. We observed a number of disagreements about parenting techniques. The doctors we observed held the view that children should be weaned from breastfeeding at around 1 year of age, that parents and children should not be sleeping in the same bed together, and that parents should sometimes allow their child to self-soothe, so as not to reinforce negative behaviors. Some of the parents we interviewed disagreed with these recommendations and if so, would often disregard them. This possibly stemmed from the parent believing that they know their child better than anyone else and that the doctor was making recommendations based on an average child. Two parents commented on this:

Mother, Family 1: *“I do trust her advice. Sometimes I do feel like – not that she reprimands, but sometimes I feel just maybe no one understands unless they’re with this baby, like, as much as I am.”*

Survey Respondent: *“I am not interested in parenting advice from my ped (sleep schedules, etc.). It is important to me that my intuition and knowledge when it comes to my children be respected.”*

Some of the parents expressed a desire for the pediatrician to better explain their motives for making certain recommendations, especially when parents had disagreements about parenting techniques. For example, parents wanted to know the pediatrician recommends that a parent stop nursing by the time the child reaches 1 year, why they should skip a “sippy” cup, or why they recommend that children under the age of 2 not watch television. Sometimes parents would ask the pediatricians why they made this recommendation, to which doctors usually gave helpful answers, but sometimes parents would not think to ask why until after they had already left. One parent felt like they might be arguing with the doctor if they challenged her on her reasons why:

Mother, Family 1: *“[She said] ‘You need to get him off baby food,’ and on the way home [husband’s name] and I were saying, well, you know, ‘Why?’ and I didn’t want to push the subject because I don’t want to spend all day arguing with her about it, but you know, when it’s good for him, why should I give him something crummy that I’m eating because I have no self control?”*

One parent we observed, the mother of Family 5, had requested that her child receive vaccinations on a schedule that is different from what the pediatrician’s office had recommended. Her older son had been thought to have a mild form of autism while he was

younger, and she had read online about how vaccines may cause autism. This alternative schedule required her to bring in her child more frequently than typical parents. Although the pediatrician allowed this, they still had disagreements during both visits we observed about the reasons for doing this.

P1: *“Alright. So now we need to talk about immunizations. The immunizations today are the MMR, that’s measles, mumps, and German measles. It is safe.”*

Mother, Family 5: *“I know it is.”*

P1: *“There is absolutely no scientific evidence...”*

Mother, Family 5: *“I’ve still got this thing...Until we can tell – I know it’s probably true, but after what I went through with [older son’s name], I’m just nervous. And until they can tell me what does cause it, I’m just going to space them out.”*

Another of the parents (Family 6) had requested advice on an alternative vaccination schedule as well. Pediatricians expressed concern about this trend and blamed the Internet for the spreading of misinformation. However, if the parent wanted to do something that made them feel more comfortable and it did not put the child at risk, such as an alternative schedule, they were typically happy to comply. The pediatrician stated they would respond differently if the parent had requested to forego vaccinations altogether.

In our interviews, several parents reported that sometimes they feel guilty when going to the pediatrician’s office because they were worried about being good parents and that the pediatrician may judge them. Sometimes they may hold back information if they felt that they might get reprimanded. Although not referring to her current pediatrician, one parent reported disliking a former pediatrician for making her feel like she was in trouble for not knowing her child was ready for the next step in development, which made her reluctant to share things:

Mother, Family 8: *“It’s not that we didn’t care for him, but that just... I felt more like I was in trouble for stuff, you know? He was real little, and I think it was over sippy cups or something. And I’m like, “Okay. I just didn’t know it was time for that yet.”*

The pediatricians we interviewed were sensitive to this and used strategies to put the parent at ease and provide advice in a neutral, non-scolding fashion, or say “the American Academy of Pediatrics recommends...” They also tried to pick their battles wisely and only persuade parents to change their mind on topics that potentially had serious consequences, such as in the above case with vaccinations.

5. DISCUSSION

We uncovered a number of findings that help provide a broad picture of the nature of Well Child Visits. We found that there is currently very little technology being used and participants saw room for technology to help improve the process. Participants in our study believed positive parent-pediatrician interactions were important to children’s health and wanted to strengthen them as best as they could. In addition, time with the pediatrician was seen as valuable, and many parents wished they could spend more time with the pediatrician and less time waiting. Thus, improving the efficiency of visits is a good goal for any information technologies. We also found that a large amount of information is shared between the parent and the pediatrician in a short amount of time, and parents are requested to recall specific details about their child on the spot during the visits. Technology that can help

begin to address these challenges would be welcome and should be explored. In this section, we present a discussion of design opportunities for this space, discuss examples of how interactive technology might fit into this space, and then discuss study limitations.

5.1 Design Opportunities

Health technology designers have the opportunity to address some of the challenges in ensuring that young children are healthy and developing normally. As a result of this study, we uncovered a number of design opportunities for interaction designers when designing for this space. Below we outline opportunities for technology designs that can fit into the environments we studied and support parent-pediatrician interaction. Many of the technology ideas were discussed in the focus group with the pediatricians, suggested by parents, or were ones we developed based on findings from the study. Although many of these make sense for other doctor-patient interactions, there are some special considerations for the specific interaction between parents and pediatricians.

5.1.1 Tracking Information

Parents and pediatricians exchanged a large amount of information between one another in our study. We were surprised by some of the details pediatricians expected parents to remember, such as the quantity of food consumed, the number of words the child knows, and the numbers of hours of sleep the child gets per day. Parents tried to estimate these numbers as best as they could, but still had some difficulty remembering specific amounts. Tools that can help parents to record and update their child's data and easily access it during visits would help smooth this process. Technology could help record vaccinations, developmental milestones, nutrition, sleep and naps, and the other common discussion topics we observed during visits. Projects like ENSURE [23] and Baby Steps [16] are good starts in helping to achieve goals set in Well Child Visits, but this line of research can still be explored further. Tools that help parents record information or tips pediatricians give them for their first child that may be helpful for their second could make visits more efficient. These tools should also allow for different parenting techniques, as patients may disregard or stop using them if they do not agree with the recommendations. They should use suggestions, rather than requirements, and allow for ignoring of features or suggestions that conflict with parenting style. In addition, parents should not be made to feel guilty for not adhering to strict rules or for slipping behind sometimes, as all parents will naturally do this due to their busy schedules.

5.1.2 Involving all Members of the Family

In our study, as well as the studies of others [10], we found that mothers were primarily the main ones involved in the child's health. Technology designs could be a way of engaging other family members in the process, by making data collection more of a fun or social activity or something that can be done remotely while parents are at work. Integration of pediatric health records, such as a baby's height and weight or developmental progress, into more socially-oriented technologies such as Facebook.com or Twitter.com may provide a natural incentive for involving both parents. These technologies are often used by both genders, and thus could be more inclusive of the whole family.

5.1.3 Utilizing Downtime and Involving the Child

Because parents spend a significant amount of time waiting during a visit, this time could be used for parent education or

preparing for the doctor's visit, such as reviewing an agenda or reminding of potential questions. The parent is often watching her child during this time, however, so any interactions should be simple and brief. In addition, children are often front-and-center during visits both by being examined by the pediatrician or nurse and being watched by the parent. Any technology should account for their presence and make sure they are not ignored when the parent and pediatrician are interacting. We should note that the children we observed were fascinated by everything in the exam room and would play with anything they could get their hands on. Thus, any technology within reach should withstand dropping or putting in the mouth, or else be ubiquitous enough to not attract the child's attention. For example, with a durable, specially designed hand-held information appliance and software, parents could spend downtime researching their questions, browsing recommendations for new ones they might ask, and finding supporting evidence for discussions they would like to have with the doctor, such as about alternative vaccination schedules. The child will also need to be involved while parents are browsing for information, so the appliance could also have colorful pictures and animations, such as an animated aquarium around the screen border, for the child to watch as the parent browses for information. The device would also have options to print or send information to an email address. During the visit, doctors could use it to provide on-demand information for parents based on topics that come up during the discussion to show the reasons for recommendations.

5.1.4 Promoting Balance in Interactions

Our analysis showed that parents ask far fewer questions than they are asked of by the pediatrician. In addition, parents reported that there were many times when they had wanted to ask a question to the pediatrician, but forgot to bring it up during the visit. The parents who brought in question lists found them helpful, but sometimes forgot or lost them. Thus, we envision designing an interactive tool that could help prompt parents to create and maintain question lists. This could be a simple mobile phone application that allows parents to maintain lists in a single location and prompts them for ideas for questions they may ask that are appropriate for their age. This application could be context-aware and prompt parents to ask questions based on their current location, the proximity to other users, or the child's age. It could also allow for emailing questions directly to the pediatrician or answer-nurse if they could not wait until the next visit. Technology can help to level this playing field, either by allowing parents to pre-answer factual questions or prepare their own questions, in advance. This can help make visits more conversational and lead to a more comfortable interaction between the parent and pediatrician.

5.1.5 Improving Parent-Pediatrician Interaction

Doctors in our study felt more confident in parent responses when they knew the patients' history, family life, and previous experiences. We believe there is an opportunity for technology to help strengthen this relationship, as social networking tools have strengthened other types of relationships. Technology that could record not just medical facts, but also personal information about parent ideology, work-life balance, and personal attributes could help pediatricians remember specific conversations with individual parents. Parents also appreciated pediatricians who had their own children and could share personal experiences of parenting. Thus, finding ways to allow parents and pediatricians to connect on a personal level can help strengthen this bond.

Allowing any information entered into a system to be transferred to a new pediatrician's office should the parent move would help to quickly establish new relationships. Parenting styles vary widely, and thus technology should help both sides come to a common understanding when some of the tensions we described in the results arise. In addition, because Well Child Visits are one of the most routine visits in all of medicine and are planned and expected, technology can anticipate upcoming visits and milestones and help parents plan more in advance. Because of the frequency of the visits, technology can account for the pediatrician and parent already being familiar with one another and go deeper into discussions surrounding pediatric care.

5.2 Future Research Opportunities

Although we provide a broad view of Well Child Visits and used a variety of methods, further research can be conducted to cover a more complete picture of parent-pediatrician interactions. For one, the views we present are very U.S. centric, as we conducted all studies with parents and pediatricians who currently reside in the U.S. In other countries, there is a different culture of the nature of pediatricians' offices, such as the use of midwives for developmental screening in the United Kingdom. Second, although our survey respondents were balanced across other demographics, our sample size was skewed toward people with higher education and income levels. Thus, future work should focus on individuals with lower socio-economic status and how technology might be able to help these families as well. Also, many of the reports were from mothers, and all of the pediatricians we observed and interviewed were female as well. Finally, Well Child Visits with pediatricians, while most common for parents in the U.S., present a more medically-focused view of children's health. Future work may include identifying ways to support interactions with naturopaths and midwives.

6. CONCLUSION

In this paper, we presented the results from a triangulated, qualitative study of parent-pediatrician interaction in the United States. Using observations, interviews, focus groups, and an online survey, we were able to provide an account of the nature of Well Child Visits and parent-pediatrician interactions. Our work uncovered the topics discussed at Well Child Visits, the amount and types of questions asked by both parents and pediatricians, the timing of visits, and tensions that may arise between parents and pediatricians. By providing a broad understanding of these visits, we were able to describe how technology might support families and pediatricians to make their interactions more effective. The information provided here provides an accurate picture of this important domain, and with it, designers can have the confidence to build systems that are grounded in empirically validated design recommendations. Moving beyond this study, we will design, build, and evaluate some of our technology ideas to test whether they could truly help strengthen the interaction between parents and pediatricians. We also will explore this topic with other populations beyond the ones we studied, such those in other countries, people exploring alternative health care methods, and people from different socio-economic status. By enabling parents and pediatricians to interact better and work better together, parents can have the tools necessary to ensure that their children are on track developmentally, or even help detect problems earlier so they can be addressed in the best possible manner.

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