

“Am I doing this all wrong?” Challenges and Opportunities in Family Information Management

SHRUTI SANNON, Cornell University
 MIHAELA VORVOREANU, Microsoft
 KATHLEEN WALKER, Allovus Design
 ADAM FOURNEY, Microsoft

Running a household requires a large amount of labor, from ensuring multiple bills are paid to organizing important documents. Failure to manage such information can have critical consequences for the financial and psychological well-being of the family; however, little is known about how families manage the full scale of information encountered in the home. In this paper, we introduce *family information management* (FIM) as a set of overarching practices involved in managing and coordinating household-related information. To understand how families engage in FIM, we conducted in-depth interviews with members of ten families, which included guided tours of their information archives. We found that families struggle to organize, store, retrieve, and share information, and that there are significant socioemotional costs to this work. We propose opportunities for designing technologies to support FIM and argue that, given the numerous challenges and unmet needs, the understudied area of FIM deserves further investment of research and design efforts.

CCS Concepts: • **Human-centered computing** → **Empirical studies in collaborative and social computing**.

Additional Key Words and Phrases: information management; coordination; families; households

ACM Reference Format:

Shruti Sannon, Mihaela Vorvoreanu, Kathleen Walker, and Adam Fourney. 2020. “Am I doing this all wrong?” Challenges and Opportunities in Family Information Management. *Proc. ACM Hum.-Comput. Interact.* 4, CSCW2, Article 138 (October 2020), 28 pages. <https://doi.org/10.1145/3415209>

1 INTRODUCTION

A lot of effort goes into running a household, such as making sure bills are paid, organizing and storing important documents, and coordinating family members’ activities. These tasks require a large amount of labor that can often go unrecognized [21], and involve managing a broad range of information from multiple sources.

HCI researchers have examined multiple aspects of information management and coordination in the home [23], such as how families manage shared calendars [46], navigate the completion of errands [62], and share passwords and devices [56]. This research often focuses on particular instances or types of household management, such as coordination around activities. However, families have multiple types of information management needs, and these likely have a compounding effect on family members’ time and resources. Moreover, the proliferation of technologies in the

Authors’ addresses: Shruti Sannon, ss3464@cornell.edu, Cornell University, Ithaca, NY; Mihaela Vorvoreanu, mihaela.vorvoreanu@microsoft.com, Microsoft, Redmond, WA; Kathleen Walker, kathleenw@allovus.com, Allovus Design, Seattle, WA; Adam Fourney, adamfo@microsoft.com, Microsoft, Redmond, WA.

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2573-0142/2020/10-ART138 \$15.00

<https://doi.org/10.1145/3415209>

home likely further complicates people's choices in how they manage various types of information. Thus, we believe there is value in understanding how families manage the *entirety* of information involved in running a household. In this study, we take a holistic approach to understanding the ecosystem of household information in terms of the types of information that are involved in running a household, how the sheer breadth of such information is managed, and the techniques and technologies people use in the management of this information. This approach enables us to form a comprehensive picture of the nature of household information work, its associated challenges, and opportunities for innovations to support it.

Extensive work has examined how information is organized, stored, and retrieved in the contexts of personal information management (PIM) and group information management (GIM). These bodies of research have covered a lot of ground in terms of understanding the challenges in managing information (such as information fragmentation [41] and information overload [35]), as well as people's organizational practices (such as their preferences for piles versus files [50] and folders versus tags [18]). GIM finds that people navigate several additional challenges when managing information in groups, including privacy concerns about keeping their personal information protected [49] and issues around collaboration [60].

However, while research on PIM and GIM are useful starting points to understand how information is managed in family settings, they do not adequately capture the dynamics posed by household contexts in three ways. First, while PIM focuses on how individuals manage their own personal information [4, 6], family contexts involve multiple stakeholders, and information may be managed by or have consequences for one or more family members. Though GIM examines how groups collaborate in managing shared information, these studies focus on issues in the workplace, where relationship dynamics are quite different from the home [19]; for example, privacy concerns in group collaborations are more salient at work than in the home [24].

Second, maintaining and nurturing interpersonal ties is a primary goal in the family [31], and thus, there may be a range of yet unexplored motivational and socioemotional factors at play in family settings that influence information management, as compared with the functional work that is characteristic of PIM and GIM.

Third, breakdowns in information management within the home are likely to have different impacts as compared to information management in the workplace. For example, inefficiencies at work can hamper productivity and corporate profitability [28], whereas it is not yet understood how inefficiencies at home may impact the family ecosystem.

Understanding the unique challenges posed in the household context can help design technologies to aid this form of information management, potentially easing the cognitive burden posed by these tasks and increasing well-being [37]. To this end, we introduce the term *family information management* (FIM) to represent the experiences and practices involved in managing household and family-related information, ranging from how families pay household bills and where they store their important documents, to how they coordinate and access shared itineraries and files. Managing household information is likely the responsibility of primarily one family member, but affects the entire family [40]. In this way, while PIM can be thought of as being performed "by an individual, for an individual," and GIM can be thought of being performed "by a group, for a group," we expect that FIM is mostly characterized as being performed "by an individual, for a group." How these differences in responsibilities impact coordination around FIM is still an open question.

In this study, we conducted in-depth interviews with individuals from ten families about how household information is managed in their homes. The interviews were conducted in participants' homes to allow for extensive guided tours of participants' information archives, including their digital information (such as their apps, devices, and local/cloud storage) and their physical information (ranging from papers on kitchen counters and in bedroom drawers to boxes in attics and

garages). Drawing on this rich set of data, this paper’s contributions are twofold: 1) we provide an understanding of the motivations, processes, and challenges involved in managing household-related information, and propose that FIM is a unique context with a distinct set of practices and challenges that warrants attention from the HCI community; and 2) we put forth a set of design opportunities for technologies that can support FIM in the home.

2 RELATED WORK

Although PIM studies focus on individual practices and GIM studies often focus on the workplace context, these rich fields are useful starting points for shaping our understanding of what challenges families might encounter as they manage household information. In this section, we begin with an examination of these two research areas, and then turn our attention to research that has focused specifically on household and family contexts.

2.1 Personal Information Management

PIM focuses on how people acquire, organize, retrieve, and maintain the information they encounter in their daily lives [39]. Jones and Maier posit that one of the ultimate goals of PIM is “to have the right information at the right time to meet our needs” [38, p.1]. Similarly, Bergman and Whittaker explain PIM as a process of curation for one’s future self, where the goal is to anticipate future information needs, and to help oneself find and access the information when it is needed [6]. Extensive research has examined the many challenges in PIM that stand in the way of these goals.

One of the main problems in PIM is that of information fragmentation [41]. Information is often split across many different tools, devices, locations, and forms (such as paper or email), which complicates and protracts future retrieval [3], and places a cognitive burden on users to manage multiple different organizational systems in parallel [12]. While we suspect that information fragmentation is a burden in the family context as well, how it manifests and its pragmatic and socioemotional consequences for family members are yet unknown.

Information overload can also significantly contribute to the cognitive burden of PIM, overwhelming and hampering people’s decision-making [35]. This cognitive burden can also play a role in how people organize their information [50]. For example, there are several points in PIM where people have to make decisions about their information, and incorrect decisions about whether to keep or discard certain information can be costly [34]. Further, when encountering useful information, people can be unsure about how or where to store it, and can also forget the information (or how to retrieve it) when they need it in the future [17]. Prior work has identified several factors that complicate the retrieval of files, such as the size of people’s collections, their workload, and properties of the file itself, including when it was last retrieved [5].

There are also many individual differences in how people engage in PIM [20]. People’s habits impact how they organize information. For example, research has examined how to design for pilers versus filers [50], as well as people’s preferences for folders versus tags [18]. People also vary in their use of technology in PIM. Jones [36] distinguishes between information warriors and worriers: those who invest time strategically in technology to manage their information, versus those who are uncertain about their technology choices and worry that they could be doing better at managing their information. People also often fall into two extremes in terms of how they approach data preservation, where they either store large amounts of data long-term or choose a more minimalist approach [71]. How these individual differences play out in the home – particularly given that the home comprises multiple family members – remains an open question.

Researchers have put forth several strategies that could aid PIM challenges. Notably, Bergman and Whittaker propose the user-subjective approach, which advocates for organizing information according to its subjective importance and usefulness to each individual user [6]. As Bergman

explains, this approach takes advantage of the fact that, in PIM, the user who stores information is the same as the user who later retrieves it [2]; thus, an individual's organizational system can benefit from being highly subjective and contextual. However, in the context of FIM, there are many scenarios where an individual may need to access information that was stored by a different family member in the home, which may warrant a different approach to information organization.

Several tools have also been developed to help tackle the challenges in PIM (e.g., [25]). However, these tools can themselves require effort to organize and maintain in addition to the processes they are designed to help [37]. Because tools to aid PIM are designed to address specific contexts and applications, they are often inconsistent with each other. Thus, people often have to use multiple tools in parallel, which further exacerbates information fragmentation [12]. In response to this issue, Boardman et al. call for a cross-tool perspective that focuses on improving support and integration across multiple PIM tools [12]. Karger puts forth several suggestions for how personal information could be better unified, such as using metadata and standard data types to improve integration [41]. Finally, PIM tools need to match people's preferences, and people can vary in terms of whether they prefer PIM tools that afford them complete control or that automate much of the decision-making process [72]. It is not yet understood how these technological solutions might address the information management needs and challenges that arise in the home.

While PIM is a useful starting point to understand the kinds of challenges that are likely to arise in organizing information in the home, it has traditionally focused on individual practices, particularly for professional users in workplace settings [12]. Thus, we next look at what is currently known about how groups collaborate to manage shared information.

2.2 Group Information Management

Research on GIM provides insight into how people collaborate on shared information. GIM is the study of how groups manage, store, retrieve, and maintain shared information [49]. There are often multiple owners and forms of governance in GIM [1] because people can produce information for others' use but also consume information created by others [51].

As with PIM, GIM research has focused primarily on workplace settings and identified challenges that center around issues of privacy, trust, and coordination. Group members can have different incentives to share or withhold information from the group. For example, managers may want to see employees' availability while employees may want to hide this information to protect their privacy [49]. Accordingly, privacy is a main concern in GIM [24] as users balance the need to share information with the need to control its dissemination. In contrast, this emphasis on privacy is likely to be less important in family contexts, where interpersonal relationships already have an intimate level of trust. These dynamics likely impact how families coordinate compared to the workplace; for example, it is common practice for family members to share devices and even passwords with each other [56].

GIM research has also identified several challenges people encounter when coordinating and sharing information in a group. Group members can be unwilling to contribute to shared resources [33], and they can disagree about how best to organize shared repositories of information [9]. They can also be hesitant to prune or edit information owned by others, and instead primarily access only files that they own [60]. Retrieving shared information can also be difficult, particularly as strategies to find individually owned information may not work in a group [9]. Finally, when storing shared information, people may have to expend additional energy preparing it for re-use by others. Similarly, when others access shared information, they must put effort into recontextualizing and deciphering it [1]. Many of these challenges focus on workplace settings and collaboration on shared projects (e.g., [60]), and it is unclear whether and to what degree these challenges translate

to the context of the home, where the nature of the information being managed, motivations for management, and relationships and communication patterns among actors are quite different.

Failures in GIM can be costly in terms of time and energy, resulting in duplication of effort, poor decision-making, and, ultimately, reduced profitability [28]. However, while we can presume that in the home context such failures may also be costly in terms of time and energy, we currently lack an understanding of their specific nature and consequences on the family system.

2.3 The Household Context

The household is a markedly different context in which to study information management and coordination, compared to the workplace [19]. The home has less organizational structure and prioritizes individual interests [49]. Responsibilities may not be clearly delineated in households; multiple family members may take on informational management roles, which in turn may have consequences for other family members. Existing research on information management in the home finds that information practices can involve either one or multiple family members, though often one person takes on the role of the primary information manager and others play supporting roles [40].

Domestic spaces are also both functional and emotional [45]. Families have socioemotional motivations and considerations as compared to the typically functional work conducted in the workplace, as managing interpersonal relationships is one of the main priorities in the home [31]. Conducting household-related informational work can be a way of expressing support for family members, and can also allow family members to feel like they are contributing members of the family [43]. Similarly, socioemotional factors can impact how families store and manage information. For example, families often store both functional and sentimental information [49], and unlike the workplace, these can be stored in a number of places in the home ad hoc, such as on notes on refrigerators [64]. The differences between the workplace and the home can also complicate how household interventions and tools are evaluated – while productivity and efficiency are useful measures in the workplace, they are not as useful in the home [19].

Traditionally, information management in the home has relied on paper, and has taken place in highly visible common spaces such as the kitchen [49]. As technologies have moved from the workplace into the home, this has changed, and information management practices in the home warrant closer study. Gaver cautions that context-sensitive approaches are needed to understand how these technologies are appropriated in new contexts [27], such as the home. People can use tools in very different ways in the home as compared with the workplace. For example, while calendars in the workplace are individually owned and used to coordinate events with coworkers, family calendars are used instead to generate shared awareness of family members’ schedules [46, 54]. Similar to work on family calendaring, researchers have studied other coordination and collaboration practices in the home, including device sharing (e.g., [30, 52]), password sharing (e.g., [56]), the completion of errands [62], and financial management [43, 61, 73]. However, there is still limited research on how families manage the entirety of information that is involved in running a household.

CSCW and HCI researchers have examined multiple types of information management in the home, such as how households manage financial information, health information, and more.

Managing financial information is a key component of broader information management in the home. Prior work indicates that managing money is a collaborative process in the home, and that family members are delegated specific roles and responsibilities [61]. The systems families develop to manage their finances draw on both physical and digital tools, reflect familial routines and relationships, and are deeply embedded in the social processes of the home [73]. Vyas et al. [73] argue that familial financial management is shaped by domestic routines, and that the design

of any tool must put these routines at the forefront. There is likely overlap between these findings around financial management and the management of other types of household-related information, though it remains to be seen to what degree this overlap exists and what this means for the design of FIM technologies more broadly.

Health information management is another large aspect of information management in the home (e.g., [59]). Such information management work can elicit strong emotional responses that can be a barrier to organizing information. For example, a study on how people with cancer manage health information found that they are overwhelmed by the sheer accumulation of information (such as bills) entering their household, and the task of organizing information often seems insurmountable [67]. Similarly, in a study on how families with young children manage health information, Palmen, Korpela, and Saranto found that families struggle with health information storage and retrieval, and the authors call for more usable personal information systems for the home [55]. Pina et al. argue for a shift from focusing on personal informatics to family-centered informatics when studying healthcare in families, finding that the family context can have additional needs that are missing in the context of personal health informatics [58]. Similarly, due to the interpersonal dynamics at play in the home, Moen and Brennan argue that a sociotechnical approach is needed to study how health information is managed in families, even when one family member is primarily responsible for such information [53]. In this study, we make a similar argument that the family context may raise new issues for information management that are not fully captured by studying PIM.

Given the diversity of information and activities involved in running households, research is needed on how the breadth of this information is managed in families. Research on information management in the household has focused on more circumscribed contexts, such as how families manage health information. To address this gap in knowledge, the goal of this study is to examine a broader spectrum of information work that occurs in the home. Our study is a step towards developing more usable information management systems that can help families navigate the information work that is involved in running households.

3 METHODS

We investigated the practices, pain points, and unmet needs of FIM by conducting extensive home visits with members of ten households, which included an in-depth interview, guided tour, information inventory, and retrieval exercise.

3.1 Recruitment and Procedure

We recruited participants from a large metropolitan area on the West Coast of the United States through a research participant database and social media advertising. We used criterion sampling, as we wanted our participants to be technology enthusiasts who are interested in personal productivity and are actively involved in managing their family's information. We used a screening survey to ensure participants fit those profiles and were between 18 and 55 years old. We reasoned that participants who are enthusiastic about using information technology would be able to help us understand and advance the most current state of FIM. The screening criteria for technology enthusiasts included questions such as "I frequently try new technology/products before other people do," "I will try new technology if it will help me be more productive," and "Technology helps make the world a better place." Knowing from previous research [40] that usually one family member is the primary manager of family information, we decided to conduct individual interviews with people who self-identified as such.

The home visits were structured in four parts: 1) an information inventory; 2) an in-depth interview; 3) a guided tour; and 4) a series of information retrieval exercises. First, we asked participants to go through an information inventory, where they recalled the different types of

household-related information they managed, such as health records for the family, car maintenance records, bill payments, legal documents, tax-related documents, receipts, pet information, travel records, passwords for shared accounts, and contact details for household-related entities (such as doctors, plumbers, and teachers).

Next, in the in-depth interview phase, once participants had established the range of information in their household, we asked them questions about the practices, processes, and roles for managing each type of information. The interview guide included questions about what and how information is organized and stored, the techniques and technologies they currently use to manage information, and how other family members coordinate or access this information. We also asked participants about any challenges they faced in managing family information.

Then, participants were asked to provide us with a guided tour [36, 66] of both their digital and physical information archives, such as on their digital devices, as well as their physical desks, cabinets, closets, and so on. Guided tours allow for richer detail and can generate insights that may not be uncovered in interviews alone [66]. The tours gave us a firsthand experience of participants’ FIM practices in situ, and also allowed participants to expand on their FIM needs and challenges as they showed us their archives and explained their organization. During the tour, we probed participants on how they organized and maintained these archives, how they used them, and about the frequency and rhythms of their activities.

Finally, during the information retrieval exercise, we asked participants to walk us through how they would go about retrieving different types of information. We asked participants to find three types of information: 1) a due date (e.g., for a child’s vaccination, or the date when one’s car registration expires), 2) a document (e.g., a warranty record for an important household item, or a marriage certificate), and 3) a password-protected piece of information (e.g., an online bank account). This exercise allowed us to follow their thought processes as they considered where any given information would be stored and how to retrieve it, as well as to witness failures and successes in retrieval.

On average, interviews lasted 85 minutes, with the shortest one being 50 minutes and the longest one 127 minutes. With participants’ consent, we took video recordings of the interviews and guided tours. As participants showed us their personal information storage systems, we asked for permission before recording archives on video, taking care throughout to ensure that we did not record sensitive information. Participants were compensated \$200 USD for their time, which is a common amount in industry studies, based on a sample of 25,000 qualitative sessions last year [14]. This amount was established in consultation with Microsoft Research’s Institutional Review Board (IRB), and took into consideration the length and nature of the interviews, the intrusion of home visits, cost of living in the Seattle metropolitan area where the interviews were conducted, and the socioeconomic status of technology enthusiasts. All procedures were approved by the IRB at Microsoft Research.

3.2 Analysis

Due to the lengthy and comprehensive nature of the home visits, the data we collected from each participant were particularly rich. After the fourth interview, we began noticing recurrence in the major patterns of how information is managed and the challenges it poses, indicating that we were reaching theoretical saturation. The following six interviews confirmed these patterns, revealed minor variations, and added more richness to the socioemotional factors involved in this work; no further major concepts emerged.

We analyzed 840 minutes of video recordings, more than 400 pages of interview transcripts, inventory lists, and notes from the retrieval tasks. We conducted a thematic analysis of our interview transcripts [13] in three rounds. In the first round, the two authors who collected the data watched

the interview videos, read the transcripts, and analyzed the data collaboratively. These two authors conducted a literature review before analysis. In the second round of data analysis, a third author independently examined the data without preconceived notions about prior work in the research areas of PIM, GIM, and FIM. This allowed us to account for our own subjective positionalities as researchers and to be more certain that our findings were rooted in the data. After the second round of analysis, we reconciled the open codes and categories. When all authors agreed on these categories, we developed a codebook, and the same author who conducted the second round of analysis went through the transcripts a third time, applying focused codes throughout the dataset. To ensure multiple systematic checks on the analysis [48], all authors met regularly to discuss the codes and themes that emerged in the data.

3.3 Participants

We interviewed members from 10 families who had self-identified in the screening survey as the primary managers of household-related information in their households. Participants ranged from 28 to 54 years old, with an average age of 39 years. Five participants identified as women, and five as men. In terms of race, five participants identified as White, three as Asian, one as Black, and one as biracial (Asian and White). Five participants held bachelor's degrees; three had graduate degrees; one held a degree from a trade school; and one had attended some college without receiving a degree. Seven participants were employed full-time in fields ranging from finance to programming, two were stay-at-home parents, and one was retired and volunteered for a non-profit organization. The majority of participants (eight) earned a household income of \$100k or more.

Participants represented different types of families, including young newly married couples without children, couples with children of varying ages in the home, and older "empty-nesters" whose children had left home. All participants except for one were married. There were two to five family members living in each home, though participants also talked about information management related to family members who did not live in the home, such as older children and parents.

4 FINDINGS

Our findings are organized into three main themes: 1) how household-related information is triaged, stored, and retrieved in the home; 2) how family members coordinate with each other to manage household-related information; and 3) how socioemotional factors influence these practices. Our findings are based on themes that occurred frequently in the dataset.

4.1 The Three Stages of Managing Information

PIM research characterizes information management as a process of curation involving three stages [6]. In this section, we illustrate how activities and challenges in these stages manifest in the family context. We found that much of FIM involves navigating household-related information through a *triaging* process that involves a number of organizational decisions when information first enters the household. These decisions impact both how and when the information is *stored*, and the process of *retrieving* information at a later stage. In this section, we discuss how the three stages of information management – triage, storage, and retrieval – play out in the context of families and households.

4.1.1 Triage. When information first enters the home, it goes through triage, in which participants make decisions about what to keep, for how long, and where [6]. Each of these decisions can be painful, and as in other contexts, incorrect decisions at this stage can be costly down the line

[34]. Participants struggled with determining whether information crossed a certain threshold of significance requiring storage or future access:

“Well, I don’t know what I need to hold on to. Well, I shouldn’t say that. I hold onto the things that I need to dispute or question, or something like that. [But] I don’t know if I should hold onto them for history, you know, in case, you know, a year later, all of the sudden, maybe the insurance says no?” (P8)

As in P8’s example, incorrect decisions about whether to keep or discard information could have tremendous impact on the family’s well-being and financial affairs. Decisions about whether items were worth keeping were particularly relevant to physical documents, as they required more effort to place in storage and took up often-limited physical space.

For both physical and digital information, participants had to contend with several organizational decisions that impacted whether information was kept or discarded. When storing information, participants took care to categorize based on a preexisting ontological model. In the case of physical documents, location was often a way to categorize and store information; for example, we found that car-related information (such as service records) was often kept in the car’s glovebox. However, participants struggled with triaging both physical and digital information that defied easy categorization, such as a one-off receipt for a big purchase. Prior work finds that small bits of information that are hard to categorize can elude organizational efforts [10]. Such items often ended up in “miscellaneous” digital folders or physical drawers, a solution perceived as imperfect and frustrating:

“One of the worst things has been ... not having a place for stuff to go ... I’ll find something and I’ll be like, I want to keep this but there’s not a neat place to put it. So I end up ... throwing it in the Home folder, which bothers me. But that’s just how it is.” (P1)

Information management poses a cognitive burden on people [21], and each decision at this stage required additional effort that our participants would rather not expend. Some coped with the onslaught of information by choosing to discard documents rather than figure out how to store them. For example, some participants used to keep copies of their paper receipts, either in physical form or digitally via photographs on their phones, but had stopped doing so to avoid organizing them.

For digital information, participants were able to reduce the cognitive burden by using tools to passively triage incoming information; for example, participants described using autofiltering and tagging options to passively manage information that arrived by email. This was seen as a way to avoid paper, with the added benefit of automatic categorization:

“Everybody probably has had the experience of somehow a paper receipt getting lost between when you walk away from the store and getting home... So then Home Depot’s receipts come in and Gmail knows to put a label on it in my receipts file with my subcategory Home Depot.” (P4)

That said, paper could also have some advantages over digital information in the triage stage. While painful to triage, physical documents were also less easy to dismiss than digital information (such as email). Physical documents could serve as tangible reminders for participants to complete or monitor specific information-related tasks. For example, P7 chose to receive paper utility bills instead of opting for autopay, despite the latter being more convenient:

“If we had it on automatic payment, we kind of forget about it and then there would be all these fluctuations [in costs] and we would have no kind of visibility into that. So, that’s why my wife likes to get the paper bill.”

This echoes previous PIM findings about the importance of ensuring actionable items are visible. In PIM, one strategy for ensuring items’ visibility is to leave actionable files on the computer’s

P#	Spreadsheets	Note-taking mobile apps	Camera apps or traditional scanners	Cloud storage	External hard drives	Online accounts	Email as a repository	Dedicated FIM (e.g. Mint)	Autopay	Total across technologies
1	Y	Y	Y	Y	N	Y	Y	Y	Y	8
2	Y	Y	Y	Y	N	Y	Y	Y	Y	8
3	Y	Y	Y	Y	Y	Y	Y	Y	Y	9
4	Y	N	Y	Y	N	Y	Y	Y	Y	7
5	N	N	N	Y	N	Y	Y	N	N	3
6	N	Y	N	N	N	Y	Y	N	Y	4
7	N	N	Y	Y	N	Y	Y	N	N	4
8	N	N	Y	Y	Y	Y	N	N	Y	5
9	Y	Y	Y	Y	N	Y	Y	N	Y	7
10	N	Y	Y	Y	N	Y	Y	N	Y	6
Total across participants	5	6	8	9	2	10	9	4	8	

Table 1. Breakdown of the various types of digital technologies used by each participant for FIM purposes (“Y” indicates that participants do use the technology, and “N” indicates that they do not)

desktop [8, 11], or to use reminders [6]. Our findings show that these strategies can take different forms in the household context. For example, we found that participants used makeshift ways to implement visibility and reminders, such as opting to get important bills delivered in the physical mail so that they would remember to check them.

Overall, participants were overwhelmed by the continuous onslaught of information pertaining to the household, and triaging this information required time and cognitive effort. Digital and physical information were both seen to have benefits and downsides: while digital information could be easier to parse (for example, through filtering mechanisms), it was also easier to dismiss than physical information; in contrast, while physical documents could serve as tangible reminders for future tasks, sorting and storing them could be difficult.

4.1.2 Storage. Most participants experienced information fragmentation because their information was stored in a wide range of places in the home, both digitally and physically. P1 described this fragmentation by saying, “*There’s so many islands of information. I wish everything was kind of one place, where it’s searchable, but it’s not.*” Unlike in the workplace, with its dedicated tools and spaces for information tasks and storage (such as a work desk or a filing cabinet), the paper “islands” in the home were extensive and pervaded many spaces that may not traditionally have been designed for information storage. For example, P10 would store incoming mail on the kitchen counter, and temporarily place receipts in a kitchen drawer; meanwhile, bills and insurance policies were stored in a drawer in the family office, and older paperwork was filed in an entryway closet. Finally, her passports, immigration documents, and warranties were kept in drawers in the master bedroom.

Participants also wrestled with digital “islands,” as their digital information was fragmented across different apps, cloud services, and devices. All participants used online accounts, such as through online banking, to access household-related information, nine participants also stored such information on cloud services, as well as used their email as a repository to filter and find information such as past bills, and the majority used note-taking apps to keep track of household-related information. Each participant had a slew of different strategies to manage their information: For example, P9 archived her digital information on Google drive, in her email, in locally stored spreadsheets, and notes on her phone, while also taking photos of items for future reference, as well as relying on autopay and various vendor websites (to access documents such as her utility bills). In Table 1, we provide a breakdown of the different types of digital applications and strategies used by participants to manage their household-related information.

The fragmentation of digital information was further exacerbated by participants switching from one app to another when they ran into issues or needed some alternate functionality. For example, P1 had used Evernote heavily in the past, but when he reached the limit of the free account, he

switched to another free app. He now used at least five different apps to make notes because each was useful for specific contexts:

“Now, I don’t use Evernote. I use Apple Notes. I use Notability, I use Google Docs, you know. I use a variety of different places to make my notes. And so, there’s an app called Simplenote as well. So, I use that, too. There’s an online one called WorkFlowy, I use that too.”

Some participants felt resigned to using tools that they had invested time in, even if they might prefer to switch to an alternative. For example, P10’s family had used Yahoo services for their information management needs for 13 years, which made switching to another service daunting:

“Sometimes it is frustrating because Yahoo doesn’t work as well. But we cannot just change it because everything is on that. So, we wouldn’t want to change it. And I don’t even think we can ... we’d have to go back and let all the other places know that our email has changed.”

Further, people also relied on many different external sources to store their digital information; for example, P6 said, *“In terms of payments and health and my tax forms and travel and all of those finance sorts of things, it’s all in like those respective accounts.”*

Participants’ digital information management tasks also involved a combination of three or more devices – phones, tablets, laptops, desktops, scanners, or printers. Many of these devices did not interface well with each other, which was an additional challenge to navigate. For example, P4 who generated her most important records – Excel spreadsheets of household information – on her Windows laptop with backups to Dropbox and OneDrive, stated, *“I wish I had easier access to my files from my phone ... when I’m out and about and I’m busy.”* Participants also ran into problems when using apps from different ecosystems. For example, during the guided tour, P8 was unable to pull up his folders on his local computer and was visibly upset that his devices were *“not talkin’ to each other.”* Only two participants were relatively less concerned by information fragmentation; these participants both represented young couples who did not own real estate and had relatively less information to manage. We suspect families undergo a change in their information management needs and challenges as their household obligations increase over time.

People made decisions about how and where to store their physical and digital information based on the significance they ascribed to each type of information. This was particularly clear with paper documents, as participants often used physical proximity as a marker for keeping their documents safe. For example, P10 explained her reasoning for storing her property ownership documents in a bedroom drawer by saying, *“We find that ... it’s most safer when it’s up, closer to you.”* Physical proximity gave participants peace of mind that they would not lose their documents in the case of an emergency: *“These are priority documents. If the house is on fire, I can just grab that folder and get out of here. That contains our passports, birth certificates”* (P1). Most participants kept these vital documents in their bedrooms; meanwhile, documents that were less important were relegated to less-visited areas of the house, such as the attic or garage.

For digital documents, participants took similar steps for safety. For example, P8 kept copies of files locally on his computer as well as in online cloud storage and on back-up hard drives. He explained his reasoning for keeping multiple backups by saying, *“I’ve had too many computers’ hard drives die with all of our stuff on it, you know, then tryin’ to recover things. So, I’m a little paranoid that way. I keep multiple copies.”* For others, documents had to cross a threshold of significance to be worth backing up. P9 would email important documents to herself to have a backup, saying *“at least then, if my laptop died, or, you know, I lost my computer then I’d have whatever was accessible via my email.”* She would also move some documents to her Google Drive; however, *“for it to, like, cross over from email to Google Drive, it would have to be something important.”* For others, relying on the cloud could make them feel vulnerable, and prior work finds that users can prefer local storage to cloud storage [32]. In this vein, P10 explained why she kept copies on both the cloud and

her local computer: “[My husband says] ‘It’s Outlook, and it will all be fine, it’s backed up somewhere.’ But I don’t know the somewhere. I need to know where, so I need to keep it on my hard drive.”

Participants struggled with culling both physical and digital archives. They could be forced into reducing their physical information when their current system failed, particularly if they ran out of space. P10, who stored her documents in multiple closets and drawers, said “So I’ve stuffed as much as I could there, and when I absolutely run out of space is when I actually go through and see I don’t really need this.”

In contrast, because digital files take up less space and digital storage is virtually limitless, participants were less motivated to edit their digital archives. Instead, some participants viewed capturing digital information to be more important than organizing it, as with P10: “I kind of see which is more important: to put this information in or to clean up? So, for me it’s more important to just put the information in so I don’t lose it.” However, the lack of digital organization frustrated others:

“The thing that is hard to do is digital culling and thinning because it just takes so much time. I do like to kinda just throw stuff in a digital bucket. But I always have on my list, ‘Hey, you need to clean this out.’ But I just never get to it.” (P1)

Paring down physical information that evoked emotional attachment could further complicate storage decision-making. For example, P8 showed us manila envelopes containing items no longer functional but difficult to discard, including an old license plate and keys to a long-gone car:

“It was an ’85 Monte Carlo SS. Black, red pin-striping. It was beautiful. Huge engine. So, no longer have that, so now, instead of the car, we have everything in here [paper file] ... So, I mean, these are things that I could probably start getting rid of. It’s just a matter of doing it.”

Overall, both digital and physical archives were extremely fragmented and participants saw them as difficult to manage or reorganize. While digital information was spread out across multiple applications and devices, physical documents were located across the length and breadth of participants’ houses. The uniting factor between digital and physical information was that the safety of the location participants chose to store information in corresponded with the perceived value of the information. Across types of information, participants felt locked into their organizational systems, for better or for worse. In PIM, one of the main challenges of managing information is how to organize it [6]. We find that this organizational challenge is further compounded in the family context by the problem of storing information across digital and physical locations, particularly in places not designed for information storage.

4.1.3 Retrieval. Due to information fragmentation, participants expressed difficulties in retrieving both digital and physical information because they had to remember where they put it. The fact that physical documents were fragmented in many spaces in the home, including spaces not typically intended for information storage, further exacerbated retrieval. As P7 said of his home, “So, we’ve got kind of stuff everywhere [LAUGH]. But it’s all like in a general area of the house. We have a big house so, yeah.” Participants then had to rely on their memory to retrieve information. For example, P3 described looking in multiple drawers “back and forth and back and forth ‘cause I can never remember. Well, did I put the kids’ doctor’s records near the insurance or is it in this spot?”

Given the difficulties of finding physical documents, all of our participants commented on the relative ease of retrieving digital documents from external parties, such as online statements from bank websites. They placed a lot of trust in these external parties, relying on them for storage rather than keeping their own copies. For example, P6 reflected,

"It makes me think I have a lot of trust in companies and their systems, which normally wouldn't be me ... So it's almost like I'm putting all my trust in that the system will always work. It's always been there. I can always go back and say, 'Remember what I purchased three years ago.'"

That said, relying on multiple external sites to retrieve digital information could complicate retrieval. Information fragmentation across different apps, services, and devices could challenge access to information when needed. Many participants voiced a desire for a technological solution that would centralize their information: *"Like a one-stop shop, on a cloud somewhere, so I'm not like bouncing off 20 websites"* (P6). Participants particularly struggled with remembering their passwords to so many services, and only half used password managers. The rest reported a range of password management strategies, from storing passwords in an encrypted spreadsheet under a disguised file name, to storing them in notes on their cell phones. By using these strategies, participants often knowingly traded security for convenience. For example, when describing how he keeps track of all his passwords, P7 told us,

"This is kind of bad – in my email, I'll just write a draft and then I'll have the username as the subject [line] and then for the password, in the [email] body, I'll have like a hint of ... the password – oh, like Mom's birthday or the Seattle house address."

Retrieval was relatively easier for participants who used their email as one of their main information repositories, as they could use the search feature. While this was convenient, some participants were dissatisfied with needing to rely on search, and wished they had a better system, as with P1: *"So, hopefully it can find it when I search for it. But it would just be nice to have it categorized."* Using email searches to mitigate retrieval challenges also meant that participants had to place a lot of trust in their email remaining secure and functional, which was a cause for concern:

"It's a lot of stuff in my Gmail. Like, it's, like, many years of many emails. And I'm also, like, really relying on my Gmail accounts. So, I also think, like, oh, what happens if I get hacked or something, and, like, you hear about it happening every so often, so that would be, like, really bad." (P9)

In response to this concern, some participants chose instead to store their digital documents in multiple places, as P10 explains: *"Initially I thought I would prefer just one place where I could just keep everything. But then I started thinking maybe it's just safer to keep it in different locations, so everything is not in one location."* While this could help allay security concerns, it hampered retrieval convenience.

Finally, in some cases, paper was easier to retrieve than digital information. Some participants found it annoying to go through the steps to look up information online. For example, P3 chose to receive utility bills in the mail so that she could easily check for mistakes, saying, *"I ask them to send me a paper bill because I don't take the time and look it up online. And they keep charging me for extra bins."* It is worth noting that paper documents were easier to retrieve when they had been painstakingly curated. For example, P10 kept a set of physical folders with copies of her bills, even though she could access them online: *"Sometimes it's a good quick reference for me ... I think I find [paper folders] way easier than going online and going onto the, logging onto the sign-in, and, you know, finding the date. I just find it easier to open my folder and look at it sometimes."*

Overall, retrieving information was a challenge for participants due to information fragmentation. Participants wanted information to be easy to locate and to access, and often physical and digital information satisfied one requirement but not the other. For example, physical documents required participants to recall a physical location and potentially spend effort visiting multiple locations to pinpoint the correct one, but once found, these documents could also be easier to look through because of their tangible nature and because they are not password restricted. In contrast, digital documents could be comparatively easier to locate, but could be difficult to access due to passwords or issues in searchability (e.g., scans and photographs). Consistent with prior work on retrieval

in families [75], the fragmentation of digital information across multiple drives and apps posed further difficulties for retrieval.

4.2 Coordination Roles, Challenges, and Strategies

In this section, we discuss how roles around information management are organized, the challenges in coordinating information, and the strategies used to mitigate these challenges.

4.2.1 Roles. In contrast with PIM, where the individual who stores and retrieves the information is often the same person [4], a key complicating factor in FIM is that there are multiple creators, owners, and users of information. Individuals may hold different responsibilities for various tasks, and their tasks may affect other members of the family. Most of our participants were the primary managers of their household information, though some received help from or allocated tasks to their partners. These divisions in information management can be based on competencies or preferences, as described by P4: *“We were like, let’s divide by what we like ... So, my husband does all the laundry. I don’t do any laundry. I do taxes and bills, we’re not really down gender lines, we’re down skills and what we like.”* Two participants were the primary managers because they were stay-at-home parents. While primary managers were in charge of most of the household-related information for the family, they were often supported by other members in specific domains. For example, P3 managed most of her family’s information, but her husband took care of travel-related information. Three participants co-managed their household information equally with their partners. These couples were relatively younger than the others, which may suggest that the ways in which information management is divided in households is changing among younger demographics.

4.2.2 Coordination Challenges and Strategies. Because the home has multiple family members with separate responsibilities around managing household-related information, coordination is an essential part of running the home. We found that the need for coordination posed several challenges, and while participants used multiple strategies to mitigate these challenges, they were unable to fully resolve them.

The fact that participants had separate roles for different household-related tasks led to a lack of shared knowledge, both in terms of what is involved in completing household-related tasks (e.g., how a bill is paid) and how the information around tasks is managed (e.g., where past bills are stored). Coordinating and sharing information with family members could be problematic in all three stages of information management. For example, when triaging new documents in the mail, P10 would need to wait for her husband’s input to know whether certain documents needed to be stored before she could file them. Navigating family members’ information management practices around storage decisions could also be challenging. For example, during the guided tour of the home, P7 was unclear about what information his wife kept and why, and was discovering these storage decisions alongside us: *“Oh, pay stubs. So, I guess my wife does keep most of her pay stubs and this is where they end up. Yeah, so a power bill, I don’t know why she was keeping this one.”* The fact that families cohabit the same physical spaces also meant that family members had to take care to not negatively affect others’ systems, as with P2 when he was showing us his wife’s files in a drawer, which contained multiple folders and bags of documents: *“I’m trying to put things back where she had them because otherwise, she would not know where they are.”*

Participants relied on each family member to carry out the tasks they had been assigned. Thus, they attended to their own tasks, and exhibited a general lack of awareness of others’ tasks and processes. For example, when asked how he would look up the date he bought new tires for his car, P2 said, *“That’s straightforward enough ‘cause my wife keeps those. With the warranties and things. So, like, pieces of paper somewhere.”* However, when we asked him where these were kept, he said *“Yeah. I don’t know where she keeps those ones.”* Prior work finds that when people expect to have access to

information in the future, they focus on remembering how to retrieve the information, rather than on the information itself [63]. Similarly, in the context of the household, family members trusted that any given information was being managed by respective owners of the task, and turned to them when needing information related to that task.

Not only did this lack of shared knowledge make it harder to retrieve information that is primarily managed by another family member, but the fragmentation of physical and digital information also made it difficult to easily share information with others. For example, P1 said, “So, if I were to want to share something with my wife, I would have to look in multiple systems, I would have to give access to multiple systems.”

While participants struggled with retrieving information in general, providing another person access to specific information was an additional barrier. Many participants said they would need to call their partners to ask for information, such as for their child’s school contact or a file’s location. This process could be quite laborious, as P3 described:

“If I were to tell [my husband] to pay the rowing fee, he’d be like, ‘Well, where do I go and what do I do?’ And so, then I would have to say, ‘Well, this is the password, it’s on my password thing.’ ... and so I’ll just walk him through step by step and he’ll just sit there on his computer and do it.”

Participants engaged in strategies to mitigate problems of access and coordination, though these sometimes did not work or gave rise to new problems. First, to ensure their family members could access household-related accounts and services, several participants set up ways to share their passwords within the family. Prior work finds that password sharing is common in families for emails [42], entertainment accounts and apps [56], and devices [52]. We find that in the context of FIM, this behavior is a practical way to manage the many demands of running a household with multiple members. However, the ways in which participants shared their passwords with family members could be problematic. For example, P2’s family used the same password for all their shared accounts to minimize the burden of memorizing and coordinating multiple passwords. Others stored all their shared passwords in a common file: “My husband and I both have Excel spreadsheets, and we both have access to them. They’re both stored on Dropbox and they’re both password protected, and we both know each other’s passwords” (P3). While this strategy mitigated issues of access, it could compromise the security of participants’ data. For example, P10’s family stored their passwords on OneNote and Yahoo Notepad. Because she needed to log into Yahoo to access the file, she saw it as more secure than OneNote, which was local to her phone. This influenced how she chose where to store her passwords:

“The kids’ passwords and stuff like that, I keep it on my OneNote. For me that’s a bit more accessible, so I would keep that on OneNote. But our personal, very personal ones, we would just store it online on Yahoo [Notepad].”

Some participants set up shared accounts to avoid the issue of navigating multiple individual accounts altogether. P10’s family had set up one email for all their accounts: “We would give that email as the email on all our forms. This is the only email that goes out, actually. Everything, yes. The taxes, the legal. The bills, yes. Definitely this just comes on there. Even the health. Anything that they send.” The downside of this strategy was that their email had become the sole point of contact and repository for their household information, and thus they felt unable to change their system if needed.

An alternative strategy was to set up a shared repository of information on a cloud storage service that was accessible to all family members and could be managed through individual accounts. For example, P3’s husband stored the family’s travel information in the family Dropbox. While this strategy worked for the most part, it could also complicate access, as when P3 was in an airport

without access to WiFi and needed to check her travel itinerary: *“I didn’t have the WiFi capability, that’s the only problem with Dropbox. So, yeah, I was stuck.”*

Since these coordination strategies were not failproof, most of our participants often had to fall back on ad hoc sharing practices, such as calling their partner. Thus, most participants wanted a system that was easily shareable to mitigate these coordination challenges. P1 described his ideal organizational solution as *“something shared. That’s very important, so that me and my wife are on the same page with, like, things to do that we have to get done, and appointments we have to get to, and who’s going to them.”*

Overall, as in prior work [40], we found that FIM is often conducted by one primary person who takes responsibility for the household. That said, FIM directly or indirectly impacts multiple family members, and participants faced numerous challenges when coordinating among family members, particularly around locating information and then gaining and granting access to it. Participants had developed several workarounds to mitigate these challenges, though these strategies could be costly in terms of efficiency and effort, or – as in the case of many unencrypted shared passwords – could compromise the security of the information.

4.3 Socioemotional Factors

In this section, we discuss motivations for managing household information and the emotional responses that such work elicits.

4.3.1 Motivations. Family coordination serves both functional and socioemotional purposes in the home [46]. While coordination is important on a functional level to get tasks done, it is also a way for families to organize their daily lives and manage their relationships [65], and to express caring and improve emotional connections with each other [16]. Similarly, we find that managing the family’s personal information also comes with both functional and socioemotional motivations and goals.

All our participants made references to the vital aspect of FIM, such as the need to ensure bills are paid. Developing a good organizational system could help participants meet this goal: *“I try to keep everything, like, inline and tidy, I guess, in a way, so that I know where things are ’cause otherwise, I lose track of what needs to be done”* (P2).

At the same time, for several participants, there were also strong socioemotional reasons for these practices, such as supporting and caring for other family members. For example, P4 put a lot of thought into her organizational system, reducing the strain on others:

“It’s like, it took me less than 30 seconds and [my husband]’s like, ‘Oh my gosh, I would’ve spent 20 minutes hunting for that.’ And then his stress is reduced, he’s happier, I’m like, ‘I feel like I can be helpful.’ ”

For some participants, being their family’s primary information manager was also a way to play a meaningful role. This was particularly important for P3 as her children grew older and her family’s needs evolved over time: *“I mean, I think the reason I keep [my organizational system] the way it is is because it makes me still feel valuable as much as that sounds silly. You know, I think as a mom your job gets taken away in bits as they grow.”*

In addition to caring for their family members in the present through their work, participants were also concerned about ensuring their families’ well-being in the long term. Since there are so many complexities to managing household information, participants were concerned that other family members may not be able to navigate their systems, particularly in the case of emergencies, or in the event that the primary information manager of the household were to pass away:

“So, if I died today, it’d be ... I mean everything’s in order, so it would take a few minutes to find it. Like the bank has been balanced, and this has been done, and that’s been done. But I’m not sure my husband would know where to go.” (P3)

Thus, some participants took active steps to make sure their systems could be deciphered by other family members. For example, P4 developed a guide for her family: *“Like sometimes I think like what if something happened to me and like [my husband] was left. So I even have a spreadsheet that’s like budget notes for [my husband] if something were to happen.”* While people struggle with passing on digital legacies in general [57], in the context of FIM, developing such legacies is crucial given that family members could face major consequences if the household system breaks down.

4.3.2 Emotional responses to information management. Participants also had emotional responses to doing the work of information management. Keeping on top of household information was seen as stressful and even overwhelming. For example, P6 spoke about the stress of retrieving information from multiple sources: *“It’s like it’s everywhere. It’s like all over the place ... in my mind it’s very chaotic. It’s like, you know, you have all these different things everywhere else.”* While most participants did not enjoy managing their household information, they viewed it as a necessary chore. For P7, the unpleasantness was compounded by the fact that tasks could bring up old concerns that he would rather not face:

“I’d rather be playing video games or go out and play outside with my son. It’s just not very fulfilling. It’s like it’s a chore, you know. I mean, it’s kind of like eating your vegetables. You know it’s good for you, but you don’t like to do it and it’s good to like clean out the junk drawer. And then you might be faced with the kinds of things that you kind of wanna ignore like, ‘Oh, I spent 2,000 dollars on a couch.’”

As in prior work on managing health information [67], we also found that health problems can exacerbate the process of managing information, both practically and emotionally. For example, P8’s family had multiple chronic health conditions, and dealing with the onslaught of information around their illnesses was overwhelming and emotionally difficult:

“Rental agreements for a wheel chair and walkers and, I mean, you know, just so much stuff to take care of. It’s a lot, so, if you were to throw those papers on here right now, on top of this, I’d probably be even more gray than I am.”

For P8, the accumulating health-related information also served as a painful emotional reminder of their problems, such as his daughter’s chronic illness:

“A lot of [medical documents] are still in envelopes. [My wife] and I get emotional. I mean, it’s our little girl and it’s been tough. So, you know, just so, one more thing to just remind us of [it] ... [VOICE BREAKS] And so, I don’t know if it’s just avoiding it ... I mean it is.”

While the process of managing household information was seen as an unpleasant but necessary chore, participants also experienced a sense of satisfaction when their organizational systems were working well. At a certain point, dissatisfaction with the present system could spur participants into reorganizing it, as with P9: *“Like, sometimes I’ll look at my Google Drive and I’ll just be really annoyed by how unorganized it is, then I’ll, like, have a wave of organizing it.”* After putting in this effort, she would feel satisfied for a while: *“I put everything in a folder and there was nothing out of a folder, and I color coded it – it looked so pretty, and it felt organized.”*

As in P9’s case, while participants made it clear to us that they cared about having an organizational system that works, most were not satisfied with their current approaches to managing household information. We found that, in the context of FIM, participants were simultaneously information worriers and warriors [36], in that they actively took steps to use technology to improve their organizational systems but also felt a sense of insecurity about what an optimal system

might look like, and how they might compare to other people. For example, at the end of P6's interview, she reflected: *"I just have some stuff to think about now. I'm just wondering how chaotic this is compared to other people. [LAUGH] Yeah, I'm like, 'am I doing this all wrong?' Do you have a better way of doing stuff?"* Some participants changed their self-assessments as they walked us through their organizational systems; for example, P1 evaluated his system's success by saying *"Before this interview I would have said that I was at 90 percent, but now it's probably like 60 percent."*

Overall, we found several socioemotional factors at play in the practices around and motivations underlying FIM. Participants engaged in FIM for their families as a way to support and care for them, and wanted to ensure that their families could access and decipher their information in emergencies. That said, participants had mixed emotional responses to engaging in FIM: while they valued having a good organizational system, the means of achieving such a system was unpleasant, time-consuming, and a source of stress.

5 DISCUSSION

In this study, we identified a number of challenges people face in managing household-related information, and the strategies they use to manage such information. While some of these challenges and practices are similar to those in PIM and GIM, we find that they can manifest in different ways in the context of the home, and that these differences warrant a specialized focus on the household context when designing technologies for FIM.

In the context of FIM, we found that one person often takes on the role of the main information manager for the whole family, and is supported in this work by a secondary person, often a spouse. In contrast, in PIM, one individual manages his or her own information for his or her own future use, and in GIM, multiple people manage shared information for future use by the group [49]. Unlike the distribution of responsibilities in PIM and GIM, our findings suggest that FIM often involves one individual managing most of the information for future use by a group. Further, even when such roles are clearly defined in households, in FIM it is essential that another family member knows how to take over if needed, and this was a concern voiced by several participants. The fact that FIM can have a direct impact on the running of a household also amplifies the need for work on digital legacies, which has been explored in other contexts, such as social media [57]. While the ways in which family members allocate responsibilities for household-related information may be changing, particularly with younger demographics, our work suggests the need for information management research to explore how to support many different combinations of ownership and responsibilities for household information.

As in prior work on PIM that finds that people can store vast amount of personal information in their digital archives, causing issues with the maintenance and retrieval of data [71], we find that the accumulation and fragmentation of data pose a major challenge in FIM. This issue is exacerbated by the fact that the primary information managers for household-related information have to account for times when another family member may have to be involved in FIM. In our study, this issue around coordination came up in all three stages of the information management process: 1) in the triage stage, family members could be unsure of how to triage incoming household-related information that they were not primarily responsible for; 2) in the storage stage, family members were unclear about where needed information was stored either physically or digitally; and 3) in the retrieval stage, family members could encounter additional barriers to retrieving information, such as password restrictions.

In terms of retrieval, all but one of our participants used their email as a repository for at least some of their household information (such as emailed monthly bills). Prior work finds that email can be a unifying tool for information in PIM, but that email applications have shortcomings in serving as a PIM tool [74]. For example, rather than providing reminders, such tools are constrained

to user-initiated actions [74]. In response to this limitation, some of our participants opted for both electronic and paper delivery of their important bills so that these would serve as multiple visible reminders. Further, some of our participants used nested folders and tags in their emails to help organize information. However, this can require effort to set up, and recent work suggests that reliance on complex folders in email is not an efficient retrieval process as compared to search [76]. In addition to the challenges of using email to organize information, as found in prior work on PIM, we find that using email as a repository of shared household-related information in FIM comes with yet an additional challenge: managing and providing access to the information to family members.

The need for shared information access, and the fact that much of this information is stored in personal accounts, also means that retrieval challenges in FIM raise additional concerns for users’ privacy and security. Prior work on PIM finds that people do not clean or maintain their stores of personal data in the cloud, which can lead to potential privacy and security concerns. For example, upon reviewing their digital archives, 83% of people surveyed reported that they would delete at least one document [44]. We find that these privacy and security risks may be further amplified in FIM, particularly since participants developed workarounds or weak security practices as a way to facilitate access to archives of household-related information, such as keeping passwords to joint accounts in a shared Google document.

Finally, we found that FIM exhibits a range of socioemotional factors as compared to PIM and GIM, such as the desire to play a meaningful role in the family and to ensure the family’s well-being in the long-term. These socioemotional factors are distinct from other non-household contexts, such as the workplace studies in GIM, and highlight the need to tailor information management technologies to the specific context of the home.

We found that FIM is both practical and emotional. Rather than serving a purely functional purpose, storing documents can also be emotionally meaningful. For example, physical bank checks can be perceived as markers of significant events [69]. Similarly, our findings suggest that documents related to managing the household can hold particular meaning for people and influence their organizational decisions, as with one of our participants who held onto old license plates for a car that he no longer owned. Thus, FIM solutions that are purely functional are likely to miss these additional socioemotional meanings held by household information.

We also found that engaging in FIM helped maintain familial relationships. For example, some of our participants saw their role as the family’s information manager as a way to stay involved in their children’s lives and to care for their families. Similarly, prior work finds that families’ financial systems can shape or support their relationships. For example, spouses can contribute to the family by saving money to express their support for each other’s goals and aspirations [73]. FIM systems, therefore, should be able to integrate seamlessly in the family system, and support family relationships.

Finally, we found that FIM elicited a lot of complicated emotions for participants, including feelings of insecurity and concern about the future. Similarly, Kaye et al. [43] found that financial planning brought up feelings of helplessness, fear about the future, and inadequacy about one’s own abilities. We observed a discrepancy between our participants’ commitment to perform FIM well and their satisfaction with the result of their work. Participants explicitly asked us how they compared to others, whether they were “doing this all wrong,” and if we had recommendations for computing tools to better support this type of work. Together, these point to FIM as an opportunity space for innovation.

It is worth noting that in the context of managing other information in the home, Snow and Vyas [61] assert that existing financial tools should not be repurposed for use by families, but rather, that technological solutions should aim to reflect familial relations and collaborative processes. As in their study, our participants eschewed traditional PIM tools and cobbled together systems that

worked for them by using a combination of paper documents and digital tools (including low-tech solutions) that were most easily integrated into their existing lives and methods of interaction. Kaye et al. [43] found that none of the people they interviewed used an aggregation tool explicitly designed to manage their finances; similarly, only one of our families used a tool dedicated to FIM. Thus, as in the case of financial management [61, 73], our findings highlight the need for FIM technologies to reflect and enable families' existing social practices rather than steering them towards pre-existing PIM tools that have been re-aimed at families, as these are unlikely to be used. In the next section, we outline design opportunities for technologies to address these unmet needs and support FIM.

5.1 Design Opportunities for FIM Technologies

Our findings provide insight into the unique nuances of practicing information management in the family context. While we encounter some of the same concepts as in PIM and GIM literature, these concepts manifest differently in the home, where they are compounded by socioemotional factors, difficulties in coordination, and no clear system to follow, in addition to having a critical impact on the family's livelihood. To this end, we propose the following suggestions to guide the design of information systems for the family context.

5.1.1 Design for fragmentation. Consistent with prior work [41], we found that people struggle with information fragmentation across several paper and digital "islands." However, we also found that people find value in redundancies, and in keeping both paper and digital records. Prior work also suggests that there are several cases where paper documents are preferable to digital ones, and that designers should not aim to override these preferences by forcing people to adopt digital solutions [69]. FIM technologies must recognize the different needs fulfilled by keeping paper and digital copies and should help families organize both, rather than supplanting their practices with a catch-all digital solution.

Further, participants saw fragmentation as enhancing security, as a data breach would expose only some of the family's information. In these cases, information fragmentation is intentional and is likely to persist. FIM technologies should be designed accordingly, accepting that there may be many copies of a document, and those copies may reside in many locations. Indices or catalogs may relieve the memory burden of keeping track of where a given piece of information is stored. For digital records, such indices could be managed automatically. For physical records, systems should create low-burden opportunities to bridge the divide. For example, when paying a bill with an online system, an optional memo field might offer to record the location where the user intends to file the printed copy.

5.1.2 Design for sharing and collaboration. Sharing information among family members is a fundamental part of FIM. Designing for sharing should be a priority requirement for FIM technologies, not an afterthought. FIM technologies should not just help family members access shared resources and archives, but also fill gaps in shared knowledge in the family to make it easier for others to participate in information management tasks. Prior research in personal informatics suggests that informatics tools (such as Mint, a tool for financial management) should allow users to make notes for their own personal reflection [47]. Our findings indicate that notes would also be beneficial in FIM, where they could facilitate collaboration. Preventing breakdowns in coordination is another important aspect of FIM, also suggested by prior work in the context of family calendaring [22]. A shared FIM system could keep track of the family's information rhythms, such as incoming bills and due dates, and alert family members of anomalies or breakdowns in task completion. Such alerts or systems could be integrated into families' existing rhythms, such as by providing non-intrusive eco-feedback or through home automated displays [61].

Further, there may be potential for FIM technologies to directly address spouses’ and parents’ desire to make their information systems decipherable to their spouses and other family members. For example, prior work suggests that children are typically excluded from conversations about financial planning, but finding ways for them to meaningfully engage in these collaborations could be fruitful [61]. In the context of FIM, even if household information is being managed by one primary family member, FIM technologies could be designed in a way to make these activities more visible and open to input from other family members, including children. This could start an initial conversation or shared awareness within families about the information work that is occurring behind the scenes to maintain the home.

5.1.3 Enable social comparisons and the incorporation of best practices. Even though our participants were committed to managing their families’ information and doing it well, they were also insecure about their practices and wanted to compare notes with others. Prior work on PIM suggests that it may be helpful to allow people to learn from other users’ data management practices [71]. Similarly, FIM technologies should support learning not only from best practices, but also from other users. For example, technologies could offer social comparisons so users could compare their organizational systems with others similar to themselves. If users preferred an alternate solution (e.g., a different ontological model for categorizing information), technology could facilitate implementing that practice, such as by offering a macro that users could run to set up a similar system with their own data.

5.1.4 Support changing ontologies and evolving archives. As more types of information enter the household, filing and categorization schemes might need to change. Some participants felt stuck using sub-optimal organizational systems because of the effort they had invested in them, and resorted to filing certain physical and digital documents under one-off “miscellaneous” folders, which was seen as frustrating. Technologies should assist large-scale migration and reorganization efforts, should users choose to switch from one system to another.

5.1.5 Facilitate information migration and consolidation. In addition to supporting migrations from one organizational structure to another, FIM technologies should facilitate information migration among digital apps, devices and clouds, but also between paper and digital formats. In many cases, migration may be performed for the purpose of consolidation – most participants expressed the desire for a secure “one-stop shop” that would keep all their information in one place. That said, participants were concerned that consolidating their information could have negative consequences, such as in the case of a security breach, and thus, FIM technologies should take users’ security concerns and mental models into consideration when designing information consolidation solutions.

5.1.6 Provide usable security. Our findings show that passwords are still a pain point, both from an individual user’s perspective and especially when sharing information. Usable security [26] remains a challenge of particular relevance in the family context, where there are no security policies, the level of security literacy varies, and users access information that can directly impact their safety and livelihood, such as banking information, bills, and passports. Many of our participants shared accounts designed to be used by an individual, such as email, and used weak security practices to enable access to these accounts (such as sharing passwords in a Notes app). The sharing challenge has been addressed by GIM systems, but previous research shows people overwhelmingly appear to prefer PIM processes over GIM, and that retrieval success is also higher in PIM than GIM [7]. Thus, rather than forcing families to adopt GIM tools, or focusing on setting up individual profiles, FIM technologies may benefit from offering “group accounts” designed for mutual use [52].

5.1.7 Enable familial privacy. We found that families use a wide variety of information and communications technologies to manage household-related information and coordinate with each other. Goulden et al. [29] argue that the use of these pervasive, shared technologies marks a shift from personal data to interpersonal data, which is generated by a group rather than just an individual. In the context of mediated spaces such as the home, these interpersonal data can be used by family members to observe each other and to hold each other accountable in new ways [29].

Issues of familial privacy are likely to become increasingly pertinent given the proliferation of smart home technologies, and the possibility that FIM might soon include managing these devices' data [29]. Prior work indicates that smart home technologies can impact families' privacy dynamics [68], and that these technologies must offer privacy-protective mechanisms for family members, such as activating different modes based on which family member's voice is detected [77]. In these settings, FIM solutions will need to allow individual users to maintain some desired level of privacy and help them manage the data collected by shared smart home devices (such as digital assistants and home security systems) while also enabling them to use shared smart technologies for household-related purposes.

It is worth noting that sharing family-related information in the home does not necessitate complete transparency at the cost of individual members' privacy. In the context of family finances, Kaye et al. [43] suggest that a financial tool could potentially share broad overviews of family members' financial activities rather than specific details. Similarly, a FIM solution could allow family members to select which types of data they would like to share with others. For our participants, accessing family-related information stored by another family member was particularly crucial in specific emergencies. Thus, a potential FIM solution could allow users to input specific contingencies and situations when access should be provided to other family members.

Finally, Vyas et al. [73] caution that not all families may have the same level of trust among family members, and that designers must be aware that their technological artefacts may be used in homes where there are imbalances in trust or control among family members. Imbalances in trust could have dire consequences in the context of FIM, given the breadth of information that is required to run a household and is at stake for potential abuse. In such cases, it is particularly crucial to ensure that family members' privacy can be respected when aiding multiple people to collaborate in doing the household's FIM work.

5.1.8 Offer multiple levels of safeguarding. Participants categorized information into different levels of importance, and stored their most important documents in accordance with their mental models of what constituted safety. Important information was often stored separately, and in the case of physical documents, proximity was an indicator of the highest level of safety. Similarly, participants attempted to secure important digital information in multiple ways, though prior work finds that users make poor security choices when attempting to control their digital data [15]. For example, P10 saw Yahoo Notepad as a secure space to store her most important passwords because it required a login. FIM technologies should support users' desire to separately safeguard their most important documents, such as by offering a digital vault that requires additional levels of authentication to access.

5.1.9 Support multiple goals and responsibilities. Thus far, our design recommendations pertain to *how* FIM systems should function. In this subsection we discuss *what types* of work FIM systems need to support and how this work might vary across people depending on their life stage. A wide variety of FIM-related work is done in the family. Some of this work, such as paying and managing bills and health information, was done by all our participants. Other work varied depending on life stage. For example, some, but not all participants, experienced one or more of the following: owning a home, having children, planning for succession, and volunteering in their community. To

support multiple activities, a FIM system could have a modular structure with modules users can turn on and off, depending on their particular needs and life stages (e.g., home ownership, children). Each module would have unique design requirements to support a specific type of work.

For example, we found that not only does home ownership complicate FIM through the addition of information, but also, special projects give rise to unique FIM design requirements. Two of our participants had recently managed significant renovation projects for their homes. P3 kept all information pertinent to the renovation (bills, contracts, receipts, warranties, material samples, contact information) in a large binder. For homeowners, one type of work FIM systems could support is managing special projects such as renovations and structural additions, and their associated information.

Families with children also had additional FIM needs. P1 had created a binder for each of his three children, in which he kept health and education records. P7, whose children were older, used paper calendars to manage schedules and online notebooks for links and passwords to education and entertainment websites. Managing children’s health and education emerged as another specialized set of tasks FIM systems should support.

In addition to the work of managing children’s health and education, we found that engaging in FIM could also be a way to build one’s identity in relation to others. Prior work on PIM finds that people see their relationship with their data as a reflection of their identity, such as being a minimalist [71]. Similarly, our participants who were parents took pride in performing this work for their families and saw their information manager roles as integral to their place in the family. FIM technologies in this space should aid users in performing this work and maintaining their caretaking identities, rather than replacing them or making them feel unneeded.

Planning for succession could be another module with specific design requirements. Prior work finds that passing on digital legacies is a challenge in families, and that while people often choose to share their passwords pre-mortem, the emotional aspect of planning for digital succession can lead people to avoid developing such legacies [57]. In the context of FIM, passing on knowledge about household-related information is crucial to ensuring the well-being of surviving family members. FIM technologies should help the owners of household-related information set up their systems for the event of succession, potentially using the cataloging mechanism discussed above.

5.2 Limitations and Future Work

This study has a few limitations that we discuss here to help contextualize our findings. First, in terms of our sample, we focused on information management in family contexts, and thus, our findings cannot speak to how information is managed in other forms of households, such as roommates, who may not have any personal ties to each other. Further, families vary widely in their composition, and the families in our sample were comprised of heterosexual couples; other types of families, such as single-parent households and same-sex couples, may have different dynamics. Finally, we purposefully sampled early adopters of technology; families that are low-income or have reduced access to technology likely have different experiences that warrant examination. For example, prior work finds that people with low incomes can have different approaches to financial planning, and that technological solutions designed for the majority of the population often overlook the needs of this group, and can hinder their management efforts [70]. Future work should explore how our findings translate across different types of families and populations.

In terms of methods, we interviewed one person from each household to get a snapshot of how all their household-related information is managed, since prior work indicates that one family member is often the main information manager for each household [40], which was also true of our sample. That said, their family members may have different perceptions of the information management practices in their homes. We do not see this as having prevented us from examining FIM since our

focus was on family-related information (rather than individually owned information), and since our participants gave us extensive tours of their physical and digital organizational systems (including, for example, their spouse's archives as well), which helped provide a broad understanding of each family's information management practices. Still, many of our participants stated that their partners performed at least some of the information management work as well, and future work could explore the perspectives of multiple family members.

6 CONCLUSION

In this study, we introduced the term *family information management* (FIM) to characterize a set of practices involved in managing the information needs in households, which we see as distinct from PIM and GIM. We identified how families triage, store, retrieve, and share household-related information, the challenges they face in doing so, and the socioemotional factors associated with such information management. Based on our findings, we put forth guidance for technologies targeted at the FIM space. Our study shows that FIM is a challenging but necessary part of everyday life, underserved by current technologies, and understudied in the HCI literature. Research in this area can make meaningful improvements to the well-being of individuals and families, and we are hopeful that this work will fuel further interest and research into FIM.

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Received January 2020; revised June 2020; accepted July 2020