

Social Networking Site Use by Mothers of Young Children

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ABSTRACT

In this paper, we present the first formal study of how mothers of young children (aged three and under) use social networking sites, particularly Facebook and Twitter, including mothers' perceptions of which SNSes are appropriate for sharing information about their children, changes in post style and frequency after birth, and the volume and nature of child-related content shared in these venues. Our findings have implications for improving the utility and usability of SNS tools for mothers of young children, as well as for creating and improving sociotechnical systems related to maternal and child health.

Author Keywords

Social media; social networking sites; Facebook; Twitter; mothers; motherhood.

ACM Classification Keywords

H.5.m [Information Interfaces and Presentation (e.g., HCI)]: Miscellaneous.

INTRODUCTION

Social networking sites (SNSes) have become an increasingly common aspect of daily life. As of August 2012, 69% of online American adults used SNSes; Facebook was the most popular, used by 66%, followed by LinkedIn (a professionally-focused network) at 20% penetration, and then Twitter at 16% [5].

Older adults are one of the fastest-growing SNS user segments; SNS adoption among more youthful segments (e.g., 18 – 29 year-olds) appears to be plateauing after achieving nearly ubiquitous penetration [25]. These changing demographics were notably parodied in a popular *Saturday Night Live* skit, “Mom’s On Facebook” [30], which satirizes concerns of teens and young adults whose privacy or “cool” reputation may be compromised by their mother’s presence in their online social network.

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Although most media discussion of mothers and SNSes focuses on the aforementioned concerns resulting from an older generation’s increased social media presence, the maturation of the original “Facebook generation,” college students and young adults who joined the network near its inception, has resulted in the growth of a different kind of mom on Facebook, i.e., women who have recently become mothers.

This growing demographic has led to new software features, such as Facebook’s addition of the ability to add an “Expecting a Baby” Life Event to one’s profile [37], and the third-party Facebook application unbaby.me, which allows aggrieved users to remove what they perceive as an unwelcome deluge of baby photos from their Newsfeed [11].

In this paper, we present the first formal study of how mothers of young children (aged three and under) use social networking sites, particularly Facebook and Twitter, including mothers’ perceptions of which SNSes are appropriate for sharing information about their children, changes in post style and frequency after birth, and the volume and nature of child-related content shared in these venues. We then discuss the implications of these findings, both with respect to how they inform our understanding of evolving societal norms and how they can inform the design of enhanced sociotechnical systems.

The following research questions motivated the analyses presented here:

- Does becoming a mother change the ways in which women appropriate social networking technologies?
- Are mothers using social networking sites to share and seek information about parenting young children? What categories of child-related information are shared and sought? What proportion of SNS use do parenting-related posts comprise?
- Do mothers in special circumstances (such as mothers experiencing postpartum depression or mothers whose children have special needs) have different SNS footprints than other mothers? If so, can this information offer insight into how to improve technologies or social services to better address the unique needs of these subpopulations?
- How can social networking sites be designed to better support the needs of mothers of young children?

The primary contributions of this work are twofold. From a computational social science perspective, this work

contributes insight into the experience of mothering young children through the lens of technology use (for example, differential status update patterns distinguish mothers with postpartum depression and those whose children have developmental delays), as well as insight into the evolving role of social networks for sharing information about one's children. From an HCI perspective, this work contributes design guidelines for tailoring social networking sites (or apps within SNS ecosystems) to better support the needs of mothers of young children, including supporting information-seeking, milestone tracking, and privacy (not only privacy for a child's information, but potentially for masking signals that our analysis shows may implicitly reveal one's motherhood status).

RELATED WORK

The intersection of technology and motherhood is a small but growing field of study [1]. Foucault studied the technological needs of expectant and new parents, finding a desire for better communications tools for keeping in touch with friends and family after a child's birth, more nuanced baby monitoring technologies, and easier access to pregnancy and childcare related information [15]. Gulotta et al. [17] learned that many parents desire to leave "digital legacies" to their children upon their death, such as allowing offspring to inherit digital photo collections. Kientz et al. [21] developed BabySteps, digital journaling software that prompted mothers to archive key moments in their child's development; BabySteps provided the personal incentive of creating a digital baby book to motivate faithful collection of developmental data for sharing with a child's pediatrician. LeDantec et al. [24] studied the use of mobile phones and other ubiquitous computing technologies by homeless mothers residing in shelters, finding that such technologies could be a transformative and empowering force. Hui et al. [19] created MammiBelli, a wearable sensor band that allowed pregnant mothers to share details of fetal activity with close friends and relatives. Rather than introduce a novel technology into mothers' lives as in the aforementioned efforts, in this paper we study mothers' use of existing technologies, specifically Facebook and Twitter.

The use of online social technologies by mothers has been most prominently characterized by "Mommy Blogging," wherein mothers write public blogs that document and reflect on their children's lives, dispense advice to fellow moms, and/or endorse parenting-related products [26]. A recent study by Scarborough Research found that 14% of U.S. moms consider themselves Mommy Bloggers [23]. McDaniel et al. [27] found that new mothers' frequency of blogging correlated with feelings of social connection and support. Motherhood forums, including traditional forums hosted on parenting sites such as babycenter.com and anonymous forums such as YouBeMom [35], are also a popular online outlet for new mothers to seek and share advice. In this paper, we focus on the use of the social networking sites Facebook and Twitter by the mothers of

infants and toddlers, rather than on traditional blogs and forums.

Several researchers have studied the use of social networking sites by specific sub-populations. For example, Brady et al. [4] reported results of a survey on the use of Facebook and Twitter by blind adults, Burke et al. studied Facebook use by adults on the autism spectrum [7], and Chang et al. [10] analyzed the differential use of Facebook by members of several ethnic groups. Rather than focusing on demographic traits, Brubaker et al. [6] studied how a specific life event (death of a loved one) played out in user actions on the social networking site MySpace. Our work can be considered an effort in this genre, with a particular focus on women who are the mothers of very young children (aged 0 – 3 years).

There are a small number of recent studies that are beginning to shed light on mothers' social networking use. NielsenWire [31] reported poll results indicating that 3 out of 4 American moms visited Facebook in March 2012, and that mothers are more likely than other women to access social media via mobile devices. Gibson and Hanson [16] conducted ethnographic sessions in the U.K. studying the general use of technology by new mothers, and noted that this demographic particularly valued Facebook as a way to remain socially connected during the perinatal period. Burke et al. [8] analyzed the prominence of intra-family connections on Facebook, including those between parents and children old enough to have Facebook accounts (above age 13), as well as the types of communications occurring between family members on Facebook; they found that 37% of English-speaking Facebook users have explicitly connected with either a parent or child, with mother-daughter connections being most common. De Choudhury, Counts, and Horvitz [12, 13] studied public tweets from new mothers as a method of identifying signals of postpartum depression (PPD), a mood disorder that affects about 11% – 18% of new mothers [9]. This paper studies broader patterns of new mothers' social networking use, such as the frequency and types of child-related content shared on different networks; we also discuss some findings on how such communications are influenced by PPD, which complement those of De Choudhury et al., and which enable us to quantify some of the qualitative findings suggested in Gibson and Hanson's results.

Ethical and privacy issues relating to the use of social networking technologies by children, while not the focus of this paper, inform the cultural backdrop that may influence mothers' decisions about appropriate sharing of child-related content. Most such studies focus on SNS use by teens, since 13 is the minimum registration age for most sites due to the U.S. COPPA act (www.coppa.org). boyd et al. [3] have explored the issue of SNS use by younger "tweens," and found that many use Facebook before they are officially of age, noting that about a third of parents have helped their children create Facebook accounts before the officially permitted age of 13 years. Although Facebook tries to

promote a “real name” policy, as of June 2012, Facebook estimated that approximately 2.4% of accounts are “user-misclassified,” such as accounts for babies, pets, duplicate identities, etc. [34]; Facebook tries to discourage parents from creating separate accounts for their babies by allowing them to add babies and even fetuses to a “Friends & Family” profile field [37]. Our study adds to the body of work concerning children and online privacy by giving insight into the types of child-related content mothers of infants and toddlers are willing to share on social networking sites.

DATA COLLECTION

Participants completed a brief online survey, which included an optional SNS data dump. Our survey instrument was available online for two months, from mid-July through mid-September, 2012. Mothers of children aged three years or younger and who had either a Facebook or Twitter account were eligible to take the survey; a drawing for a \$500 gift card was offered as an incentive for participation.

The survey was advertised via several online venues (all targeted to a U.S. audience), including posts to e-mail lists for new mothers (both within our organization and within the broader community in our metropolitan area), tweets from our organization’s social media accounts, paid advertisements on Facebook targeted to U.S.-based women in their twenties and thirties, and sponsored posts on BabyCenter (babycenter.com), a popular website aimed at mothers that hosts discussion forums and parenting articles.

The survey collected demographic data and data related to the child/childbirth experience (child’s birthdate, whether the child is the first-born, whether the child had been diagnosed with a developmental delay, whether the mother had been diagnosed with PPD, etc.). The survey also asked whether the respondent used Facebook and/or Twitter to share several types of information about the child (status updates, photos, videos, etc.).

Respondents were then optionally asked to provide their Twitter username and/or to install a Facebook application that collected a one-time snapshot of their Wall/Timeline posts. The Twitter username allowed us to capture all of the user’s public Twitter posts and account details (via our institution’s access to the complete public Twitter Firehose). The Facebook data dump included status updates and captions associated with photos, videos, and links that the user shared on their Facebook Wall/Timeline. Multimedia such as photos and videos were not collected for privacy reasons.

RESULTS

After discarding invalid surveys (e.g., incomplete surveys or surveys from participants not meeting the eligibility criteria), we had 412 valid surveys. After discussing the demographics of our respondents, we then present results regarding Twitter use and Facebook use; for the latter, we further explore trends in post frequency and content, as well as trends

associated with particular maternal sub-groups, such as those with PPD or with developmentally-delayed children.

Manual labeling of whether individual posts were or were not about the child would be infeasible due to the size of the data set (e.g., 59,316 postnatal Facebook posts). Instead, we used posts containing the child’s name or nickname(s) as a proxy for identifying child-related posts. Note that this heuristic underestimates the total number of child-related posts – manual coding of a random sample of 144 status messages not containing the child’s name identified an additional 28.5% of these as being parenting-related, e.g. “Peed on twice in one day! Lordy how life changes...”; “my oldest told me tonight that she’s glad that I’m her mommy...aawwww thanks!”; “Nothing like sitting and waiting to find out if your daycare is closing.”

Note that throughout the results section we report medians rather than means and conduct non-parametric statistical tests in the situations where data is not normally distributed (e.g., number of social media posts made by participants).

Demographics

348 of the 412 participants indicated how they learned of the survey; of these, 34.2% indicated that they learned of the study through the promoted posts on BabyCenter, 23.0% were recruited via posts on e-mail lists for new mothers, 12.4% were recruited via Facebook advertisements, and 10.6% via our organization’s social media posts, and the remainder indicated learning of the survey through other routes (e.g., word of mouth from a friend). Most (91.3%) were external to our own organization. This broad recruitment strategy resulted in a diverse group of participating mothers along dimensions such as age, ethnicity, occupation, and socioeconomic status.

410 of the 412 participants provided their age. The average age was 31.2 years (median = 31), and ranged from 19 to 46. 0.5% were in their teens, 34.9% in their twenties, 59.8% in their thirties, and 4.9% in their forties.

As per the study call, the children whom the mothers referred to in their surveys ranged in age from newborn to three years old. On average, the child’s age was 12.3 months (median 8 months). 42.5% of the children were infants, 29.6% were one-year-olds, 17.7% were two-year-olds, and 10.2% were three-year-olds. 63.8% of the mothers were completing the survey about a first-born child, while the remainder were describing experiences with respect to non-first-born children.

408 participants reported their race/ethnicity. The majority of these (75.5%) identified as Caucasian, followed by 15.0% identifying as Asian, 3.7% as Latina, 2.7% as African-American, 0.7% as Native American, and 2.5% as “Other.”

407 participants gave information about their occupation, selecting from a provided set of occupational categories. Of these, the most common occupation was “Stay at Home Mom,” which described 27.8%. The other 72.2% pursued a

variety of careers outside the home, including work in sectors such as law, education, healthcare, science, engineering, food preparation, personal care, the arts, sales, administrative support, and the military.

359 participants provided their annual household income. Incomes ranged from \$10,400 per year to \$1,100,100 per year, with an average annual household income of \$111,322 (median = \$90,000); 22.3% had incomes below \$50K/year, 30.6% between \$50K and \$100K, 19.2% between \$100K and \$150K, and 27.9% reported household incomes exceeding \$150K annually.

Note that while this group of participants is diverse in many respects, it is not a representative sample of U.S. society overall. For instance, white mothers and mothers from high-income households are overrepresented. This may be a consequence of the demographics of the venues where we advertised and/or the demographics of users who possess Facebook or Twitter accounts [10, 28]. Understanding how mothers from underrepresented groups use social media and understanding the perspectives of mothers who do not use social media at all are both valuable areas for future inquiry, but are beyond the scope of this paper.

Twitter Use

77 of the respondents (18.7%) indicated that they used Twitter; this proportion is similar to that of a recent a Pew study finding that 16% of online U.S. adults had Twitter accounts in August 2012 [5]. Of the 77 who indicated that they used Twitter, the Twitter usernames of 71 were valid. Of these accounts, 9.9% were protected (with non-public status updates).

Respondents universally did not view Twitter as a medium for sharing information about their child. Not a single respondent indicated using Twitter to share tweets, photos, or videos about their child. In the survey’s comments field, two mothers explained that they do use Twitter to discuss their child indirectly, by “posting [links to news] stories relevant to my child” and by “link[ing] to blog posts about my child”; another indicated that she only posted about child-related issues to the extent that she tweeted “abstract motherhood/feminist theories.”

Because no mothers reported sharing specific content about their child in their tweets, we focus the remainder of our analysis on Facebook. However, although respondents all claimed not to share details about their children in their tweets, it is interesting to note that manual inspection of the 71 valid Twitter account homepages provided found that 17 of the mothers (23.9%) used a photo containing their child’s face as their Twitter profile photo, and 3 (4.2%) mention the first name(s) of their child(ren) in the public bio associated with their Twitter account.

Facebook Use

259 (62.9%) of the mothers indicated that they used Facebook (though only 233 provided access to a dump of their Facebook timeline data). This is comparable to the 66%

Behaviors	Examples
Questioning	<ul style="list-style-type: none"> • “ask other mothers questions about concerns I have” • “inquiry of appropriate behaviors, stores, products, or illnesses” • “information seeking about care”
Curation	<ul style="list-style-type: none"> • “linking to blog posts about baby” • “making a memory archive”
Mommy Networking	<ul style="list-style-type: none"> • “Facebook messaging/email with people in online forum for my baby group” • “interacting on [Facebook] pages of mom-groups”

Table 1. Example survey comments by mothers describing parenting-related appropriations of Facebook.

of online U.S. adults found to use Facebook in a recent Pew survey [5]. Of the 259 mothers who were Facebook users, 89.2% indicated that they posted Facebook status updates about their child, 96.5% said they posted photos of their child to Facebook, and 45.6% said they posted videos of their child to Facebook.

Additionally, a few respondents (4.6%) used the comments area to describe other ways in which they used Facebook for parenting-related purposes. These other uses fell into three main categories (established using open coding): *questioning*, *curation*, and *mommy networking*. Table 1 shows examples of mothers’ descriptions of appropriating Facebook for each of these three activity types. Only one mother used the comment field to raise privacy issues: “I used to post about my kid, including pics (sic) and videos, but I stopped because of privacy concerns.”

For the 233 mothers who provided access to a dump of their Facebook Timeline, our analysis focused only on posts authored by the mother. These posts consisted of the text associated with status updates, and captions of photos, videos, and/or links shared on the mother’s Timeline/Wall.

Post Frequency

Mothers’ status updates generally taper off after birth, from a median of 0.12 statuses/day in the 100 days before the birth to a median of 0.05 statuses/day after the birth. A Wilcoxon test found this to be a significant difference, $z = -6.89$, $p < .001$. Photo posting rates remain steady, however, at a median of .02 photos/day both before and after the birth; indeed, photos make up a median of only 9.8% of mothers’ posts in the 100 days before the child’s birth, but comprise 26.8% of posts afterward, a significant difference according to a Wilcoxon test ($z = -10.32$, $p < .001$).

Posts containing the child’s name are most common in the first month after birth, during which they represent a median of 28.6% of all posts authored by the mother. After the first month, the proportion of posts mentioning the child’s name quickly tapers off; by the second month, these comprise only 12.8% of the mother’s posts, and by the end of the first year,

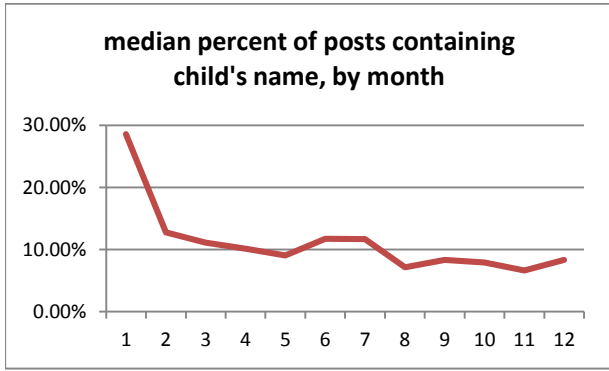


Figure 1. The proportion of a mother’s Facebook posts that mention her child by name drops sharply after the first month post-birth.

only 8.3%; a Friedman test confirms there is a significant change in the proportion of posts mentioning the child over time, $\chi^2(2, N = 81) = 30.0, p < .001$. Figure 1 illustrates this trend over the course of the baby’s first year.

Posting rate, regardless of whether the post is baby-centric, remains relatively constant after the sharp drop-off from the pre-birth median of 0.2 posts per day, holding steady at a median of 0.1 posts per day for each of the 12 months after the birth.

Post Content

A median of 13.5% of all posts written by mothers after their child’s birthdate contain the child’s name. For status messages, the median is 14.0%, for photos it is 14.0%, and for videos and links the median is 0%, as these latter two types of posts were relatively uncommon.

First-time mothers tend to post more about their child (median 15.3% of all posts) than non-first-time mothers (median 10.8%); a Mann-Whitney *U* test indicates that this is a statistically significant difference, $z = -2.98, p = .003$.

Since several mothers indicated in their survey comments that they use Facebook for questioning activities, a finding also mentioned by participants in Gibson and Hanson’s (2013) ethnographic study, we examined question-asking behavior by looking at status message posts containing a question mark, a heuristic found to be reasonably satisfactory at identifying SNS questions in prior studies [18, 32]. Overall, questioning appears to be a common activity by expectant mothers and mothers of young children. For status messages posted by the mother in the 100 days before the birth of the child, the median proportion of questions is 9.4%. In contrast, after the birth of the child, question asking increases to represent 12.5% of the status updates; however, this difference is not statistically significant by a Wilcoxon test ($z = -0.79, p = .4$).

A single coder iteratively developed a labeling scheme after reading samples of mothers’ questions, and then two coders applied this scheme to another random sample of 100 questions. Questions were first labeled as being parenting-

Category	Examples
Social Support	<ul style="list-style-type: none"> • “Any other moms out there have trouble falling asleep... around the 3 month postpartum mark?” • “How does one tiny person generate SO much laundry???”
Advice	<ul style="list-style-type: none"> • “So [anon] is going to be 6 months on the 6th and he cries everytime i try to give him solids with a spoon... any advice?” • “So dumb question...when do babies start sitting in their car seats facing forward?”
Parenting Purchases	<ul style="list-style-type: none"> • “Is Sophie the Giraffe really worth the price or is it just a really hyped up squeaky toy?” • “Anyone know of someone selling a crib in good condition with the new safety standards?”
Social Interaction	<ul style="list-style-type: none"> • “Heading to the [anonymized] Children’s Center mid-day, anyone want to join us?” • “Any [anonymized location] peeps doing fun stuff for kiddos today? We need to get out some energy and would love company!”
Favor	<ul style="list-style-type: none"> • “Anyone have a kiddie pool I can borrow?” • “I am in need of a loving friend to watch my sweet baby for the day on Wed Jan 25. Any takers?”

Table 2. Categories of parenting-related questions asked in mothers’ Facebook status messages.

related or not (41% were parenting-related, Cohen’s Kappa of .90). Parenting-related questions were further categorized by type (Cohen’s Kappa of .81): 63.4% were seeking social support over the joys and travails of parenting, 19.5% were seeking parenting advice, 7.3% were seeking opinions or recommendations for child-related purchases, 4.9% were seeking social interaction with other parents/children, and 4.9% were seeking parenting-related favors. Table 2 shows examples of questions from each category.

We also analyzed the emotional content of mothers’ Facebook posts, using the LIWC lexicon’s positive emotion and negative emotion term lists. LIWC’s lexicon has been validated on Internet language [33], and has been used to compute affect in several computational social science projects (e.g., [12, 13]). Each post was assigned an *emotion score* using the following process: a post’s component words were compared against LIWC’s positive and negative emotion lists – for each positive word, one point was added to the score, and for each negative word, one point was subtracted.

We call posts that have an emotion score greater than zero *positive posts* (as they had more positive than negative terms), and those with scores below zero *negative posts* (note that a *neutral post* having an emotion score of 0 is also possible, either due to a lack of use of emotionally charged terminology or due to equal use of positive and negative terms cancelling each other out). “[name] **loves** his new toy



Figure 2. Word cloud depicting the most common terms appearing in the first Facebook post mothers made containing their child's name. Terms that appeared in posts from at least 10 mothers are included; word size increases proportionally to frequency of use. [wordle.net]

cell phone... I think it's **adorable** he **likes** to hear my voice over and over 'I **love** you [name]!' is an example of a post identified as being positive by this method (emotion score = 4, relevant terms bolded), whereas "[name] **screamed** all **freaking** night. we finally got him to sleep and the second we put him down all **hell broke** loose." is an example of a post identified as negative (emotion score = -4, relevant terms bolded).

Overall, mothers' posts trend toward being more positive after their child's birth (mean emotion score = 0.82) than in the 30 preceding days (mean emotion score = 0.74) ($t(174) = -1.81, p = .07$). This is probably explained by mothers' propensity to use positive terms in posts about their child – examining only post-birth posts, those containing the child's name had significantly higher emotion scores (mean = 0.99) than those not mentioning the child's name (mean = .77) ($t(225) = 5.57, p < .001$). 54.3% of posts with the child's name were positive posts, compared to only 49.1% of those without the child's name ($t(225) = 4.10, p < .001$).

Announcing the Birth

Since we knew the date of the child's birth, but not the time, it was not possible to precisely identify the first post made after the birth (since many posts were often made on the birth date but before the birth itself, i.e., describing labor, hospitalization, or non-birth-related events). As a surrogate, we analyzed the first post on or after the birthdate that mentioned the child's name.

For the first post mentioning the child's name, 61.5% of mothers shared a traditional text-based status update, 33.6% shared a photo, 3.5% shared a link, and 1.3% shared a video. These initial posts were not necessarily made on the birth date itself (though 29.2% were); rather, the announcements came a median of two days after the birth.

An aggregate examination of terms appearing in the first post mentioning the child confirms that these generally constitute birth announcements, with the most common co-occurring unigrams being "born" (57 posts), "baby" (45), "lbs" (44), "oz" (43), "long" (33) and "inches" (32). Figure 2 depicts the terms mentioned in first posts by at least 10 mothers.

Category	% of Firsts	Examples
Event	29.9%	trip; bath; swim; flight
Temporal	16.0%	night; today; tonight
Holiday	14.5%	birthday; Christmas; Easter; Halloween
Descriptive	12.7%	big; last; long; official
Developmental	12.4%	word; food; step; laugh
Health	4.1%	cold; fever; shots
Miscellaneous	10.4%	thing; duck; life

Table 3. Most prevalent categories of milestones of the form "first <X>" shared in mothers' Facebook posts containing their young child's name.

Sharing Milestones

To understand, at an aggregate level, the ways in which mothers use Facebook to discuss child-related issues, we extracted words (unigrams) occurring in post-birth posts that mention the child's name after removing stop words, punctuation, and the child's name itself, and tally their frequencies for all 233 mothers who provided Facebook data. The five most common terms occurring in posts with a child's name were temporal: "just" (in 828 posts), "today" (755), "time" (708), "first" (695), and "day" (631).

We further explored the term "first" to understand what milestones of a child's life mothers were sharing via Facebook. We extracted the first non-stop-word unigram following the word "first" or the common phrases "first time," "first day," "first ever," or "first real" in posts containing a child's name.

We categorized these milestones using open coding with a two-pass process – a first pass to develop a set of categories based on common themes in the terms, and a second to apply a category to each term (an additional coder also applied the labeling scheme, with good inter-rater reliability of Cohen's Kappa = 0.65). All terms appearing in at least two posts were included in the categorization (93 unique terms comprising 338 "firsts"). Table 3 shows these categories and their prevalence, with examples of each; sharing milestones relating to novel events (e.g., travel, educational experiences, etc.) was most common ("[anon]'s first time sledding was a success!" "[anon]'s first Patriot's game!"), followed by holidays ("Taking [anon] to her first Easter Egg hunt..." "[anon] went to her first Christmas party today (at dad's work)."), then by more traditional developmental milestones (e.g., walking, speaking) ("[anon] took her first steps last night! We're in for it now." "[anon]'s first words include: shoes ('szehz') and dog ('dah')..."), and lastly by health milestones (e.g., vaccinations, doctors' visits) ("Little [anon] had a day of firsts: first PB reaction, first ambulance ride and first ER visit but praise the Lord he is now doing

just fine!” “First pediatrician’s appointment: at 8 days old, [anon] is 3 oz above his birth weight.”).

Post Reception

For each of the mother’s posts, we calculated an *attention score* that equals the sum of the number of “Likes” and the number of comments the post received. While calculating the actual audience of a post is infeasible from observable post traits [2], our attention score serves as a proxy for the level of interest a user’s friends had in her post (similar to the heuristics users themselves use to reflect on a post’s success [2]). For example, a post receiving 2 “Likes” and 2 comments would have an attention score of 4.

On a per-mother basis, we calculated the average attention score for all post-birth posts containing their child’s name, and all post-birth posts not mentioning the name. Posts mentioning the child had significantly higher mean attention scores (18.1) than those not mentioning them (9.7), according to a paired samples t-test, $t(224) = 8.35, p < .001$. Only 12.5% of mothers had a named/unnamed attention score ratio below 1 (indicating that this minority typically received more likes and comments for posts not mentioning their child’s name).

We also identified the post receiving the highest attention score for each mother, from the date of the baby’s birth onward. For these “most popular” posts, the median attention score was 55 (comprising a median of 32 “Likes” and 23 comments per post). 50.2% of these “most popular” posts mention the child’s name, a much higher proportion than one would expect given that 13.5% of all post-birth posts mention the child’s name ($\chi^2(1, N=233) = 269.0, p < .001$).

Birth announcements are highly likely to be the most attention-receiving post a mother makes. 36.5% of the “most popular” posts corresponded to those that we had automatically identified as birth announcements (the first post on or after the child’s birthdate that mentioned their name). This likely underestimates the proportion of birth announcements comprising “most popular” posts – 49.4% of the posts in this set are posted within one week of the child’s birth date, with most on the first 3 days (Figure 3).

Postpartum Depression

Our survey asked mothers, “Have you ever been clinically diagnosed with postpartum depression?” 92 of the mothers taking our survey (22.3%) reported having been diagnosed with Postpartum Depression (PPD), a type of depression generally commencing shortly after giving birth that the U.S. CDC estimates affects between 11% - 18% of new mothers [9].

Of these, 29.3% used Twitter and 79.3% used Facebook, higher rates of social networking site use than respondents without a PPD diagnosis, of whom 15.6% used Twitter and 58.1% used Facebook. These SNS usage rates of mothers with and without PPD are significantly different: Twitter: $\chi^2(1, N=92) = 13.2, p < .001$; Facebook: $\chi^2(1, N=92) = 17.1, p < .001$.

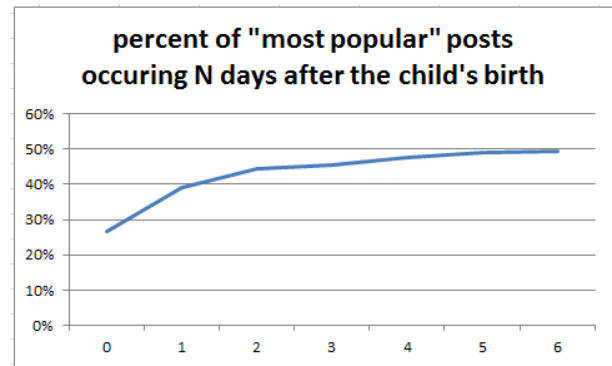


Figure 3. Of the “most popular” post for each mother (the one receiving the highest number of “Likes” and comments), almost half are likely birth announcements (49.4% occur within one week of the child’s birth, and most of those occur within the first few days after birth).

69 of the mothers who had been diagnosed with PPD provided Facebook data. Mothers with PPD were as likely to post about their child (median of 12.0% of posts, as measured by the proportion of posts containing the child’s name) as those who did not report having a PPD diagnosis (median of 13.6% of posts) (no significant difference according to a Mann-Whitney *U* test, $z = -1.37, p = .17$). While there is a slight trend toward mothers with PPD posting content to Facebook more frequently, it is not statistically significant – in the 100 days before the child’s birth, mothers who later received a diagnosis of PPD authored a median of 0.23 posts per day, while those without authored 0.18; after the birth, mothers with PPD authored a median of 0.12 posts per day, compared to 0.09 for those not reporting a PPD diagnosis.

Prior work [12, 13] has analyzed the relative mix of positive and negative affect of terms used in Twitter posts by mothers with and without PPD. We find that lexical analyses of emotion words also discriminates between mothers with and without PPD on Facebook. In particular, the use of negative emotional words between these two groups was significantly different post-birth (8.0% of non-depressed mothers’ posts were negative compared with 9.8% for mothers with PPD, $t(231) = -2.29, p = .02$), though these two groups did not have significantly different proportions of negative posts in the 30 days pre-delivery ($t(173) = -1.54, p = .13$).

Developmental Delays

Our survey asked mothers, “Has your child been diagnosed with any of the following types of developmental delay?” Answer options were: “Language or Speech”; “Gross or Fine Motor”; “Social or Emotional”; “Cognitive”; and “Other (please specify).” 32 of the 412 mothers in our study (7.8%) reported that their child had been diagnosed with a developmental delay. Of these, 15.6% had Twitter accounts, and 53.1% had Facebook accounts (neither of which is significantly different from the proportion of mothers of children not reporting delays who have such accounts, 18.9% on Twitter, $\chi^2(1, N=32) = .22, p = .6$, and 63.7% on Facebook, $\chi^2(1, N=32) = 1.55, p = .2$).

Of those with Facebook accounts, only 58.8% reported posting status updates about their child (a much lower percentage than the 91.3% of mothers of children not diagnosed with delays who reported posting such updates, $\chi^2(1, N=32) = 49.5, p < .001$). However, the proportion reporting sharing photos (94.1% vs. 96.7%) and videos (47.1% vs. 45.5%) were similar to the larger pool of mothers.

15 of the mothers who reported that their child had been diagnosed with a developmental delay provided their Facebook timeline data for analysis. Mothers of children diagnosed with developmental delays tended to write fewer posts including their child's name (13.0% of posts compared to 18.1% of posts for mothers of children without a delay) – however, this is not a significant difference according to a Mann-Whitney U test, $z = -1.28, p = .2$; a larger sample size may be necessary to identify whether this trend reflects a true difference. The mothers of children with developmental delays used a smaller percentage of positive words in posts containing their child's name than mothers not reporting developmental delays (4.2% vs. 5.5%, $t(15) = 2.35, p = .03$).

DISCUSSION

Our findings provide insights into evolving sociotechnical trends regarding the media mothers find appropriate and useful for sharing information about their young children, and the ways in which they use these media. These findings have implications for the design of future technologies that meet the needs of mothers of young children.

SNS Choice

Although our participants overall had Facebook and Twitter profiles in similar proportions to the general U.S. population, our findings reveal that these networks are viewed very differently through the lens of motherhood, particularly with respect to their suitability as an outlet for sharing child-related content.

Twitter, specifically, was not viewed as an outlet suitable for posting tweets or imagery of one's child, even among the subset of users whose accounts were restricted to be private. If privacy concerns were indeed at the root of mothers' reluctance to embrace Twitter for child-related content, then the discrepancy we found in mothers' claimed avoidance of child-related posts on Twitter and the prevalence of revealing information about their child in their profile may represent a form of privacy leakage. Alternatively, the discrepancy may be due to factors such as our survey asking about what they shared in the content of tweets rather than in the account profile, inaccurate self-reporting by respondents, and/or cognitive dissonance surrounding actual versus desired behavior (i.e., embarrassment at violating social norms dictating that it may not be prudent to share a child's info on a public site).

The prevalence of photo-sharing on Facebook after a child's birth suggests another possible reason for the negative view of Twitter as an information-sharing venue – though it supports sharing imagery, Twitter's reputation and roots as a

simple, text-based interaction experience may bias mothers toward using other services. Network composition might also play a role, as other studies (e.g., [4]) indicate that Twitter networks may contain lower proportions of friends and family than Facebook.

Post-Natal Changes in SNS Use

De Choudhury et al. [12] found that machine learning systems could classify major life events based on signals present in tweets, focusing largely on the positive/negative affect of terms used. Our findings indicate that similar systems could be built on Facebook, and suggest features beyond emotional valence of post terms that might be important, such as posting rate and post type. In the case of mothers of young children, a sharp and prolonged drop in posting frequency follows the birth of their child, and the use of Facebook shifts away from a text-based status update style toward a multi-media photo-sharing style. We also found that emotional terms in post-natal Facebook posts differ for specific sub-populations of mothers, with those diagnosed with PPD having higher rates of negative posts, and those whose children have developmental delays using fewer positive terms in conjunction with their child's name.

Although pop-culture sensibilities, exemplified by the Facebook app *unbaby.me* [11], suggest that new mothers post incessantly and exclusively about their offspring, our findings indicate that this is a greatly exaggerated perception. Indeed, mothers of young children post far less often than they did before their child's birth (at only half of their prior rate), and posts mentioning the child comprise only a small portion of their total posts. Furthermore, the proportion of posts mentioning the child drops off sharply following the first month after birth, and continues to drop as the child ages. However, the amount of attention ("Likes" and comments) given to a mother's child-related posts is much higher on average than for non-child-related posts; this may influence which of a mother's posts are given prominence in Facebook's Newsfeed algorithm (which incorporates likes and comments as a factor [14]), thus contributing to misperceptions of the proportion of parenting content in mothers' posts.

Our finding that mothers' posts are not primarily about their children substantiate the findings of an ethnographic interview study by Gibson and Hanson [16], in which new mothers indicated using social technologies, such as Facebook, to connect with others socially (in order to avoid the isolation that often comes with new motherhood) and as a channel for identity preservation, in order to maintain connections to non-mothering hobbies and interests.

Gibson and Hanson's interviewees also reported using social technologies as methods of seeking parenting advice, an increasingly common phenomenon among general SNS users, as well [29]. Our analysis shows that question posts are indeed quite common among mothers of young children, comprising 12.5% of posts, suggesting that SNSes represent an important medium not only for *sharing* information about

one's child, but also for *seeking* parenting-related advice, product recommendations, favors, social interactions, and social support.

Implications and Future Directions

These insights into mothers' SNS use patterns suggest design and usability changes that such platforms might consider to optimally serve this demographic. For example, mothers of young children's tendency to share more photos and fewer traditional updates, their tendency to share birth announcements of a relatively uniform format, their interest in social information seeking, and their desire to curate and share key milestones in their child's life are all functionalities that could be explicitly supported by Facebook, emergent competitors, and/or app developers.

The large digital footprints created by mothers of young children have potential implications for both maternal and child health, as well. As De Choudhury et al. [12, 13] have observed, social media traces can be used to detect warning signs of serious conditions like postpartum depression. Our findings complement theirs by suggesting other related features that such algorithms might consider, such as the presence or absence of accounts on certain services, posting frequency, and the proportion of negative posts; our findings also indicate elements that do not appear to be valuable features for such distinctions, such as the proportion of posts about the child.

Although we only had a small number of mothers of children with developmental delays in our participant pool, our findings suggest that examining how technology could serve this group is an important area for further research. The decreased likelihood of sharing information about their child on Facebook that this group reported, despite being on Facebook at rates similar to other mothers, might place this group at increased risk of social isolation. Further, it might be advantageous for this group to record more detailed digital traces of their children's developmental progress – Kientz et al.'s [21] work on Baby Steps prompted mothers to record key milestones for sharing with a pediatrician in order to identify developmental delays in time for early interventions. Our findings indicate that attempting to automatically glean such milestones from mothers' Facebook posts is unlikely to be fruitful, as developmental milestones accounted for only a small percentage of the "firsts" mothers typically shared with their online social networks. However, perhaps a Baby-Steps-inspired approach could be successful if prompting for milestone entry were incorporated into Facebook, a venue where mothers are already sharing such information, rather than in the form of a standalone piece of software as originally proposed by Kientz et al.

Common patterns in mothers' Facebook use (e.g., changes in post type and frequency, similar linguistic patterns used in birth announcements, etc.) may represent privacy risks. SNS companies, app developers, advertisers, or other parties with access to users' posts may be able to automatically infer

motherhood status (as well as indicators of conditions affecting a mother or her children like PPD or developmental delays) with high probability, even if users have not explicitly identified their motherhood status in their SNS profile. This information could potentially be used for ethically or legally questionable purposes, such as an employer choosing not to display "help wanted" ads to mothers of young children. The growing body of examples of implicit privacy leakages enabled by "big data" (e.g., [22]) suggest that developing social, technical, and legal protocols for handling such issues is an increasingly timely issue.

Limitations

While our study offers the first systematic insights into use of social networking sites by mothers of young children, its findings and limitations suggest valuable avenues for future work. Interviews, observations, and other ethnographic approaches (such as efforts by Foucault [15], Gibson and Hanson [16], Gulotta et al. [17], and Jomhari et al. [20]) are important complements to the types of survey- and log-based analyses we presented here. Such approaches may be particularly valuable for gaining insight into issues surrounding privacy concerns of this demographic, an issue not explicitly addressed by our study. Qualitative coding of posts might also yield more nuanced insights than the "big data" approaches used in this paper; for example, as mentioned at the beginning of the "Results" section, our heuristic of using mentions of the child's name as a proxy for identifying child-related posts underestimates the total number of such posts, but facilitated analysis of large post volumes. Manual coding of posts might yield more nuanced insights about the extent and manner of child-related social media posts.

Further log-based work may also yield new insights – for example, automated or qualitative analyses of the photos shared by mothers may shed additional light on the feasibility of using SNS traces for a "Baby Steps"-style digital diagnostic record. Understanding the richer ecosystem of SNS use by mothers of young children, including the use of within-network apps, the network structure itself, and/or the ways in which they access such sites (by phone, tablet, PC, etc.) would also be a valuable avenue for further inquiry.

Our study did not examine the intersection of fatherhood and SNS use. Understanding differences in how mothers and fathers utilize social media may be a valuable area of inquiry – for example, perhaps combining data streams from several caregivers (be they mothers, fathers, grandparents, nannies, etc.) would provide a more complete dataset for applications like automatic milestone tracking.

The use of SNSes by mothers as their children grow beyond baby- and toddler-hood is also a rich area for further study not addressed in this paper. For example, Burke et al.'s recent analysis of families on Facebook [8] indicates that SNSes provide important venues for connection and communication for parents and their teenaged and adult children.

As noted earlier, another limitation of this study is the oversampling of affluent, white women. Additionally, our sample was limited to women who currently have accounts on social networking sites. Understanding the perceptions and behaviors of mothers who choose not to use social technologies, or of those from more diverse cultural and socioeconomic backgrounds (as well as from beyond the U.S.), are open areas for further work.

CONCLUSION

In this paper, we presented the first study of how mothers of young children (aged 0 – 3 years) use the popular social networking sites Facebook and Twitter. By analyzing surveys from 412 U.S. based mothers (and associated Facebook data from 233 of them), we identified the types of content mothers share about their children, where they prefer to share it, and how their SNS use patterns change after birth. Our findings have implications for improving the utility and usability of SNS tools for mothers of young children, as well as for creating and improving sociotechnical systems related to maternal and child health.

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