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Comparison of Text Messages vs Email When Communicating and Querying with Mothers about Safe Infant Sleep

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Abstract

Objectives—To assess how mothers' choice of email or text messages (SMS) to receive safe sleep communications impacts educational video viewing and responses to care practice queries.

Methods—792 new mothers received safe sleep-related communications for 60 days following newborn hospital discharge, as part of a trial of health education interventions on infant care practices. Mothers chose email or SMS for study communications and were sent 22 short safe sleep videos and 41 queries regarding infant care practices.

Results—55.7% elected to receive study communications via email. The SMS group had a modestly higher overall view rate of videos (59.1% vs. 54.4%; aOR 1.39, 95% CI 1.07–1.81) and a substantially higher response rate to queries (70.0% vs. 45.2%; aOR 3.48, 95% CI 2.74–4.43).

Conclusions—Participants more commonly opted to receive infant care practice videos and queries via email. SMS was associated with higher viewing and response rates, especially for query responses. These results highlight the importance of understanding how specific modalities of communication may vary in reach.

Keywords

safe sleep; text messaging; email

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Introduction

New technologies have increased options for communicating with patients about their health. Currently 89% of U.S. adults and 99% of 18-29 year olds have internet and email access,¹ 95% of all adults own a cellphone, and 77% own a smartphone.² Searching for health information is one of the most frequent activities done online; in 2015, 72% of all Americans looked online³ and more than half of smartphone owners used their phone⁴ to access health information. Additionally, patients are receptive to receiving messages related to appointment or medication reminders and health-related messages via email or Short Message Service (SMS; i.e., text message). One survey of 1000 adults found that mobile phone was the favored method of receiving medical test results,⁵ and studies of persons of low socioeconomic status⁶ and those with chronic illnesses⁷ have found that they are receptive to receiving messages related to appointment or medication reminders and health-related education through these methods. Parents have also expressed openness to receiving health-related messages about their children.^{8,9} Furthermore, systematic reviews of interventions using mobile health (mHealth) technologies [those that use mobile communication devices (e.g., cell phones) to provide health services and information] found positive impacts on appointment attendance, immunization rates, medication adherence, and diabetes self-management.¹⁰⁻¹²

While many health professionals have begun to use mHealth technologies to provide health information directly to patients, it is yet unclear whether email or SMS is more effective in bidirectional communication, specifically receiving responses from patients, as this may promote more active engagement in managing their health.¹³ Such engagement may be important in assessing medication adherence, obtaining information rapidly about public health outbreaks, and obtaining responses for research protocols. Indeed, some studies suggest that requiring a reply to a text message may increase adherence to medication,^{14,15} and that the effect may be sustained, even after the text messages stop.¹⁵ Many mHealth interventions have focused on automated message systems using SMS technology, and most of these have used “push” technology, in which target patients receive automated SMS messages tailored to their specific health care needs and/or personal preferences without a user-initiated request.¹¹ One study found that adolescents with delayed vaccines who received SMS reminders were more likely to become up-to-date with their vaccinations than those who received email reminders;¹⁶ however, others have found that SMS and email are equally effective for collecting health information from patients.^{17,18}

Although email and SMS share a number of features, such as the ability to be accessed by many devices, including cell phones, and asynchronous access (at any time convenient for that individual), there may be individual preferences regarding receipt of electronic messages. Some prefer email because it is easier to store messages for future reference, while others find SMS easier to access.¹⁹ Depending on the device and service plan, there can be extra charges for SMS or email access.²⁰ However, both SMS and email may be perceived as less invasive than a phone call. Studies have demonstrated that personally tailored messages are more effective in changing health behaviors than generic messages.^{21,22} Both email and SMS may also allow for a more interactive, participatory

process than traditional methods, which in turn may be more effective in promoting health behavior changes.²³

Knowing which technologies are most efficient for communicating with patients has important implications for research and for clinical care. We therefore analyzed data from the Social Media and Risk Reduction Training (SMART) infant care practices study, a large, 4-armed randomized controlled study of the impact of complementary health education interventions on infant care practices. SMART hospitals completed nursing QI training in safe sleep or breastfeeding, and mothers received health messages via email or SMS on safe sleep or breastfeeding. The 4 arms of the study were breastfeeding QI/breastfeeding mobile health (mHealth), breastfeeding QI/safe sleep mHealth, safe sleep QI/breastfeeding mHealth, and safe sleep QI/safe sleep mHealth. We analyzed data from all mothers who received the safe sleep mHealth intervention during the 60-day intervention period, with the following objectives: 1) to determine the proportion of mothers who chose SMS vs. email for health messages, 2) to identify factors, including demographic characteristics, associated with choosing SMS or emails, 3) to compare rates of educational video viewing for those who chose SMS or email, and 4) to compare response rates when health-related queries were sent via SMS or email.

Methods

Study Population

Participants were mothers of healthy term infants born from March 2015 to May 2016 at 8 hospitals across the U.S. Hospitals were selected from a nationally representative sample of 32 hospitals (See Acknowledgements for a list of hospitals), based on their successful performance in a prior study²⁴⁻²⁶ and baseline parental adherence to infant care practice recommendations. Each hospital enrolled 100 mothers after delivery in a systematic manner, using pre-assigned “start with” and “take every” numbers. To assure adequate representation of minority racial/ethnic groups, these groups were oversampled; hospitals were provided target recruitment numbers for Hispanic, non-Hispanic Black, and mothers of all other race/ethnicities. Mothers were excluded if they were not English-speaking or did not have custody of the infant, or if the infant required hospitalization for more than 3 days, had contraindications to breast milk feeding or following safe sleep guidelines, or was deceased. Mothers were also excluded if they did not agree to receive messages by SMS or email. Institutional review board approval was obtained at all participating hospitals.

Data Collection

After signing written informed consent, mothers chose to receive health information messages through their preferred mode of communication (SMS or email) during a 60-day period after the newborn stay. Research staff assisted mothers in enrolling in the preferred communication platform. Mothers received the first 2 messages at the time of enrollment. Within 24 hours, mothers began receiving additional messages through short (60-90 seconds) informational videos supporting safe sleep, which were made specifically for this study. They received these videos on a daily basis for the first 11 days after enrollment, and

then every 3-4 days for 60 days (See Table 1 for schedule of videos and queries). Videos were timed to anticipate known barriers to safe sleep practices, based on prior research.²⁷⁻³¹

Unique links were used to track when and how many times each participant opened one of the videos, and a video was counted as “viewed” if the link was clicked at least once. We were unable to measure whether or not the mother watched the full video after it was opened.

Mothers were also sent a total of 41 short queries by their preferred mode of communication to both keep the mothers engaged in the study and obtain weekly data on current infant care practices. For each query, mothers who signed up for SMS received a text message containing the query text, multiple-choice responses, and instructions to reply with A, B, C, or D. All text messages were delivered at 10 am and/or 7 pm in the mother's time zone each day. On days when 2 messages were scheduled, the first was sent at 10 am and the second at 7 pm. Standard text messaging rates applied and varied depending on the mother's cell phone plan. Mothers who signed up for emails received an email with the query text and a link to respond to the query. When the mother clicked on the link, she was directed to a secure webpage with the multiple-choice question. She then selected her response and clicked “Submit.” Email messages were sent each day at the same chronologic time that the mother was initially enrolled. If 2 messages were scheduled for the same day, both emails were sent simultaneously. Receiving emails did not result in additional expenses. Timing of text and email messages were set by the proprietary communication platforms used to send messages.

Data Analysis

Email and text message platforms allowed us to track video views and query responses across the 60-day study period. Demographic characteristics of mothers who chose to receive messages via email vs SMS were compared through chi-square analysis. Odds of viewing a video (or responding to a query) were analyzed through general estimating equation (GEE) logistic regression models that accounted for the correlated data resulting from analyzing multiple videos (or queries) per mother. Univariate models compared the crude odds of viewing a video (or responding to a query) for mothers receiving messages through SMS vs email, and multivariable models examined associations between demographic characteristics and mode of receiving messages on these outcomes. Changes in view rates over time were also analyzed through GEE logistic regression models.

Results

Study Population Characteristics

Of 1422 eligible mothers, 800 were enrolled; of this group, 792 received safe sleep messages; eight were incorrectly enrolled in the email or SMS program during study sign-up and thus did not receive any videos or messages (See Figure 1). The majority (441, 55.7%) of mothers elected to receive email messages, while 351 (44.3%) selected SMS messages. Demographic characteristics of mothers are shown in Table 2; mothers in the two groups were demographically similar, with the exception that mothers choosing SMS were less

likely to be married ($p=0.05$). Although differences were not significant, mothers choosing email were more likely to be primiparous and college graduates.

Viewing of Videos

6,778 videos were sent to the 351 mothers receiving SMS messages, and 8,036 to the 441 mothers receiving emails. Approximately one-third (30%) of mothers viewed all of the videos, 23% viewed 51-99%, 9% viewed 26-50%, and 13% viewed 1-25% of videos. Twenty-six percent did not view any videos after enrollment. When adjusted for demographic variables, odds of viewing a video were statistically higher in the SMS group (aOR 1.39, 95% CI 1.07-1.81). Odds of viewing a video were lower for mothers who were Black (aOR 0.66, 95% CI 0.46-0.96) or never married (aOR 0.65, 95% CI 0.47-0.91) (Table 3).

View rates over time are illustrated in Figure 2. View rates declined similarly over time in both the SMS and email groups ($p=0.404$ for time-by-group interaction, $p<0.001$ for slope over time). In the SMS group, view rates dropped from 64% for the first video to 45% for the last, and in the email group dropped from 57% to 43%.

Response Rate to Queries

13,818 queries were sent to mothers receiving SMS messages, and 16,267 to mothers receiving emails. The overall mean response rate to queries was 56.6% (range for individual queries, 38.0%-87.5%). Twelve percent responded to all queries, 42% responded to 51-99% of queries, 10% to 26-50% of queries, and 17% to 1-25% of queries. Nineteen percent did not respond to any queries. In adjusted analyses, mothers receiving SMS had 3.5 times higher odds of responding to queries than those receiving emails (aOR 3.48, 95% CI 2.74-4.43) (Table 3). Odds of responding to a query were lower for mothers who were 20-29 years (aOR 0.68, 95% CI 0.51-0.90), non-White (Black aOR 0.54, 95% CI 0.38-0.76; Hispanic aOR 0.73, 95% CI 0.54-0.99; Other aOR 0.56, 95% CI 0.35-0.89), and were never married (aOR 0.71, 95% CI 0.52-0.96).

Query response rates over time are illustrated in Figure 2. The query response rate in the SMS group showed a greater drop over time ($p<0.001$ for the time by group interaction) but remained higher than the rate in the email group at the end of the study. Query response rates dropped from 87% to 59% in the SMS group, and from 46% to 39% in the email group.

Discussion

In this study utilizing email and SMS communications to send educational videos and health-related queries to mothers, we found that SMS was a more successful mode both for engaging mothers in viewing the educational videos and obtaining responses to queries; there were modest increases in video viewing rates and substantially higher query response rates.

There are several potential reasons that SMS recipients are more likely to respond to queries. While emails are designed for asynchronous responses, text messages may be perceived by

recipients as requiring more immediate responses. In one web survey, participants receiving both text and email messages were more likely to read text messages and respond more quickly than those who received only email messages.³² Marketing statistics cite that >90% of text messages are read, compared to 22% of email messages.³³ In addition, the communication platforms may have facilitated more rapid SMS responses, as they only required pressing the keypad once. Email responses required clicking on a link, which connected to a separate webpage, where one responded to the question and then pressed the “Submit” button. Additionally, if cellular signals were weak, it may have been more difficult to open and respond to emails than text messages. Finally, although the mothers in our study selected either email or SMS, and individual characteristics may have impacted responses, we do not believe that this explains the differential response rates. In general, SMS is most popular among young adults, non-Whites (particularly African-Americans), and those with lower education and income.³⁴ However, in our sample, the demographic characteristics of those choosing email or SMS were similar, except that those who had never been married were more likely to choose SMS; these mothers were also less likely to view videos or to respond to queries.

The majority of mothers in our study elected to receive messages via email. This may in part be due to the fact that email services are generally free of charge, particularly on computers, while some cellular service providers charge fees for receiving and sending text messages.¹⁹ Computer access or data plans are needed to open and view videos; this may also have made email a more popular choice. As we did not obtain information about the type of phone (smartphone vs. no smartphone), carrier, or plan, we do not know if this was a consideration for mothers. In addition, maternal characteristics that were not measured, such as the desire to receive messages asynchronously, may have played a role.

We had fairly consistent engagement of over 50%, as measured by video view and query response rates, throughout the entire study, with higher rates in the SMS group. Nonetheless, both groups demonstrated a significant decreasing trend over time. In general, study retention is often challenging, and rates in the literature have varied. In one systematic review of 14 interventions utilizing SMS, retention rates ranged from 43% to 100%.²¹ SMS thus is a promising mode of communication for both health information and for study retention.

Limitations

We acknowledge the limitations of this study. Mothers in this study chose to receive either SMS or email messages. This self-selection rather than random assignment may have introduced bias into the results. In addition, while we postulate that access to specific types of technology and associated costs may have played a role in the selection of SMS or email, we did not ask mothers for the reasons underlying their choice. Future studies about reasons for choosing SMS or email health messaging will be important, particularly if interventions are more effective when delivered via SMS; barriers to receiving SMS messages and strategies for overcoming these barriers should be identified. There may also be limitations with regards to the different communication platforms and the time of day when messages were received. SMS recipients received messages at 10 am and/or 7 pm, while emails were

received at the same time that the mother signed up for the study. If a message is received at a convenient time, there may be increased likelihood of a response. If it is at an inconvenient time, it is possible that mothers would not go back later to respond to previously received messages. In addition, if 2 messages were sent on the same day, SMS recipients received them 9 hours apart; however email recipients received the 2 emails at the same time. It is possible that email recipients may have thought that the second email was a duplicate and deleted it without viewing. We also measured video viewing by whether the mother clicked on and opened the video. We could not assess if the mother viewed the entire video. Further, we could not gather additional information on mothers who were not engaged in the study. Additionally, our recruitment strategy was designed to oversample non-Hispanic Black and Hispanic mothers to allow for stratification; however, as we had overrepresentation of these groups (22.6% Black and 33.0% Hispanic), compared to U.S. Vital Statistics data (14.8% Black and 23.2% Hispanic),³⁵ this may have skewed our results. Finally, we only included English-speaking mothers, and it is possible that these results may not be similar in mothers whose primary language is not English.

Conclusions

After controlling for demographic characteristics, SMS was associated with higher rates of educational video viewing and especially query responses. These results highlight the importance of understanding how specific modalities of communication may vary in their ability to reach the target audience. It will be important to understand facilitators and barriers to use of this modality.

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What's New

Although the majority of participants in this study opted to receive infant care practice videos and queries via email, text messaging (SMS) was associated with higher rates of educational video viewing and query responses.

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Figure 1. Participant Flow Diagram for TodaysBaby Safe Sleep

*191 mothers not approached/1649 mothers assumed preliminary eligible before approach= 11.6% of mothers not approached. 36 mothers were found to be ineligible after approach.

Figure 2. Video view rates and query response rates over time, by mode of communication

Table 1
Schedule of videos and queries

Day	Videos	Queries
2	Why sleep position matters	Feeding
3	Do you worry about your baby choking?	Sleep position
4	Your baby's sleep space is important	Sleep location
5	Should you share a bed with my baby?	Falling asleep while feeding
6	How to handle outside advice	
7	What is the safest mattress?	
8	What about bedding and bumpers?	When is baby fed
9	Should I feed my baby in bed?	Feeding
10	Should I give my baby a pacifier?	Sleep position
11	Why you shouldn't smoke around your baby	Sleep location
12		Falling asleep while feeding
13	What makes a baby a "good sleeper"?	
14		
15		When is baby fed
16		Feeding
17	Are some sleep spaces more dangerous than others?	Sleep position
18		Sleep location
19	A reminder about pacifiers	Falling asleep while feeding
20		When is baby fed
21		
22		Soft bedding
23	How can I make sure my baby is comfortable?	Feeding
24		Sleep position
25		Sleep location
26		Falling asleep while feeding
27		When is baby fed
28		
29	More about pacifiers	Pacifier use
30		Feeding
31		Sleep position
32		Sleep location
33	Do you worry about choking?	
34		
35		
36	Why sleep position matters	Falling asleep while feeding
37		When is baby fed
38		Feeding

Day	Videos	Queries
39		Sleep position
40	Should I share a bed with my baby?	
41		Sleep location
42		
43		Falling asleep while feeding
44	What about bedding and bumpers?	When is baby fed
45		Soft bedding
46		Feeding
47		
48		
49		
50		Sleep position
51		Sleep location
52		Falling asleep while feeding
53		When is baby fed
54		
55		
56		
57		Feeding
58		Sleep position
59	Thank you	Sleep location
60		

Table 2
Demographic Characteristics of Participants, by Choice of Communication Mode

Characteristic	Overall	SMS	Email	Chi sq. p-value
Overall	792 (100%)	351 (44.3%)	441 (55.7%)	
Parity				0.06
1	342 (43.2%)	142 (40.5%)	200 (45.4%)	
2	256 (32.3%)	109 (31.1%)	147 (33.3%)	
3+	194 (24.5%)	100 (28.5%)	94 (21.3%)	
Mother's Age				0.23
Less than 20 y	57 (7.2%)	27 (7.7%)	30 (6.8%)	
20-29 y	406 (51.3%)	190 (54.1%)	216 (49.0%)	
30+ y	329 (41.5%)	134 (38.2%)	195 (44.2%)	
Mother's Race				0.41
White	300 (37.9%)	122 (34.8%)	178 (40.4%)	
Black	179 (22.6%)	86 (24.5%)	93 (21.1%)	
Hispanic	261 (33.0%)	119 (33.9%)	142 (32.2%)	
Other	52 (6.6%)	24 (6.8%)	28 (6.3%)	
Mother's Education				0.10
Less than HS	56 (7.1%)	27 (7.7%)	29 (6.6%)	
HS or GED	187 (23.7%)	79 (22.5%)	108 (24.7%)	
Some college	277 (35.1%)	138 (39.3%)	139 (31.7%)	
College or more	269 (34.1%)	107 (30.5%)	162 (37.0%)	
Marital Status				0.05
Married	397 (51.0%)	167 (48.8%)	230 (52.6%)	
Never Married	338 (43.4%)	148 (43.3%)	190 (43.5%)	
Separated/Divorced/Widowed	44 (5.6%)	27 (7.9%)	17 (3.9%)	
Household Income				0.13
Less than \$20,000	109 (13.8%)	55 (15.7%)	54 (12.2%)	
\$20,000-49,999	144 (18.2%)	71 (20.2%)	73 (16.6%)	
\$50,000 or more	295 (37.2%)	129 (36.8%)	166 (37.6%)	
Unknown	244 (30.8%)	96 (27.4%)	148 (33.6%)	

Table 3

Rates of Video Viewing and Query Responses

Characteristic	Overall – videos sent	Video View Rate	Crude OR (95%CI)	aOR (95%CI)*	Overall – Queries sent	Query Response Rate	Crude OR (95%CI)	aOR (95%CI)*
Overall	14814 (100%)	8376 (56.5%)			30085 (100%)	17028 (56.6%)		
Parity								
1	6428 (43.4%)	3564 (55.4%)	REF	REF	13036 (43.3%)	7379 (56.6%)	REF	REF
2	4740 (32.0%)	2804 (59.2%)	1.16(0.87,1.55)	0.96(0.71,1.31)	9594 (31.9%)	5695 (59.4%)	1.12(0.85,1.47)	0.89(0.66,1.19)
3+	3646 (24.6%)	2008 (55.1%)	0.99(0.72,1.34)	0.81(0.56,1.18)	7455 (24.8%)	3954 (53.0%)	0.87(0.65,1.15)	0.66(0.48,0.91)
Mother's Age								
Less than 20 y	1072 (7.2%)	490 (45.7%)	0.44(0.26,0.72)	1.00(0.58,1.72)	2206 (7.3%)	898 (40.7%)	0.36(0.23,0.57)	0.57(0.32,1.03)
20-29 y	7648 (51.6%)	3870 (50.6%)	0.53(0.41,0.69)	1.62(0.87,3.03)	15524 (51.6%)	8045 (51.8%)	0.57(0.45,0.72)	0.68(0.51,0.90)
30+ y	6094 (41.1%)	4016 (65.9%)	REF	REF	12355 (41.1%)	8085 (65.4%)	REF	REF
Mother's Race								
White	5559 (37.5%)	3537 (63.6%)	REF	REF	11279 (37.5%)	7576 (67.2%)	REF	REF
Black	3271 (22.1%)	1457 (44.5%)	0.46(0.33,0.64)	0.66(0.46,0.96)	6638 (22.1%)	3065 (46.2%)	0.42(0.31,0.57)	0.54(0.38,0.76)
Hispanic	4957 (33.5%)	2791 (56.3%)	0.74(0.55,0.99)	1.13(0.80,1.59)	10076 (33.5%)	5155 (51.2%)	0.51(0.39,0.67)	0.73(0.54,0.99)
Other	1027 (6.9%)	591 (57.5%)	0.77(0.47,1.28)	0.70(0.42,1.19)	2092 (7.0%)	1232 (58.9%)	0.70(0.44,1.12)	0.56(0.35,0.89)
Mother's Education								
Less than HS	1066 (7.2%)	504 (47.3%)	0.49(0.29,0.81)	0.86(0.45,1.65)	2194 (7.3%)	844 (38.5%)	0.31(0.20,0.47)	0.58(0.33,1.02)
HS or GED	3464 (23.5%)	1590 (45.9%)	0.46(0.33,0.64)	0.75(0.49,1.15)	7072 (23.6%)	3107 (43.9%)	0.39(0.28,0.53)	0.66(0.44,0.993)
Some college	5214 (35.3%)	3005 (57.6%)	0.74(0.54,0.99)	0.98(0.69,1.38)	10583 (35.3%)	6291 (59.4%)	0.72(0.54,0.96)	0.92(0.67,1.26)
College or more	5010 (34.0%)	3251 (64.9%)	REF	REF	10113 (33.8%)	6776 (67.0%)	REF	REF
Marital Status								
Married	7478 (51.4%)	4924 (65.8%)	REF	REF	15160 (51.3%)	9964 (65.7%)	REF	REF
Never Married	6241 (42.9%)	2968 (47.6%)	0.47(0.36,0.61)	0.65(0.47,0.91)	12691 (42.9%)	5835 (46.0%)	0.44(0.35,0.56)	0.71(0.52,0.96)
Separated/Divorced/Widowed	836 (5.7%)	425 (50.8%)	0.54(0.31,0.94)	0.58(0.32,1.06)	1709 (5.8%)	1017 (59.5%)	0.77(0.47,1.26)	0.80(0.45,1.41)
Household Income								
Less than \$20,000	2066 (13.9%)	907 (43.9%)	REF	REF	4226 (14.0%)	1815 (42.9%)	REF	REF
\$20,000-49,999	2671 (18.0%)	1417 (53.1%)	1.44(0.94,2.23)	1.12(0.71,1.78)	5387 (17.9%)	2915 (54.1%)	1.57(1.07,2.28)	1.21(0.80,1.85)

Characteristic	Overall – videos sent	Video View Rate	Crude OR (95%CI)	aOR (95%CI)*	Overall – Queries sent	Query Response Rate	Crude OR (95%CI)	aOR (95%CI)*
\$50,000 or more	5602 (37.8%)	3727 (66.5%)	2.54(1.73,3.74)	1.28(0.79,2.08)	11332 (37.7%)	7793 (68.8%)	2.93(2.08,4.11)	1.48(0.95,2.30)
Unknown	4475 (30.2%)	2325 (52.0%)	1.38(0.93,2.05)	1.21(0.80,1.83)	9140 (30.4%)	4505 (49.3%)	1.29(0.92,1.82)	1.26(0.86,1.83)
Method								
SMS	6778 (45.8%)	4007 (59.1%)	1.21(0.95,1.55)	1.39(1.07,1.81)	13818 (45.9%)	9676 (70.0%)	2.83(2.25,3.56)	3.48(2.74,4.43)
Email	8036 (54.2%)	4369 (54.4%)	REF	REF	16267 (54.1%)	7352 (45.2%)	REF	REF

* Adjusted for all variables in table and intervention group