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Readability assessment of patient-provider electronic messages in a primary care setting

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ABSTRACT

Background The high prevalence of limited health literacy among patients threatens the success of secure electronic messaging between patients from diverse populations and their providers.

Objective The purpose of this study is to generate hypotheses about the readability of patient and provider electronic messages.

Methods We collected 31 patient-provider e-mail exchanges ($n = 119$ total messages) from a safety-net primary care clinic. We compared the messages' mean word count and Flesch-Kincaid Grade Levels (FKGLs), calculated the frequency of provider messages below an FKGL = 8, and assessed readability concordance between patients' and providers' messages.

Results Patients used more words in their initial e-mails compared to providers, but the FKGLs were similar, and 68% of provider messages were written below an FKGL = 8. Of 31 exchanges, 9 (29%) contained at least one patient message with an FKGL > 3 grade levels lower than the corresponding provider message(s).

Conclusion Our study demonstrates that most providers are able to respond to patient electronic messages with a matching reading level.

Keywords: secure messaging, readability, health literacy, safety-net, primary care

BRIEF COMMUNICATION

INTRODUCTION

The United States struggles with low literacy levels, reflected in a recent federal survey that estimated there are currently 30 million functionally illiterate adults and 63 million adults who read at a "basic" literacy level in the country.[1] Efforts to mitigate the societal cost of this problem are evident in policies directed toward health literacy, which is the capacity to "obtain, process and understand basic health information and services needed to make appropriate health decisions."[2]

Secure electronic messaging, which takes place through internet-based patient portals, is a relatively new medium that offers great promise for enhancing patient-provider communication outside of healthcare settings. Notably, secure electronic messaging is increasingly recognized as a key element of 21st century care standards[3] and was recently included as part of the meaningful use Final Rule in the electronic health record (EHR) incentive program administered by the Centers for Medicare and Medicaid Services.[4] In the clinical setting, patients are increasingly using secure electronic messaging to access health services.[5,6]

The readability of providers' secure electronic messages is essential to the efficacy of electronic communication with patients, and, by extension, the desired improvements in costs and patient outcomes as a result of that communication. We interpret the National Institutes of Health recommendations that health materials be written within a "range of about a 6th or 7th [ie, less than 8th] grade reading level"[7] to include all patient-facing text, including secure electronic messages. However, there are no clear guidelines or specific recommendations regarding the intersection of health literacy and electronic communication. For example, one of the goals of the US Department of Health and Human Services National Action Plan to Improve Health Literacy is to, "develop and disseminate health and safety information that is accurate, accessible, and actionable."[8] Yet, the National Action Plan does not specifically address the readability of providers' secure electronic messages.[8]

The absence of best practices for secure electronic messaging readability likely results from the lack of research on this topic. We are aware of only one study of electronic message readability, which analyzed the linguistic components of singular electronic messages written by adolescents with language deficits.[9] To our knowledge, there are no studies on the readability of patient-provider secure electronic message exchanges. Moreover, despite initial research on the length of electronic messages,[10] there are similarly no guidelines relating to the optimal word count of secure electronic messages.

In the setting of wide adoption of secure electronic messaging as part of clinical practice, the lack of knowledge about providers' message readability is startling. Such uncertainty is especially worrisome in the context of the "digital divide," which perpetuates disparities in care based on the differing technological capabilities of providers and patients. Those with limited health literacy have worse health outcomes[11] and, thus, could benefit from clear, comprehensible between-visit communication with health care providers, to supplement in-office care. It is therefore essential to understand how well providers are meeting patient needs vis-à-vis the readability of the information they are providing in secure electronic messages, so that physicians can learn how to use this new medium to enhance effective communication. The purpose of this study is to generate hypotheses about the readability of patient and provider electronic messages in a safety-net primary care setting.

METHODS

The collection of patient-provider e-mail exchanges has been described thoroughly in previous publications.[12] Briefly, we collected e-mail correspondence from provider e-mail accounts as part of

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"usual care" (ie, not within an internet-based portal) at the General Medicine Clinic at San Francisco General Hospital in San Francisco, California, a safety-net primary care clinic. All exchanges were initiated by a patient or caregiver e-mail and included at least one provider response. We received 23 e-mail "threads" (defined as e-mails exchanges over time) that contained 31 "strands" (defined as all messages related to at least one consistent issue), for a total of 119 messages. E-mails were de-identified (names and contact information were removed) prior to analysis. The institutional review board at the University of California, San Francisco, reviewed this study and found it to be exempt from committee review.

We used Microsoft Word© to calculate the word count for each individual message. To assess readability, we highlighted the main body of text (excluding greetings or closings) using Microsoft Word© and applied the Flesch-Kincaid (FK)[13] formula. The FK formula provides scores based on the average number of syllables per word and the average number of words per sentence. FK Grade Levels (FKGLs) represent the minimum grade level at which the reader should be able to read in order to understand the text. An FKGL is calculated as $0.39x + 11.8y - 15.59$ (x = number of words/number of sentences; y = number of syllables/number of words). The FKGL is highly correlated with other commonly used readability assessment methods.[14,15]

To accurately calculate FKGL, we developed a series of text modifications specific to de-identified e-mails: periods were added at ends of sentences or sentence fragments where they were omitted by the writer;[15] formatting glitches from the conversion of the text from e-mail to Microsoft Word© format were mitigated by transforming each message into one paragraph; all first names were changed to John; all last names were changed to Smith; all e-mail addresses were changed to smith@gmail.com; all numbered items (eg, medical record numbers, phone numbers, etc.) were standardized (eg, phone numbers were changed to 123-456-7890, medical record numbers were changed to 1234567, and social security numbers were changed to 123456789); all websites were changed to www.google.com; and all addresses were changed to 123 Main Street. Two e-mail strands contained no patient-authored words in the first patient message (they included a forwarding of results and forwarding of a web link); so, in these cases, the second patient message (ie, the first with patient-authored text) was considered the first patient message. Additionally, one e-mail strand contained a cut-off provider message that was omitted from the analysis.

We focused our patient-provider readability comparisons (word count and FKGL) by using paired t-tests on the first messages sent by patients and providers, respectively, in a given strand. This approach allowed us to focus on a similar message-writing style (ie, initiation of dialogue) and avoid analyzing an unequal number of messages in a given strand. We then qualitatively compared the mean word count and FKGL of the first, second, and third e-mails from patients and providers, respectively, in each strand. Next, we calculated the frequency of provider first messages written below an FKGL = 8, using national guidelines as a benchmark. Finally, we graphed the relative word count and FKGL between the first messages within patient-provider strands and calculated the frequency of patient first messages written >3 grade levels below provider first messages. While there is no standard threshold for establishing a significant difference in FK reading levels, various studies report clear differentiation between each grade level.[13] A three-grade difference is a conservative threshold for readability differences between providers and patients, compared to prior studies of health education materials.[16,17]

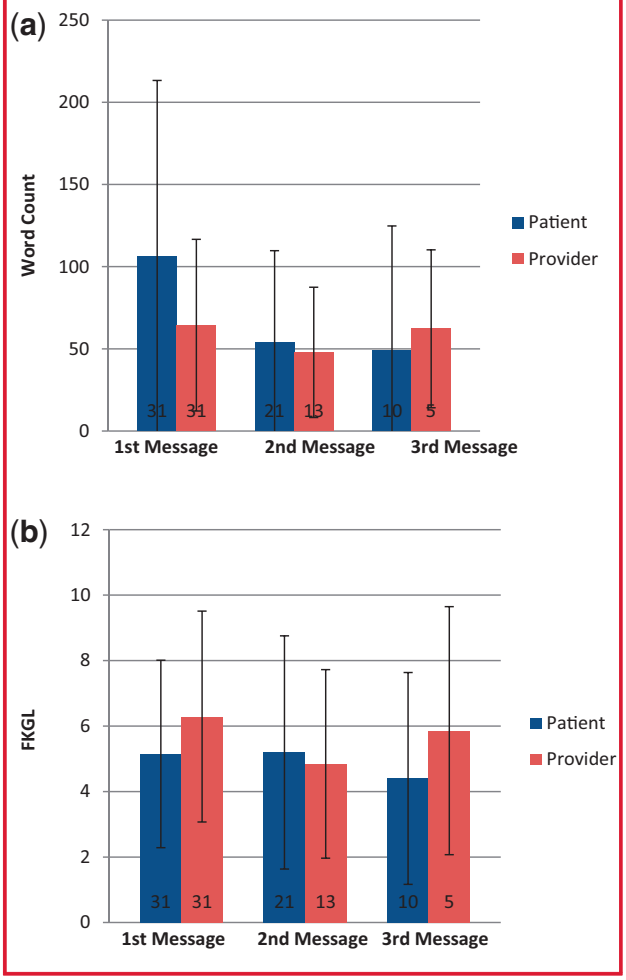
RESULTS

First, we examined the average word count of messages. The mean word count of patients' initial messages (106.0; standard deviation [SD] = 107.3) was higher than that of providers' initial messages (64.4; SD = 52) (P = .02; Figure 1a). There also appeared to be a qualitative decrease in the words per message in patient messages over time, but not in those written by providers (Figure 1a).

Next, we examined the readability of messages. Overall, the mean FKGL of initial messages from patients was 5.76 (SD = 2.9), which did not differ significantly from the overall readability of providers' responses to those messages (FKGL = 6.29; SD = 3.2; P = .49). There appeared to be no qualitative change in patient or provider FKGL over subsequent messages (Figure 1b). Overall, 68% of provider initial messages were written below an FKGL of 8.

Finally, we explored the variability of message readability within and between patient and provider messages in more depth. The range of patient and provider first message FKGL was 0–10.8 and 1.7–12, respectively. Of the 31 strands we collected, 9 (29%) contained at

Figure 1: (a) Word count and (b) Flesch-Kincaid Grade Level (FKGL) of first, second, and third e-mails between patients and providers. Values are listed with standard deviation (SD) error bars and the raw number of messages at the base of each bar.



least one patient message with an FKGL > 3 grades lower than the corresponding provider message(s) (Figure 2b), and there were multiple examples of both concordant and discordant FKGLs. The examples in Table 1, below, show that the discordant exchange uses more words and fewer (and, therefore, more complex) sentences to respond to a similar topic as the concordant example: making a follow-up appointment.

DISCUSSION

We provide the first descriptive readability assessment of secure electronic messages between patients and providers. In contrast to previous studies of patient education materials,[15,18–22] in our study, there was no significant overall difference in readability between patient and provider messages. Moreover, most providers wrote messages at a grade level consistent with national recommendations for written health communications. While our sample size was somewhat limited, these findings may suggest that electronic communication involves more straightforward topics than other media or that providers can match the communication style of their patients in e-mail correspondence. However, it is important to note that we also identified several cases of discordant patient-provider message readability.

We also provide an analysis of word counts in electronic messages between patients and providers. Our data suggest that patients write more verbose initial e-mails than providers.[10] Interestingly, this difference was not present in subsequent messages, which may result from patients responding to provider messages in a more focused manner or a change in patient writing style after securing their provider's attention.

The future delivery of quality healthcare that reduces, rather than reinforces, the "digital divide" will depend on system-level improvements to address discordant readability in patient-provider electronic communication.[23–25] The wide variation in message readability found in our study's analysis demonstrates that some providers will need training on effective written communication techniques. We also believe that successful improvement of provider message readability will depend on the development of real-time feedback tools. For example, there is a need to adapt comprehensive assessment tools like the Patient Education Material Assessment Tool[26] into a real-time, automated format that gives feedback to providers as they construct messages. We envision that adding supplemental links, graphics, and/or audiovisual elements like videos can also help providers increase the comprehensibility of their communication for patients with low health literacy. Finally, while it will be important to develop new tools

Figure 2: Relative assessment of patient-provider first messages. Ordered absolute value differences between the number of words (a) and Flesch-Kincaid Grade Level (FKGL) (b) for individual patient-provider first messages. Negative values listed on the left of each graph indicate provider messages with higher word counts or FKGL; positive values listed on the right indicate patient messages with higher word count or FKGL.

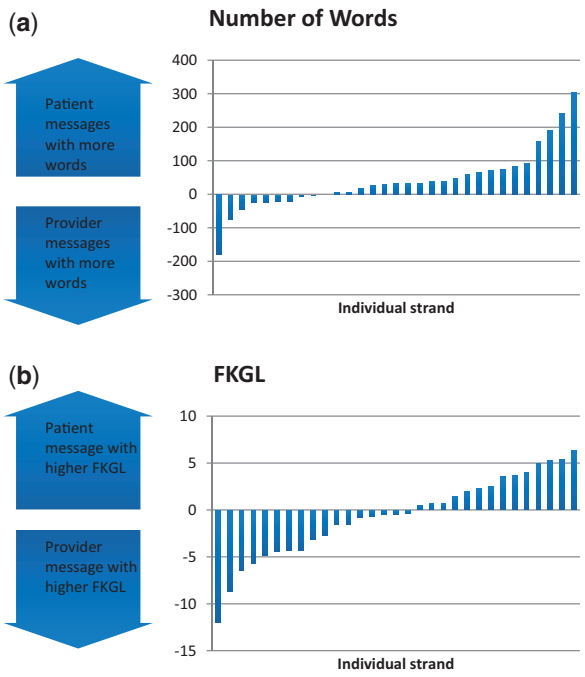


Table 1: Message Examples

Type of Thread	Message Author	Flesch-Kincaid Grade Level (FKGL)	Example
Concordant	Patient	6.0	"I was told by the doctor who is not in the General hospital system that I have enlarged spleen. I got an appointment with you on Tuesday the 19th. Should I get any blood test before I see you and we could talk about my problem?"
	Provider	6.5	"The best thing would be if at our appointment next week you could bring your records from the doctor who gave you this information. I will review them and that will help me decide if any additional tests need to be done. Thanks and looking forward to see you on Tuesday."
Discordant	Patient	4.3	"For the past month or so, John has had a decline in his strength and energy. He feels very weak and his stamina is diminishing. He said he sleeps a lot, and wants to sleep to avoid his neck and back pain. I guess dialysis usually checks for anemia. He hasn't been eating as well either. Should I bring him in for an appointment earlier than his November one? Thanks."
	Provider	10.7	"I asked Dr. Smith to send me labs. My next available appt is 10/3/13 at 9:10. If you think he needs to be seen sooner, particularly if he is short of breath or weak, please call 123-456-7890 and the advice nurse can book you with my practice partner nurse practitioners (who see patients on Monday which may be more convenient)."

and standards, improved use of electronic health communication will also necessarily rely on the success of simultaneous efforts to increase health literacy among patients.

There are several limitations to our analyses. First, our study analyzed a circumscribed sample of correspondence that contained only 31 message strands. Second, as described previously,[12] the patients used in this study may represent an "early adopter" sub-population of our target population, limiting the generalizability of our findings. Third, we employed a single and simple measure of readability to produce simple comparisons between groups, because the FK formula was the most widely used and accessible readability metric available. We did not use other readability measures[7,27,28] because they correlate closely with the FK formula, and we were more interested in overall patient-provider message readability differences than the precise characterization of a given message's readability. The vast majority of the readability indices like the FK formula use word/syllable counts and/or sentence lengths to determine readability, because these aspects are the easiest to automate. However, automated tools may not provide nuanced information on patient comprehension or action planning, which is necessary in healthcare communication.

This study highlights the need for future work investigating the readability of providers' electronic messages to patients, especially because the use of secure electronic messaging is becoming increasingly widespread as a part of healthcare reform. It is crucial to determine whether readability discrepancies within patient-provider correspondence poses a barrier to effective communication (via decreased patient education or understanding) and, more distally, patient outcomes. It will also be interesting to assess whether word counts or FKGL change over time, and, if so, whether providers can dynamically modulate readability to meet patient needs. At a systems level, healthcare leadership, health technology vendors, national professional organizations, and patients and advocacy groups can work collaboratively to convene experts in health literacy and informatics to create guidelines for the development of more literacy-appropriate information delivered through standard platforms like secure electronic messaging via EHRs.

We hope that our study will galvanize an effort to better understand how this new healthcare communication platform is affecting patients' understanding of healthcare information and, ultimately, the care they receive.

CONTRIBUTORS

J.B.M. was responsible for data analysis and manuscript writing, U.S. for data acquisition and manuscript intellectual contribution, C.R.L. manuscript intellectual contribution, and L.T. for data analysis and manuscript intellectual contribution.

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COMPETING INTERESTS

None.

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