

# Patient–Clinician Mobile Communication: Analyzing Text Messaging Between Adolescents with Asthma and Nurse Case Managers

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## Abstract

**Background:** With the increasing penetration of digital mobile devices among adolescents, mobile texting messaging is emerging as a new channel for patient–clinician communication for this population. In particular, it can promote active communication between healthcare clinicians and adolescents with asthma. However, little is known about the content of the messages exchanged in medical encounters via mobile text messaging. Therefore, this study explored the content of text messaging between clinicians and adolescents with asthma. **Materials and Methods:** We collected a total of 2,953 text messages exchanged between 5 nurse case managers and 131 adolescents with asthma through a personal digital assistant. The text messages were coded using a scheme developed by adapting categories from the Roter Interaction Analysis System. **Results:** Nurse case managers sent more text messages ( $n=2,639$ ) than adolescents with asthma. Most messages sent by nurse case managers were targeted messages ( $n=2,475$ ) directed at all adolescents with asthma, whereas there were relatively few tailored messages ( $n=164$ ) that were created personally for an individual adolescent. In addition, both targeted and tailored messages emphasized task-focused behaviors over socioemotional behaviors. Likewise, text messages ( $n=314$ ) sent by adolescents also emphasized task-focused over socioemotional behaviors. **Conclusions:** Mobile texting messaging has the potential to play an important role in patient–clinician communication. It promotes not only active interaction, but also patient-centered communication with clinicians. In order to achieve this potential, healthcare clinicians may need to focus on socioemotional communication as well as task-oriented communication.

**Key words:** adolescent health, computer-mediated social support, e-health, mobile health, mobile messaging, patient–clinician interactions, telemedicine

## Introduction

Asthma is a leading chronic illness among adolescents in the United States. Among Americans under 18 years of age, 7.1 million (9.5%) suffer from asthma.<sup>1</sup> Of high school students, 11.9% currently cope with this chronic illness.<sup>2</sup> As those suffering from asthma are at higher risk of serious complications, adolescent asthma is a major health concern. The inadequate management of asthma has been known to cause frequent school absenteeism, diminish social skills and physical activity, and increase hospital admissions and problematic health status.<sup>3,4</sup>

To address these challenges of adolescent asthma, medical facilities and health professionals have offered asthma education, self-management, and outreach care programs in a variety of settings.<sup>5</sup> In recent years, much attention has been focused on the application of mobile technologies such as mobile computing, medical sensors, and communication technologies in the care of adolescents with asthma.<sup>6</sup> In particular, these technologies promote interactive and supportive communication between healthcare clinicians and adolescents with asthma. Using digital mobile devices, patients can request and receive information, social support, and advice from healthcare clinicians 24 h/day, 7 days a week. Frequent text messaging can help develop a strong relationship between clinicians and patients. Additionally, the confidentiality and direct communication features of mobile text messaging allow for the exchange of personal information between healthcare clinicians and these patients.<sup>7</sup>

Mobile text messaging is the dominant daily mode of communication between adolescents and all those with whom they communicate.<sup>8</sup> It is reasonable, then, to suggest that adolescent patients may exchange a variety of information with healthcare clinicians through mobile text messaging. Although there is a dearth of research on this point, intervention studies demonstrate the effectiveness of messaging systems in the self-management of asthma in adolescents.<sup>9–11</sup> In a recent study, adolescents showed a strong willingness to use mobile text messaging to discuss their health information.<sup>12</sup> Yet little is known about the nature of adolescent–clinician interactions using mobile text messaging, suggesting the need for content analysis of communication in mobile contexts. To address this research need, we examine the content of mobile text messages exchanged between

healthcare clinicians and adolescents with asthma and identify key differences in the features of their text messages.

## Materials and Methods

### INTERVENTION AND PATIENT PARTICIPANTS

The data in this study were collected as part of an intervention testing a mobile asthma control system called the Mobile-Comprehensive Health Enhancement Support System (M-CHESS). M-CHESS provides adolescents (12–18 years of age) suffering from persistent asthma with easy-to-access, just-in-time information, tools, reminders, and tracking as well as support and advice from peers and nurse case managers.<sup>13</sup> One of the interactive communication services provided by M-CHESS is communication with nurse case managers. Once a month, M-CHESS sends to the nurse case manager a report concerning the designated asthma patient’s medical information, including current and previous scores of asthma control tests, medication adherence information, asthma-related healthcare visits, missed school days due to asthma, and a summary of M-CHESS utilization. If asthma control problems are identified in the report, the nurse case manager initiates contact with the adolescent patient and refers, as necessary, to the primary care clinician. The adolescent with asthma can also at any time directly initiate a contact with the nurse case manager regarding issues he or she is experiencing related to asthma.

Adolescents with asthma ( $n=218$ ) were enrolled into the randomized control trial testing the effect of M-CHESS intervention on asthma symptom control in teens. They were randomized to either a control group ( $n=87$ ) that received a personal digital assistant (PDA) and access to an educational Web site for people with asthma or an intervention group ( $n=131$ ) that received a PDA preinstalled with M-CHESS. In the control group, 54% of adolescents were females, and 34% had someone who smoked at home, whereas 58% of adolescents in the intervention condition were females, and 33% had someone who smoked at home. These participants were recruited from five managed care organizations in Milwaukee County, Wisconsin. All participants had experienced an emergency room visit or hospitalization due to asthma-related causes and had filled one or more prescriptions for an asthma medication within the prior 12 months.

### SAMPLE TEXT MESSAGES

Because the current research focuses on describing the content of mobile text messages exchanged between healthcare clinicians and adolescents with asthma, our analysis is limited to the text messages that 131 adolescents assigned to the intervention condition exchanged with 5 nurse case managers through a PDA equipped with M-CHESS. We collected a total of 2,953 text messages exchanged between nurses and adolescents from November 2008 to August 2010.

For our analysis, the text messages were classified into three types of messages: (1) tailored text messages—posts customized to meet personal needs and characteristics of an asthma patient—sent by nurse case managers to adolescents with asthma, (2) targeted text messages—posts fitted to meet shared characteristics of adolescents

suffering from asthma—sent by nurse case managers to all participating adolescents with asthma, and (3) text messages sent by adolescents with asthma to nurse case managers. Additionally, we distinguish communicative behaviors of text messages into task-focused behaviors and socioemotional behaviors based on the Roter Interaction Analysis System (RIAS), which is the most widely used instrument for assessing clinician–patient communication in pediatric primary care.<sup>14</sup>

### CODING SCHEME

No coding scheme has been established to analyze the content of mobile text messaging between healthcare clinicians and adolescent patients. Hence, we created one based on coding categories from the RIAS, which is derived from social exchange theories related to interpersonal influence, problem-solving, and reciprocity for analysis of medical interactions.<sup>14</sup>

Although the RIAS coding rules have been adopted for assessing clinician–patient communication in telemedicine,<sup>15–17</sup> we further modified them to be better suited for analyzing the content of text messages exchanged between healthcare clinicians and adolescent patients using emerging mobile technologies. For example, this study provided adolescents with asthma a PDA to communicate with their nurse case managers. This digital affordance was acknowledged when operationalizing some coding categories. Thus, “giving technological information or asking open/closed-ended technological questions” was created to capture the conversations related to the usage and problems of the PDA. In addition, intervention-related categories were made to measure the information and questions concerning the M-CHESS intervention study.

Through the modification process, we developed coding schemes for text messages sent by nurse case managers and those sent by adolescents with asthma. Regarding the former, we divided them into tailored and targeted text messages. Other aspects of the coding scheme were common to both message sources. *Table 1* illustrates specific coding instruments and examples of text messages sent by nurse case managers.

*Table 2* displays the coding instruments and examples for text messages sent by adolescents with asthma. Here we eliminated “giving biomedical counseling” and “facilitating communication” from task-focused behaviors because they could be seen only in text messages sent by nurse case managers. However, all other sub-categories were the same as the coding scheme of text messages sent by nurse case managers.

### CODING PROCEDURE

Out of a total of 2,953 text messages, 164 were tailored text messages sent by nurse case managers to a specific patient, and 2,475 were targeted text messages sent to all participating patients. The targeted text messages included a large number of duplicates, but this study treated them as individual messages focused on dyadic clinician–patient communication. Lastly, adolescents with asthma sent 314 text messages. The unit of analysis in coding was a statement reflecting a complete thought, such as a simple sentence, a sentence

**Table 1. Coding Scheme of Text Messages Sent by Nurse Case Managers**

CONCEPT, COMMUNICATION BEHAVIOR	DEFINITION	EXAMPLE
Task-focused behaviors		
Giving biomedical information	Give information regarding medical condition, diagnosis, treatment, side effects, and health insurance concerns	This way the medication can go deeper into your lungs!
Giving psychosocial information	Give information regarding lifestyle changes and social psychological issues	
Giving technological information	Give information regarding M-CHESS system use, mobile device, and problem-solving	I sent your e-mail to tech support if you haven't already figured it out.
Giving intervention-related information	Give information regarding intervention procedure and preparation	We have noticed that you haven't done any of your surveys in awhile
Asking open-ended biomedical questions	Ask open-ended questions regarding medical condition, diagnosis, treatment, side effects, and health insurance concerns	How often do you have to use your quick acting inhaler?
Asking open-ended psychosocial questions	Ask open-ended questions regarding lifestyle changes and social psychological issues	
Asking open-ended technological questions	Ask open-ended questions regarding M-CHESS system use, mobile device, and problem-solving	What is your phone number?
Asking open-ended intervention-related questions	Ask open-ended questions regarding intervention procedure and preparation	
Asking closed-ended biomedical questions (yes/no)	Ask closed-ended questions regarding medical condition, diagnosis, treatment, side effects, and health insurance concerns	Have your symptoms resolved?
Asking closed-ended psychosocial questions (yes/no)	Ask closed-ended questions regarding lifestyle changes and social psychological issues	
Asking closed-ended technological questions (yes/no)	Ask closed-ended questions regarding M-CHESS system use, mobile device	Is your phone working now?
Asking closed-ended intervention-related questions (yes/no)	Ask closed-ended questions regarding intervention procedure and preparation	Can u also please respond back that you got this e-mail?
Giving biomedical counseling	Persuasive statements including specific assistance and behavioral guidance (should, have to, need) in resolving medical condition, treatment, side effects, and health insurance problems	If someone wants to smoke while you are in the car ask them to pull over and smoke outside
Facilitating communication	Request for call or respond (only biomedical counseling purpose)	Please text me about your asthma whenever you want.
Socioemotional behaviors		
Positive expression	Agreement, approval, reaffirmation	You are correct, very good
Emotional support	Emotional self-disclosure (concern, worry), emotional support providing, and emotional self-support	I want you to feel your best and know everything about asthma
Social conversation	Greetings, farewell, gratitude, apologies, consolations, congratulations, human-relationship related talk, briefly introducing oneself, social talk (nonmedical chitchat)	Enjoy the holiday season and stay in good health!
Not applicable	Does not follow in any of other categories	
M-CHESS, Mobile-Comprehensive Health Enhancement Support System.		

clause, a sentence fragment, or a single word.<sup>16</sup> Three coders divided all text messages into several statements after discussion and agreement. This was to make sure that coders analyzed the same statement and avoided double coding a single statement. Coders analyzed 7,774 statements: 627 in tailored text messages and 6,548

in targeted text messages sent by nurse case managers. In addition, coders examined 559 statements in text messages sent by adolescents with asthma.

Each statement was coded according to the adjusted RIAS categories as “not present” (0) or “present” (1). Coders first examined the

**Table 2. Coding Scheme of Text Messages Sent by Adolescents with Asthma**

CONCEPT, COMMUNICATION BEHAVIOR	DEFINITION	EXAMPLE
Task-focused behaviors		
Giving biomedical information	Give information regarding medical condition, diagnosis, treatment, side effects, and health insurance concerns	My asthma becomes really bad when I'm running or doing a form of exercise
Giving psychosocial information	Give information regarding lifestyle changes and social psychological issues	My school has a girls soccer team and I'm thinking if I should try out or not
Giving technological information	Give information regarding M-CHESS system use, mobile device, and problem-solving	Hi, my internet is not working
Giving intervention-related information	Give information regarding intervention procedure and preparation	You can call me at 414 442 7071 around 6:30
Asking open-ended biomedical questions	Ask open-ended questions regarding medical condition, diagnosis, treatment, side effects, and health insurance concerns	So what should she do? How can u get asthma?
Asking open-ended psychosocial questions	Ask open-ended questions regarding lifestyle changes and social psychological issues	
Asking open-ended technological questions	Ask open-ended questions regarding M-CHESS system use, mobile device, and problem-solving	Why I cannot get videos and music on the phone?
Asking open-ended intervention-related questions	Ask open-ended questions regarding intervention procedure and preparation	Do I get the money from lasts month?
Asking closed-ended biomedical questions (yes/no)	Ask closed-ended questions regarding medical condition, diagnosis, treatment, side effects, and health insurance concerns	Can I do things that people w/o asthma & w/asthma
Asking closed-ended psychosocial questions (yes/no)	Ask closed-ended questions regarding lifestyle changes and social psychological issues	
Asking closed-ended technological questions (yes/no)	Ask closed-ended questions regarding M-CHESS system use, mobile device	Can you help me (device)?
Asking closed-ended intervention-related questions (yes/no)	Ask closed-ended questions regarding intervention procedure and preparation	
Socioemotional behaviors		
Positive expression	Agreement, approval, reaffirmation (ok, yes, right, correct)	Yes, OK
Emotional support	Emotional self-disclosure (concern, worry), emotional support request, and emotional self-support	It's like my self-esteem is going down
Social conversation	Greetings, farewell, gratitude, apologies, consolations, congratulations, human relationship-related talk, briefly introducing oneself, social talk (nonmedical chitchat)	Hi, thank you for the advice
Not applicable	Does not follow in any of other categories	

M-CHESS, Mobile-Comprehensive Health Enhancement Support System.

function of each statement by choosing either a task-focused behavior or a socioemotional behavior. The statement then was coded for subcategories of communication behaviors. As each of subcategories was mutually exclusive, double coding was not allowed. Three coders rated text messages having conducted a series of training and pilot-test sessions. A subsample (10%) of all text messages was selected to calculate intercoder reliability. Intercoder reliability corrected for agreement by chance (Krippendorff's alpha) indicated an average reliability of 0.79 across all coding categories.

## Results

This study examines the types of content prevalent in three types of text messages and whether significant differences separate task-focused behaviors and socioemotional behaviors in each type of text message. *Table 3* shows the frequencies of coded content for all text messages.

### TAILORED TEXT MESSAGES BY NURSE MANAGERS

"Giving intervention-related information" (15.5%) occurred most frequently as a task-focused behavior in tailored text messages sent

**Table 3. Frequency of Content Coding Categories in Text Messages Exchanged Between Nurse Case Managers and Adolescents with Asthma**

CODING CATEGORIES (%) FOR TYPES OF TEXT MESSAGES	TAILORED TEXT MESSAGES BY NURSE MANAGERS (N= 164)	TARGETED TEXT MESSAGES BY NURSE MANAGERS (N= 2,475)	ADOLESCENT TEXT MESSAGES (N= 314)
Task-focused behaviors	462 (73.7)	5,485 (83.7)	345 (57.7)
Giving biomedical information	95 (15.2)	2,115 (32.3)	122 (20.4)
Giving psychosocial information	0 (0.0)	0 (0.0)	22 (3.7)
Giving technological information	52 (8.3)	33 (0.5)	40 (6.7)
Giving intervention-related information	97 (15.5)	161 (2.5)	74 (12.4)
Asking open-ended biomedical questions	47 (7.5)	230 (3.5)	21 (3.5)
Asking open-ended psychosocial questions	2 (0.3)	0 (0.0)	1 (0.2)
Asking open-ended technological questions	9 (1.4)	0 (0.0)	8 (1.3)
Asking open-ended intervention-related questions	12 (1.9)	0 (0.0)	12 (2.0)
Asking closed-ended biomedical questions	40 (6.4)	979 (15.0)	12 (2.0)
Asking closed-ended psychosocial questions	3 (0.5)	73 (1.1)	0 (0.0)
Asking closed-ended technological questions	6 (1.0)	2 (0.0)	18 (3.0)
Asking closed-ended intervention-related questions	10 (1.6)	0 (0.0)	15 (2.5)
Giving biomedical counseling	77 (12.3)	1,164 (17.8)	—
Facilitating communication	12 (1.9)	728 (11.1)	—
Socioemotional behaviors	163 (26.0)	1,063 (16.3)	237 (39.5)
Positive expression	19 (3.0)	0 (0.0)	58 (9.7)
Emotional support	28 (4.5)	169 (2.6)	11 (1.8)
Social conversation	116 (18.5)	894 (13.7)	168 (28.0)
Others	2 (0.3)	0 (0.0)	17 (2.8)
Total	627 (100.0)	6,548 (100.0)	599 (100.0)

by nurse case managers, followed by “giving biomedical information” (15.2%), “giving biomedical counseling” (12.3%), “giving technological information” (8.3%), “asking open-ended biomedical questions” (7.5%), and “asking closed-ended biomedical questions” (6.4%). “Facilitating communication” and “asking open-ended intervention-related questions” appeared less often, both accounting for only 12 instances (1.9%) in the tailored text messages. Similarly, “asking closed-ended intervention-related questions” (1.6%), “asking open-ended technological questions” (1.4%), and “asking closed-ended technological questions” (1.0%) were found far less often in the tailored text messages. With respect to socioemotional behaviors, “social conversation” (18.5%) took place with the highest frequency in the tailored text messages, followed by “emotional support” (4.5%) and “positive expression” (3.0%).

Overall, in 164 tailored text messages, task-focused behaviors were found a total of 462 times, an average of 2.82 times per message. Socioemotional behaviors were found a total of 163 times with an average of 0.99 times in each tailored text message. A paired-sample

test showed that the difference was statistically significant ( $t=9.94$ ,  $p<0.001$ ).

**TARGETED TEXT MESSAGES BY NURSE MANAGERS**

The task-focused behavior to most frequently appear in targeted text messages sent by nurse case managers was “giving biomedical information” (32.3%), followed by “giving biomedical counseling” (17.8%), “asking closed-ended biomedical questions” (15.0%), and “facilitating communication” (11.1%). Found less often in the targeted text messages were the remaining task-focused behaviors: “asking open-ended biomedical questions” (3.5%), “giving intervention-related information” (2.5%), “asking closed-ended psychosocial questions” (1.1%), and “giving technological information” (0.5%). When it came to socioemotional behaviors, “social conversation” (13.7%) occurred predominately in the targeted text messages, followed by “emotional support” (2.6%). To sum up, task-focused behaviors appeared a total of 5,485 times in 2,475 targeted messages, with an average of 2.22 times per message. Socioemotional behaviors took place less often (a total of

1,063 times), with an average of 0.43 times in each message. The difference was statistically significant ( $t=57.43, p<0.001$ ).

### ADOLESCENT TEXT MESSAGES

Most task-focused behaviors in text messages sent by adolescents with asthma were related to giving their case managers information, including “biomedical information” (20.4%), “intervention-related information” (12.4%), “technological information” (6.7%), and “psychosocial information” (3.7%). Task-focused behaviors that appeared less frequently were asking nurse case managers questions, such as “open-ended biomedical questions” (3.5%), “closed-ended technological questions” (3.0%), “closed-ended intervention-related questions” (2.5%), “closed-ended biomedical questions” (2.0%), “open-ended intervention-related questions” (2.0%), and “open-ended technological questions” (1.3%). In regard to socioemotional behaviors, what came up most often in the adolescents’ text messages was “social conversation” (28%). The other two socioemotional behaviors, “positive expression” and “emotional support,” were found less often (9.7% and 1.8%, respectively). Taken together, a single text message sent by adolescents with asthma included, on average, 1.10 task-focused behaviors (a total of 345 times in 314 text messages) and 0.75 socioemotional behavior (a total of 237 times in 314 text messages). The difference was found to be statistically significant ( $t=3.70, p<0.001$ ).

### Discussion

In this content analysis of mobile text messages exchanged between nurse case managers and adolescents with asthma, we found that various topics were well represented in terms of task-focused behaviors and socioemotional behaviors. More specifically, nurse case managers generally focused on task-focused behaviors, such as giving biomedical information and clinical counseling. Likewise, the task-focused behaviors texted most often by adolescents with asthma were giving biomedical information and intervention-related information. Both nurse case managers and adolescents actively participated in information-exchanging behaviors via mobile text messaging. These findings are consistent with previous literature that has identified information exchange as a dominant role in clinician–patient communication.<sup>18</sup> In the collaborative healthcare approach, successful information exchange enables health professionals to facilitate discussion and negotiation with patients about treatment options considering the patients’ situation and needs.<sup>19</sup> When patients offer the information sought by healthcare clinicians or volunteer additional information, both healthcare clinicians and patients are likely to arrive at a common goal for resolving the patients’ problems through shared decision-making.

Adolescent patients often struggle to form therapeutic relationships with health professionals because diagnosis and treatment information is mainly directed to their parents.<sup>20,21</sup> Moreover, their parents play the roles of “gatekeepers,” controlling the information exchange between healthcare clinicians and adolescent patients.<sup>22</sup> Because of these factors, chronically ill adolescents strongly desire information from health practitioners and to be involved in treatment

decisions.<sup>23–25</sup> How healthcare clinicians interact and communicate is central to identifying and addressing the information needs of adolescent patients.<sup>20</sup> Given this, our findings highlight the potential of mobile text messaging to promote active clinician–adolescent patient communication.

In addition, this research found the characteristic of patient-centeredness in text messages sent by nurse case managers. Patient-centered communication is the preferred approach in clinician–patient communication. It helps health practitioners provide care that is concordant with the patients’ values, needs, and preferences and that allows patients to provide input and participate actively in decisions regarding their healthcare.<sup>26</sup> According to the classification of Roter and Hall,<sup>27</sup> asking open-ended biomedical questions, psychosocial questions, technological questions, and intervention-related questions, asking closed-ended psychosocial questions, and giving biomedical counseling in task-focused behaviors can be identified as patient-centered. Socioemotional behaviors are all involved in patient-centered components. Of the text messages sent by the nurse managers, in tailored messages, approximately half of the coded content was patient-centered, and in targeted messages, 38% of the coded content was patient-centered.

Another notable finding is that adolescents with asthma sent their case managers a considerable number of text messages with the purpose of socioemotional behaviors, including social conversation, emotional support, and positive expression. Adolescents also have a high need for emotional support from social relationships with healthcare clinicians.<sup>28</sup> It is for these reasons that adolescents with asthma may send clinicians texts about socioemotional behaviors.

### IMPLICATIONS

This research has important implications for future research and medical practice. It extends the understanding of the role of mobile text messaging in patient–clinician communication, demonstrating that mobile text messaging is used for exchanging task-focused behaviors between nurse case managers and adolescents with asthma. Beyond simple alert and reminder functions, mobile text messaging can be a powerful communication vehicle that helps healthcare clinicians and adolescent patients interact more frequently, exchange social support, and develop social relationships. With the adoption and diffusion of interactive communication technologies in the health service realm, the paradigm for healthcare delivery is evolving into greater reliance on online communication between healthcare clinicians and patients.<sup>29</sup> Our findings lend empirical credence to this argument for adolescent asthma care.

In addition to being able to expand clinician–patient communication into cyberspace, mobile text messaging shows the potential to improve patient-centered communication between healthcare clinicians and adolescent patients. Certain patients do prefer clinician-centered communication, a disease-oriented approach, and clinician-centered decision-making. However, most patients still prefer patient-centered communication.<sup>30</sup> Patient-centered communication may be particularly preferred among adolescent patients because they want to take on a more adult role in their healthcare.<sup>31</sup> Engaging adolescent patients is likely to

enhance their autonomy and feelings of patient empowerment, which in turn may improve treatment adherence and disease outcomes.<sup>32</sup> Therefore, healthcare clinicians who wish to increase the patient-centeredness of their interactions with adolescents may do so by using mobile messaging.

Finally, this research provides healthcare clinicians with another practical implication. Healthcare professionals increasingly recognize that existing healthcare services may be failing to meet the needs of adolescent patients.<sup>33</sup> The unmet needs may discourage adolescent patients from participating in the conversation with their healthcare clinicians. To prevent such problems, health professionals ought to fully understand the needs of adolescent patients. For a more accurate understanding, this research points out that adolescents with asthma have greater needs for socioemotional behaviors as well as problem-focused behaviors. Given that adolescent patients are generally more vulnerable and face greater risks of socioemotional problems, healthcare clinicians need to pay greater attention to providing emotional support.

## LIMITATIONS

Notwithstanding these major implications, this study has important limitations to be addressed in future research. First, we did not consider individual differences when exploring the content of text messages exchanged between nurse case managers and adolescents with asthma. Prior research showed that the quality of clinician-patient communication was affected by patients' individual characteristics such as gender, perceived attitudes toward adolescents, and the communication skills of adolescent patients and health professionals.<sup>20,34,35</sup> Therefore, future research should examine how individual factors influence clinician-adolescent patient communication through mobile text messaging.

Second, the significant findings of this study are hard to generalize because they are based on only 131 adolescents with asthma and 5 nurse case managers. In addition, nurse case managers cannot represent other types of healthcare clinicians, such as physicians, pharmacists, nurses, or therapists. Future studies are encouraged to use a more representative sample in order to enrich and corroborate the findings from the current research.

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## Disclosure Statement

No competing financial interests exist.

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