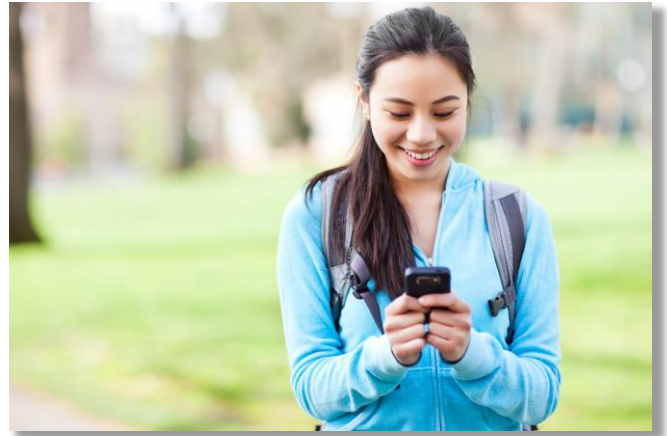# Text Messaging in Healthcare Research Toolkit

Introduction

The *Text Messaging in Healthcare Research Toolkit* was developed for medical and health services researchers who are planning to use text messaging as part of a healthcare intervention or a method for data collection.

Opportunities for research in mHealth and text messaging are growing as funding agencies offer increasing support for research on the use of technological communication in healthcare. The past success and future potential of text messaging to reach the right audience at the right time with the right message at a minimal cost has caught the attention of the health research community.[1]

As of 2012, there were 321.7 million wireless subscriptions within the U.S., and the number of text messages sent monthly during that year amounted to 184.3 billion.[2] Because of its accessibility and ubiquity, text messaging is a cost-effective option with the abilities to reach a large audience, support provider-patient communication, deliver health information and education, and collect patient data.[3]

The implementation of a text messaging system requires basic knowledge of SMS technology and design considerations specific to your needs and resources. This toolkit overviews the basics of short message service (SMS) technology and regulations, and provides information and tools to aid researchers in developing an effective text messaging system.

Text messaging in healthcare

Settings
- Primary care
- Hospitals
- Public health
- Healthcare research

Purposes
- Behavior modification
- Disease management and treatment adherence
- Prevention and public health education
- Appointment and immunization delivery
- Reminders
- Motivational messages
- Data collection
- Disease surveillance

Populations
- Children and adolescents
- Adults
- Elderly
- Minorities
- People in underdeveloped countries
- Women in postpartum period

*See a full list of studies in Appendix D: *Table of Text Messaging Studies.*

Inside

Tools (Appendix B)

Tool 1: *Checklist for Assessing Functionality Needs* (p. 20)
> This tool will help you identify what features you will need in your text messaging platform and can be used in conjunction with the *SMS System Feature Checklist and Guide (p. 6)* .

Tool 2: *Platform Type Decision Making Checklist* (p. 21)
> This checklist is intended to provide a starting point from which you can determine what type of system your project may require. It can be used in combination with the SMS Provider *Platform Comparison Matrix (p. 23)* to determine customizability needs.

Tool 3: *SMS System Implementation Planning Tool* (p. 22)
> This worksheet was designed to assist with SMS system planning. It offers questions to guide you through the assessment and decision making process, and can be completed as you read through each of the sections in this toolkit.

Tool 4: *SMS Provider Platform Comparison Matrix* (p. 23)
> This matrix can be used for the comparison of SMS service providers and platforms to help with the decision making process. It can be adapted and customized according to your list of required features and implementation plan.

Sources

(1) Labrique A, Vasudevan L, Chang LW, Mehl G. H_pe for mHealth: More y or o on the horizon? Int. J. Med. Inform. (2012), http://dx.doi.org/10.1016/j.ijmedinf.2012.11.016
(2) CITA-The Wireless Association, (2012). *Wireless Quick Facts.* Retrieved from http://www.ctia.org/advocacy/research/index.cfm/aid/10323
(3) Adler R. (2007). *Health care unplugged: The evolving role of wireless technology*. California HealthCare Foundation. Retrieved from http://www.chcf.org/~/media/MEDIA%20LIBRARY%20Files/PDF/H/PDF%20HealthCareUnpluggedTheRoleOfWireless.pdf

SMS Basics

Short Messaging Service (SMS)

SMS is a method for sending text messages between mobile devices. The common use of text messaging is person-to-person, from one mobile phone to another (or multiple) mobile phone(s). However, it is also possible to send bulk messages to a number of recipients using an SMS software application. The focus of this toolkit is on the implementation considerations for using and evaluating text messaging as a health care intervention, in contrast to personal text messaging applications.

SMS Messaging Components

Large-scale text messaging programs require specialized software applications and services to handle message content and delivery scheduling, and message routing services to deliver messages via multiple cellular network carriers. SMS messaging application software supports scripting, scheduling, replying, and routing to an SMS gateway based on pre-configured algorithms, thus eliminating the need for an individual to send, monitor, and respond to each text. In this process, a sender uses an SMS messaging application to enter necessary data (message script, message sending schedule, messaging algorithms or logic, etc.) An SMS gateway (also known as SMS provider, aggregator, or messaging server) encodes and routes text messages according to the specific requirements of the recipient's wireless network operator or carrier. Network operators have SMS centers (SMSC) that forward the messages to recipients' mobile phones (see figure below). SMS responses are routed back through the same channels.

The system that will work best for you depends on the complexity of your intervention program, the programming and technical resources you have available, and the amount of customization your project will require. Many messaging application providers and SMS gateway providers provide both application and gateway services, in addition to professional services to assist with implementation and customization.

The most common platform options are either a simple, ready-to-go application or a customizable application with vendor support. It is also possible, although costly and requiring in-house programming expertise, to develop a system from the ground up. The *Application and Hosting Options* section (p. 8) offers more information about these options.

Text messages sent through an SMS gateway
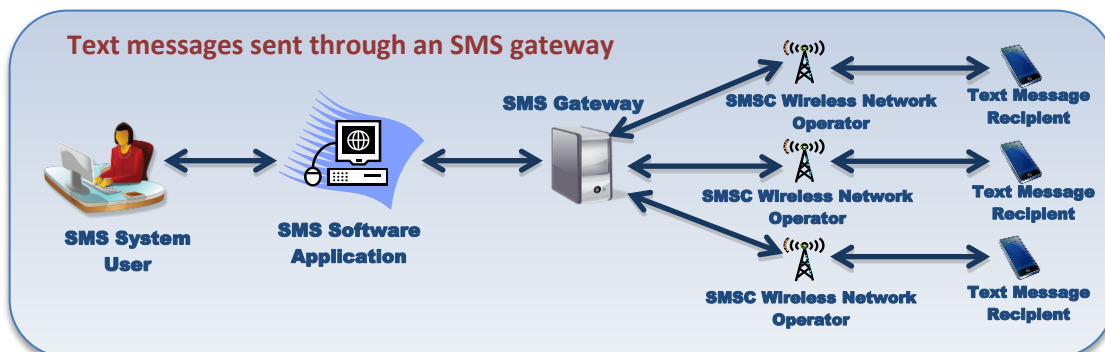
SMS Application Features

The sophistication and complexity of your intervention program will also determine your SMS functional requirements. For example, a project limited to reminders or educational information may only require simple, unidirectional texting. In contrast, an intervention that includes replies to incoming responses will require bidirectional texting. For bidirectional texting, you will need to determine if the incoming responses will be closed ended (choice of 1,2,3) or open ended responses written by the end user, which require reading of each response. If more than one message will be sent, the ability to automate a schedule or trigger for sending messages is required.

Additionally, outgoing responses may be customized with conditional branching logic for tailored messages. This branching capability allows you to send an automatic, customized response to different types of closed-ended responses (e.g. If "yes" send outgoing response "Keep up the good work"; if "no" send "Try to get 30 minutes of exercise tomorrow").

Most SMS software has the capability to track data such as the number of messages that are sent, delivered, opened, or undeliverable. Bidirectional systems also track responses. These programs typically interface with most computer systems, databases, and spreadsheet applications. However, it is important to know what data you will need to collect and how you want to store it, so you can verify a platform's compatibility with your needs. Learn more about messaging features in the *SMS System Feature Checklist and Guide (p. 6)*.

Short and long codes

SMS messages are limited to 160 characters and can be sent using either a **short code** or a **long code**. Short codes are usually five or six digits so they are easier to remember. A potential drawback is that a recipient may mistake a message from a short code for spam if the code is not customized. Short codes can be either custom (vanity) or random; vanity short codes typically cost more. All codes are numeric, but vanity short codes typically spell out something when translated on a typical phone keypad and are easier to remember. Examples of vanity short codes include:

- COKE: 2653
- ABCTV: 22288
- Obama: 62262

Short codes may be either "dedicated" or "shared," and shared short codes typically cost less. Short codes are leased from either an SMS gateway provider, who acts as a re-seller of short codes, or through the US administrator, the Common Short Code Administration (CSCA) or www.usshortcode.com. CSCA was created jointly by Neustar and the Cellular Telecommunications & Internet Association (CTIA), which oversee the federally mandated regulations of phone and Internet carriers, to administer all US short codes. "Common" short codes are common across all major carriers, whereas a short code (that is not common) is specific to one carrier (such as AT&T). See http://www.usshortcodes.com/ for more information about common short code use and cost.

Long codes are 10- or 11-digit dedicated phone numbers. They were originally intended for person-to-person communication, and were not supported for sending bulk text messaging and were often blocked or filtered when used for bulk messaging. As more and more businesses communicate and provide services via text messaging, long codes are being used more frequently. A business can use its own, recognizable phone number for telephone, fax, email, and texting. Long codes (regular phone numbers) can be used for texting without additional leasing costs.

Audience Preferences and Legal Rights

Consideration of your audience's needs and preferences using direct input or relevant published studies is important when developing a text messaging intervention. You will want to consider how many messages to send and how often, as well as the most effective message content. We recommend designing messages carefully, considering the desired outcomes and using a theory-driven, evidence-based approach. You can learn more about communication theory and developing message content in the *Develop a Communication Strategy* section (p. 13) and other sources listed in the *Text Messaging Bibliography* section (p. 24).

Another factor to consider is maintaining participants' privacy. Laws and regulations regarding patient privacy apply to text messaging in healthcare. Although text messages are encrypted during transfer, a message that displays on a screen may be visible to people close by and accessible to people who have access to a user's phone. Researchers can protect patient privacy by restricting the amount of information in messages or advising research participants to protect their cellphones with passwords and settings that restrict the amount of information delivered with a text message receipt notification. Additionally, participants can use antitheft applications that allow them to remotely lock their phone and wipe it clear of sensitive information.

SMS applications must allow for recipients either to opt-in or to opt-out. The universal method of opting out of a program is to respond with the keyword "STOP." Opt-in options require active acceptance by texting a code word, such as "EATWELL" for a program to deliver daily nutrition tips, to a predetermined short code. Opt-in programs require advertising or outreach to the target audience that would also include the short code and the code keyword so they know how to opt in. If you are sending messages to a predetermined list, an opt-out feature may be the best option. See the *Security and Privacy* section (p. 16) for a complete list of applicable regulations and best practices.

Helpful links

Developer's Home. (2013). *Short Message Service / SMS Tutorial*:
http://www.rapidsms.org/code/reference/guides/

Seattle King County Public Health. *Life of a text message*:
http://www.kingcounty.gov/healthservices/health/preparedness/texting/costs.aspx#life

Common Short Code Administration:
http://www.usshortcodes.com/about-sms-short-codes/sms-marketing-overview.php

CSCA Shared Versus Dedicated Short Codes:
http://www.usshortcodes.com/about-sms-short-codes/shared-sms-vs-dedicated-sms.php

SMS System Feature Checklist and Guide

Messaging Features

Required	Features	Description
☐	**Text Blasting/Bulk Messaging**	Simple, one-way text messages are sent to a list of recipients. This feature is useful for public health alerts or health education campaigns. Requires minimal or no customizability.
☐	**Two-Way Text Messaging**	The capability to send messages and receive text message responses is available in SMS systems.
☐	**Tailored or Personalized Text Messages**	A personalized message feature enables you to autoreply to a response with a tailored message making the message more relevant or targeted to the recipient. This feature can require more customizability and possibly the ability to interface with EHR systems and databases.
☐	**Short Messaging Service (SMS)-to-email/email-to-SMS**	This feature allows SMS communication between the sender of a message and the recipient's email. This is useful for people who would rather receive or send information via email.
☐	**Short Codes**	Common short codes are numbers used for sending and receiving texts. They allow rapid, high-volume outbound messaging. These codes are normally 5-6 digits, so they are easy to read and remember, allowing the receivers of a text to more easily identify the sender. It is not necessary to have a short code, but they are available for lease from the Common Short Code Administration for $500-$1000 per month or they may be obtained through a text messaging vendor.
☐	**Long Codes**	A long code is a 10-digit local number from which SMS messages are sent. They can be obtained from an SMS service provider. In some cases long code may be preferable to short code because they can be either leased or owned, which can reduce cost and allow for repeated use of the code. Furthermore, a local phone number may be more identifiable to the recipient, and some cell phone providers may block messages sent from short codes.
☐	**Automated Response**	A response system sends out an automated response or series of responses to an incoming SMS message. Various options for tailored automated responses include keyword response, personalized response, and scheduled response. This feature requires variable degrees of customizability, depending on the type of response.
☐	**Keyword Response**	Text message response options include keywords. Automated responses are then sent to recipients according to the keyword they return in their response. Incoming keywords may be in response to a marketing campaign, a reply to a text message, or a request for more information. For example, an incoming text message with a keyword such as "INFO" might generate an automatic response with information. This feature requires a minimal amount of customizability.
☐	**Conditional Branch Logic**	Conditional branch logic is a software feature that allows for keyword and automated responses based on a predefined algorithm. It recognizes incoming response types and sends appropriate messages according to what is indicated in the logic. This feature requires a moderate amount of customization.
☐	**Tailoring by Group**	Recipients may be divided into groups, and tailored messages can be sent to each of those groups. Recipients might be grouped according to sex, location, demographics, or other characteristics. A moderate amount of customization is needed for this feature.
☐	**Message Scheduling/ Staggering**	Out-going messages may be scheduled to be sent at specified times or time increments. This feature is valuable for reminders and behavior modification programs and usually requires a small amount of customizability.
☐	**Multimedia Message Service (MMS)**	Messages sent via MMS may include photos or videos, graphics, and texts longer than the standard 160-character limit of normal SMS messages. However, MMS is not compatible with all cell phones, and costs for sending MMS messages is higher than for sending SMS messages.

Required	Features	Description
☐	**Active Links**	URL links that direct recipients to a website may be included in the text. This can be used to minimize the inclusion of protected health information in a text message, direct people to a survey or personal health record, or provide access to information in addition to what can be sent in a text message.
☐	**Voting and Polling**	Polls can be created and sent via text message. Recipients may respond to multiple-choice answers either by numeric or alphabetic response. Polling can be useful for collecting qualitative or quantitative data, and for gathering general information about a group of people. This feature requires minimal customization.
☐	**Automatic Stop Function**	This feature allows end users to opt-out by sending the keyword "STOP" if they wish to stop receiving text messages from the sender.
☐	**Message Queuing**	Messages may be sent in a predetermined order, with verification that a message was completed before sending a subsequent message. This requires minimal customizability.
☐	**Unicode Support**	This feature accommodates messages in any language using proper characters and formatting, such as French (Français), Japanese (日本語), English (English), or Arabic (العربية).

Database and Group Management Features

Required	Features	Description
☐	**Opt-out/Opt-in (subscription) Management**	Text messaging lists require updating to include new subscribers and delete subscribers who wish to opt out and not receive future text messages. Different text messaging platforms may offer varying capabilities and options for the updating of recipient lists. Researchers may choose between an opt-out or an opt-in system based on their project goals, institutional policies, and institutional review board guidelines.
☐	**Ability for Multiple Groups**	Most text messaging platforms offer unlimited recipient lists and the creation of multiple recipient groups to assist with messaging management. This feature requires minimal customizability.
☐	**End User Web Portal Access**	Portal access for recipients allowing the ability to subscribe to text messaging campaigns or programs via a webpage with any standard browser.
☐	**Integration with Other Information Systems**	Text messaging platforms generally have the ability to upload lists of names, cell phone numbers, and other data from outside programs such as Excel or Outlook. Some text messaging platforms can integrate with EHRs, but this is relatively new and is best discussed with EHR vendors. Integration with programs such as Excel requires only minimal customization, while interface with EHRs requires a high degree of customization and security measures.
☐	**Backup System**	It is important to have a back-up system for stored data. Data may be backed up on a vendor server or on an internal server.
☐	**Master Account With Sub-Accounts**	Some systems offer user accounts under a master account to allow for multiple projects or message administrators.

Reporting and Administrative Features

Required	Features	Description
☐	**Text Message Statistic Recording**	Many text messaging systems provide data such as audit logs of messages sent, declined or undeliverable (bounce) reports, opt-out reports, and demographics and behavioral data regarding use. This type of information can be important to researchers who need to track the results of text messaging interventions. This feature requires minimal customization.
☐	**Exportability of Data**	Data and message statistics may be exported to outside applications such as Excel. More complex systems may have advanced software and security measures for research data capture, storage, and interface with databases or analysis software. The amount of customization required for this feature will vary according to the type of system you wish to interface with.
☐	**Usage Metering**	Usage metering provides convenient information regarding important usage data, which may be valuable for designing and monitoring systems.

Application and Hosting Options

The amount of resources you have available and the level of customization necessary for your text messaging intervention will determine how you approach the SMS system set-up and the storage of your data. The main decisions will be your choice of 1) text messaging application, 2) SMS gateway, and 3) hosting locations for the software and data necessary for your system. Many vendors can provide all of the components, often acting as a reseller and providing professional development and support services.

Participant data and message content may be stored, or hosted either in a vendor's database or cloud, or in an internal database. The advantages of storing information with a vendor are minimal effort and cost for initial set up, and less required database integration capability. However, vendors usually charge service fees, and their systems may not meet your security requirement, so care must be taken to ensure that protected health information is only stored on a secure server. Hosting messages internally requires more database capability and initial set up, but service fees are lower and the system has more flexibility and control over the security.

Options for SMS platforms include off-the-shelf applications for simple text messaging interventions, customizable existing platforms for somewhat complex interventions, and completely customized systems for interventions requiring sophisticated integration with other health information technology systems such as electronic health records (EHR). In this section we describe several common system solutions categorized into three levels of customization: 1) none to minimal customization, 2) moderate customization, and 3) advanced customization.

Text messaging application and gateway providers

We do not endorse any particular vendors, but rather we recommend researching several companies. Below is a partial list of text messaging companies to serve as a starting point. For more information about choosing a vendor, see the *Selecting a Text Application Vendor* Section.

Application vendors
Sumo text
Callpointe
Mobile commons
Message-Media
Televox
Ex Texting
Trumpia

SMS gateway providers
Twillio
Clickatell

Helpful links

Seattle and King County Public Health – *Should you be your own SMS vendor?*
http://www.kingcounty.gov/healthservices/health/prepare dness/texting/~/media/health/publichealth/documents/tex ting/CostAnalysisSummary.ashx

Top Ten Reviews – *2013 Best Text Message Marketing Service Comparisons and Reviews*: http://text-message-marketing-review.toptenreviews.com

Level 1: None to Minimal Customization
Solution for one-way or standard response interventions

<div style="border: 1px solid; padding: 10px;">

Case study 1

<u>Simple, one-way messages:</u> SMS reminders were used in a 2009 behavioral change campaign to increase adherence to sunscreen application recommendations. Researchers measured the effectiveness of sending a daily weather report followed by a motivational reminder to apply sunscreen to a group of 70 participants via SMS. This study indicated that even simple, untailored text messaging is a viable, cost-effective solution that could be effective in large-scale public health interventions.

Source:
Armstrong AW, Watson AJ, Makredes M, Frangos JE, KimballAB, Kvedar JC. Text-message reminders to improve sunscreen use: a randomized, controlled trial using electronic monitoring. *Arch Dermatol* 2009;145(11):12301236.

</div>

Interventions sending non-interactive, one-way messages will usually require only a simple off-the-shelf application. There are many companies that offer a ready-to-go Internet interface in which you simply enter the message and a list of recipients' numbers. The only in-house technical requirement is access to the Internet (see figure below). Therefore, there is little or no set up involved and the fees are generally very low. Check with individual vendors for details about the features and customizability options they offer.

In-house   Vendor server/cloud and gateway   Outside cellular service
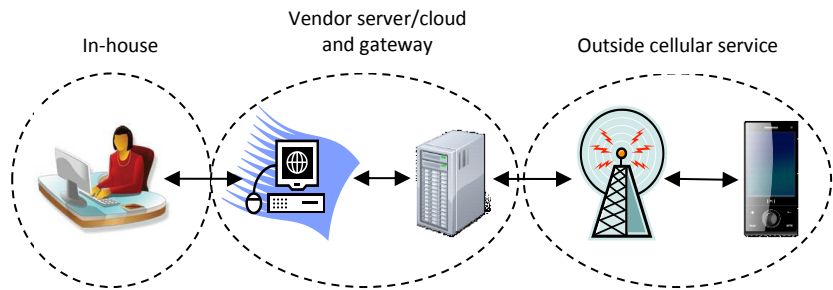
Elements in a vendor-hosted system

Commercial off-the-shelf application

Description	• An vendor application is used to send and receive text messages; includes support service, limited professional services
Common uses	• Public health education campaigns • Emergency/risk notifications • Reminders
Features and customizability	• Low customizability • One-way outbound or simple two-way messaging • Often non-interactive to inbound text messages • Bulk messaging
Hosting/data storage	• Data typically stored on vendor database or cloud, but could be stored on internal server
Cost considerations	• Low up-front development costs • Low to medium service fees
Advantages	• Easy set-up • Low maintenance • Adequate for simple projects

Level 2: Moderate Customization
### Solution for two-way intervention with tailoring

Case study 2

A recent study used text messaging in combination with social media to deliver a weight loss program to college students. Researchers sent 3 types of text messages at random intervals. The first was a prompt to monitor weight, calorie intake, and activity level and text back nightly the information. After responding, the participants received a general response. The second type was sent 2 days per week and included a motivational message along with a request for information. Upon receipt of the data, immediate feedback was sent to the participants based on their response. The third type (also sent 2 times per week) offered tips tailored to participant's previously identified risk behaviors and situations. All data received from text messages were then compiled into personalized feedback reports for participants on a weekly basis.

The text messages sent to the participants in this study were created and managed using in-house customized text messaging software. The data that supported the application (e.g. participant Facebook URL address and mobile phone numbers) were stored on an external server. The system used an external SMS gateway provider (Twilio).

Source:
Napolitano MA, Hayes S, Bennett GG, Ives AK, Foster GD. (2013). "Using Facebook and text messaging to deliver a weight loss program to college students". *Obesity* (1):25-31.

For interventions intending to use tailored, two-way messaging, a system with a customized, in-house text messaging application and an external SMS gateway provider may be the best choice (see figure below). This type of program will allow for more customizability in scheduling, reporting, tailoring, and personalizing of messages. They have greater flexibility interfacing with other health it systems and can incorporate conditional branching logic. Outgoing responses can be tailored to the recipient's response. Application customization usually requires the assistance of a programmer, or application developer. Many application vendors provide this service. There is usually some set-up expense and fees for sending messages. Check with individual vendors and developers to get specific costs.

In-house software   External SMS gateway   Outside cellular service
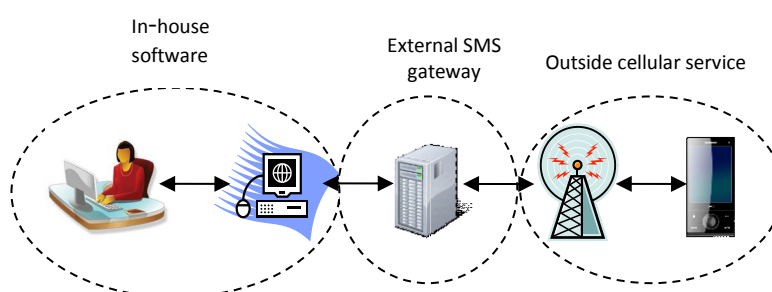
Elements in a customizable application with external gateway

Customizable application	
Description	• Application with greater customization capability (professional services available from vendor) • External SMS gateway provider
Common uses	• Disease management and monitoring • Personalized reminders and responses • Data collection • Personalized notifications
Features and customizability	• Moderate to high customizability • Two-way interactive text messaging • Supports multi-channel (voice, text) messaging • Some flexibility in integration with other programs
Hosting/data storage	• Data usually stored internally, but pass through an SMS gateway
Cost considerations	• Some up-front development costs • Low service fees
Advantages	• Easy to moderate set-up • Opportunity to add customized features and tailor or personalize messages

Level 3: Advanced Customization
Solution for interventions involving secure information or electronic health record (EHR) interface

Case study 3

A large vertically-integrated safety-net health care system in Denver, Colorado tested an intervention to remind adult patients with diabetes to monitor their blood sugar levels and attend medical appointments. Blood sugar testing reminders were sent 3 times per week and appointment reminders were sent 7,3, and 1 day(s) prior to appointments. The text message interactions were integrated with the facilities electronic health information systems.

In this scenario, the goal was not only to test the intervention but also to develop a patient outreach platform that was integrated with clinical and administrative IT systems and supported text messaging in addition to other methods of communication. The text messaging application was an integrated feature of Microsoft's Customer Relationship Manager application (Microsoft Dynamics CRM), which was rebranded as a "Patient Relationship Manager" (PRM) application for healthcare-specific applications.   The text message application supported 2-way text messaging with customization of delivery scheduling to an individual's preferences, as well as basic branch logic capability. The PRM database was integrated with clinical and administrative datasets to enable automated triggering of outreach (such as texting appointment reminders) as well as the flow of patient-generated data collected at home into the clinical database. The entity currently contracts with an outside SMS gateway vendor, Twillio. Data and software are hosted internally.

Source:
Fischer HH, Moore SL, Ginosar D, Davidson AJ, Rice-Peterson CM Durfee MH, Mackenzie TD, Estacio RO, Steele AW. (2012). "Care by cell phone: text messaging for chronic disease management". *The American journal of managed care (1088-0224)*, 18 (2), p. e42.

Interventions that require interfacing with patient electronic health records or other health IT systems may need to be completely customized or built from the ground up to ensure compatibility and security. These systems can be extremely expensive and time consuming to build, but offer the benefit of being able to draw upon and add to patient electronic health records. Storing all data on internal servers may also provide assurance regarding security. It is possible to have an internal gateway server; however, they will usually be external. Most agencies that use this type of system have in-house IT personnel that can help build a text messaging application and implement the system.

In-house software   External SMS gateway   Outside cellular service
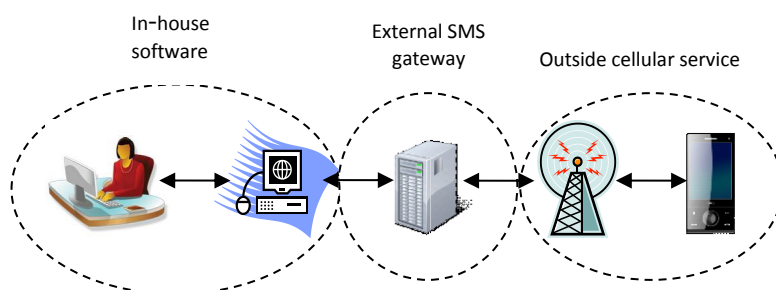
Elements in a custom integrated system

Completely customized, integrated system

Description	• Completely in-house system built from the ground up; requires programming resources; highly customizable
Common uses	• Integrated with electronic health records, personal health records
Features and customizability	• High customizability • Allows complex conditional branch logic design of interactive messages for highly personalized and tailored messages (aka dynamic application logic)
Hosting/data storage	• Data are stored internally, and may pass through an SMS gateway or may be sent directly to a cell service provider
Cost considerations	• High up-front development • In-house maintenance costs
Advantages	• Opportunity to add customized features • Allows greatest flexibility for integration with other systems

Selecting a Text Messaging Vendor

Selecting a Text Messaging Application

If after assessing your needs for a text messaging system you decide to use an off-the-shelf application, you will need to select a product and vendor to work with. The services that SMS vendors offer vary, so researching different options will help you find the right company for your project. Information on specific vendors can be found on company websites.

Questions for application vendors
☐ What are the set-up and service costs?
☐ Is 2-way texting available?
☐ What level of customization and other functions are available?
☐ What is the interfacing compatibility with other data systems?
☐ What is the Interfacing compatibility with gateway providers?
☐ What message tracking ability and audit recording is available?
☐ What is the security of data stored on the vendor's system?
☐ Can the system accommodate multiple users?
☐ How is the system backed up?
☐ What is the availability and cost of technical support services?

Selecting an SMS Gateway Provider

Using an SMS Gateway provider is usually very simple. Providers generally offer either a credit-based program, requiring prepayment for a set number of messages or a pay-per-use program, which charges per message sent.

Questions for SMS gateway providers
☐ What is the cost per message sent?
☐ Are there any other costs?
☐ What are the payment options?
☐ What is the availability and cost of technical support services?
☐ Is there a monthly minimum credit purchase requirement?
☐ Is there an expiration period for credits purchased?
☐ Can you test the system at no charge?
☐ What is the quality of the SMS gateway's network coverage?
☐ Is the SMS gateway compatible with the application or interface you are using?
☐ Where will the data be stored?
☐ How are the accounts and availability of remaining credits managed?

Finding a Programmer

If your text messaging program requires custom development, you will need to employ a programmer. Larger research institutions typically have in-house resources; however, you can also find services on the Internet at sites such as the Mobile Marketing Association Industry Directory.

Helpful links

Top Ten Reviews – *2013 Best Text Message Marketing Service Comparisons and Reviews*: http://text-message-marketing-review.toptenreviews.com

Seattle and King County Public Health - *Considerations when selecting a text messaging vendor:*
http://www.kingcounty.gov/healthservices/health/preparedness/texting/costs.aspx#vendors

Developer's Home – *How to Choose an SMS Service Provider*:
http://www.developershome.com/sms/howToChooseSMSGateway.asp

CSCA- Find a SMS Marketing Partner: https://www.usshortcodes.com/partners/find-a-sms-marketing-partner.php#application-tab

Mobile Marketing Association Industry Directory (http://www.mmaglobal.com/resources/directory).

Develop a Communication Strategy

When developing a text messaging program, messages should be designed in a way that will have an impact on the target audience. Messages are more effective when they are carefully composed considering the target audience characteristics and motivators, and the program's desired outcomes. Additionally, messages can be tailored and personalized for each individual. This guide is not a review of those theories. Sources with further information on designing SMS communication campaigns are located in the *Text Messaging Bibliography* (p. 24). This section will discuss how to analyze and engage your audience, and create a theory-based text message intervention.

Engage the Audience in the Intervention Design

A successful text messaging intervention will work with members of the target audience to learn their preferences. Audience members can offer feedback and input on the program idea, how many text messages they prefer, and times of the day or week they would like to receive messages. This feedback can be obtained iteratively, to gather input regarding specific messages and then tested as a system prototype. Researchers should be sure to test an entire system with as many users as necessary to reach information saturation prior to deployment.
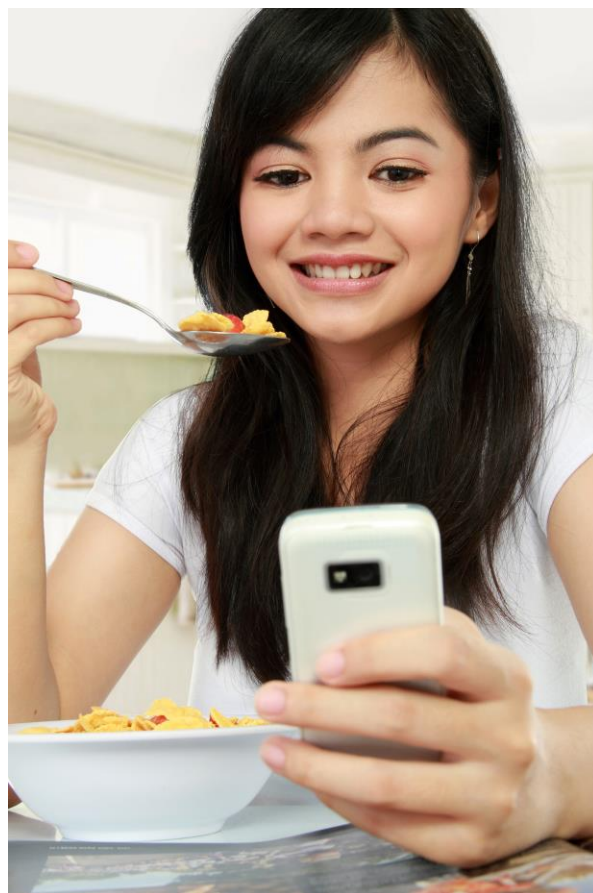
Use Communication Theory to Target and Tailor Messages

There is a substantial body of literature on message design within health communication that can be used to inform message content and intervention design. Messages are more likely to be compelling and evoke a behavioral response if they are grounded in communication and behavioral change theory, and are linked to specific desired outcomes.

For example, message design that complies with gain frame or loss frame appeals may be more effective. Research shows that patients are more willing to undergo an unpleasant task or procedure—such as a mammogram or colonoscopy—if they are presented with the positive rewards (gain frame appeal) for that behavior, such as peace of mind. Conversely, people are more likely to take action to avoid risks when they are reminded of potential negative outcomes (loss frame appeal)[1]—applying sunscreen to prevent skin cancer, for instance. Thoughtful and deliberate framing of messages will improve the likelihood that your intervention is effective.

Using a message library to explicate and link every message to a specific desired outcome and communication theory or evidence can help researchers design a stronger intervention. The following table illustrates use of a message library.

Example of a text messaging library matrix

Message Type/ Outcome	Message Content	Character Count	Date	Time	Tailoring	Theoretical Construct
Reminder: regular exercise for increased fitness and weight loss	30 minutes of exercise each day can improve your mood, increase your energy, and help you get back into your favorite pair of jeans!	130	4/8	8am	Women ages 35-50	Gain frame *Risk:* Exercise *Gain:* mood, energy, and appearance

Two other forms of message tailoring are personalization and feedback. Personalized messages contain information specific to the recipient, such as a name, and can solicit attention and be a motivating factor. Depending on your intervention and desired outcomes, you may decide to use a 2-way texting system that provides feedback to information sent to you from the user. You may, for example, send a message saying, "You are only eating an average of 2 servings of vegetables per day. According to the FDA, you should be eating an additional 2." Providing specific feedback and instructions can be an effective way of promoting behavior change.[2]

Text messaging best practices

☐ **Keep messages short and concise**. Each message should be less than 160 characters including spaces, punctuation, and any branding or links to additional information.

☐ **Make messages engaging.** Write relevant, timely, clear, and actionable messages. Try to begin each message with an interesting fact or question so that users will be more likely to open the text message and read all the information.

☐ **Make content readable**. Content should not exceed an 8th grade reading level or contain difficult to understand terminology.

☐ **Use abbreviations sparingly**. Because text messages have a character limit, it is acceptable to use abbreviations, but only when they are easily understood and do not change the meaning of the message.

☐ **Limit non-Latin characters.** Depending on the mobile carrier, non-Latin or accented letters do not always work.

Source:
Centers for Disease Control and Prevention. (2012). Guide to Writing for Social Media. Retrieved from: http://www.cdc.gov/socialmedia/Tools/guidelines/pdf/GuidetoWritingforSocialMedia.pdf

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Security and Privacy Considerations

The main privacy concern regarding text messaging in healthcare is the transmission and storage of protected health information (PHI). Unfortunately, it is currently not possible to encrypt SMS messages end-to-end when they are sent between different cellular networks. Therefore, individually identifiable health information is subject to exposure when transmitted via text message. Some vendors and platforms such as Apple iPhone now provide secure, encrypted text messaging services for in-network messaging, and there are some recently available applications that allow messages to be sent with password protection (Text Fortress). However, these solutions are viable only if your intervention uses person-to-person or in-network text messaging.

Another concern is that messages may be visible to those other than the phone's owner, either because the phone is not password protected or because incoming text messages are displayed on a screen preview feature. Study participants can be advised to protect their phone and turn off preview features that allow a preview of the message to be automatically displayed on the screen.

Because information transmitted in a text message is stored on a non-secure server, a SIM card, or by a third party, any protected health information sent is vulnerable to exposure. It is important to consider that *any* information indicating past, present or future medical conditions or care is considered PHI. For example, a reminder to return for a second immunization or an inquiry about a patient's current pain level is subject to regulation. Therefore, it is advisable to not include any identifying information via text message. Using coded language to communicate health information can render it incomprehensible to outside parties. Patients can create their own code to serve as a reminder; for example, "down the hatch" could cue a patient to take medication.

Know the Laws and Regulations
HIPAA
The Health Insurance Portability and Accountability Act of 1996 (HIPAA) was established to regulate the use and disclosure of PHI, which consists of "individually identifiable health information." HIPAA describes this information as any demographic information relating to past or present health conditions, healthcare received, and payments for healthcare, along with any identifiers such as name, address, birth date, and social security number.[1] HIPAA's security rule includes specific security standards for the disclosure and storage of electronic health information and requires safeguarding of PHI. Text messaging is regulated under this rule when it involves the transmission and/or storage of PHI. The security

rule requires covered entities to conduct a thorough risk analysis to determine threats to the safety of PHI. Some texting platform companies advertise that they are HIPAA compliant, but they provide secure communication only within a closed network.

FTC's CAN-SPAM Act of 2003

The Federal Trade Commission (FTC) enacted the CAN-SPAM law to protect the privacy of consumers. This law applies to text messaging campaigns and requires that recipients are told how to opt-out of receiving text messages and that those opt-out requests are honored in a timely manner. Penalties for non-compliance can reach up to $16,000.

HITECH Act

The American Recovery and Reinvestment Act of 2009 includes the Health Information Technology for Economic and Clinical Health (HITECH) Act, which was written to promote the use of technology in healthcare and ensure compliance to HIPAA rules. The HITECH Act increases the U.S. Department of Health and Human Service's ability to impose penalties for violations of HIPAA rules. Under the HITECH Act, penalties for violations have a maximum of $1.5 million, and penalties cannot be barred for unknown violations unless corrections are made within 30 days.[2]

FDA regulations on medical devices

The FDA regulates only mHealth applications that are associated with or serve as a platform for a medical device. The FDA allows for the exemption of "safe" devices, including cellphones, used for investigational and clinical data collection purposes from regulation. For more information refer to the FDA guidance document found at http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM263366.pdf

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Security and privacy best practices

☐ **Conduct a risk analysis and manage the risks**
Conducting a thorough analysis of all potential risks to the privacy of PHI will help you understand the specific measures you should take to safeguard information. These measures may be at the administrative level, the physical level, or the technical level. At the administrative level, covered entities must create policies and procedures for the prevention of security violations, and a continual monitoring process to ensure the continued protection of PHI. Physical access to PHI must also be secured, including access to facilities and systems on which health information is stored. Additionally, the disposal of storage systems and data must be controlled. At the technical level, controls should protect the access to PHI, such as the use of passwords or encryption. An excellent example of a comprehensive risk assessment done for the Project Health Design, Breath Easy research study can be found at http://www.projecthealthdesign.org/media/file/BreathEasy-Privacy-and-Security-Analysis-lisa Memo-080210.pdf

☐ **Exclude protected health information from messages**
Sending private health-related messages to an individual cell phone is complicated because the owner of the phone is identifiable. In other words, if the owner of the phone can be identified, anything sent to that phone is also identifiable. One option for avoiding HIPAA compliance issues is to exclude individually identifiable health information from all text message communication. You might send out generic, "unidentifiable" text messages or messages may be sent in a code pre-established by the two communicating parties.

☐ **Verify the user's identity**
Verifying the recipient of a text message can protect PHI from being disclosed to the wrong person. You may direct the recipient to access a secure website where they enter a password to see their message or direct the recipient to call in directly and speak with a member of the research team, or their personal physician, as warranted for your scenario.

☐ **Use only secure vendors**
If your text messaging system is physically located within your organization, your organization is responsible for all security measures to protect stored PHI. However, you may choose to use a third party vendor to distribute and manage your text messaging. Many vendors have built-in security features that will protect information.

Institutional review boards

Institutional Review Boards (IRB) oversee the use of human subjects in research projects. We recommend consulting with the IRB at your institution. IRBs must comply with the U.S. Department of Health and Human Services requirements regarding the use of human subjects in research regarding the risks to, and the selection, consent, privacy, and protection of human subjects. A list of regulations is available at the U.S. Department of Health and Human Services Office for Human Research Protections website listed under *Helpful Links* on this page.

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Mobile Commons – *HIPAA and Text Messaging Security Whitepaper:* http://www.mobilecommons.com/wp-content/uploads/Mobile-Commons-HIPAA-Text-Messaging-Security-White-Paper.pdf

*More security and privacy resources in the *Useful Links and Resources: Security/HIPAA* section

U.S. Departmetn of Health and Human Services. *Office for Human Research Protections (OHRP)* http://www.hhs.gov/ohrp/

Appendix A

Health Text Messaging Glossary of Terms

API (Application Programming Interface): A set of routines, protocols, and tools for building software applications. An API makes it easier to develop a program by providing all the building blocks. A programmer then puts the blocks together. Many text messaging applications are considered APIs, and the building blocks allow for the needed customizability.

CSC (Common Short Codes): Shorter numbers, usually 5-6 digits, from which a text message can be sent or received; short codes can be leased for a fee from the Common Short Code Administration (CSCA).

Encryption: The encoding of a message by digitally scrambling the information to prevent interception of messages by third parties.

SMS (Short Messaging Service): A simple, limited character (140-160) text message format that is compatible with any type of cellular phone.

mHealth (Mobile Health): Refers to the overall use of mobile devices in healthcare, which includes text messaging, cellular applications, internet applications and interfacing with electronic health records, and other types of data transmission.

MMS (Multimedia Messaging Service): A message format used in smart phones that can include media content.

Server: Computer software and hardware that facilitates network service.

Platform: Computer software/hardware frameworks that allow software programs to run.

SMS gateway: Translates messages between different carriers' protocols A gateway user sends SMS messages to a gateway, which then routes the messages to either a mobile phone, another SMS gateway or a SMSC (short message service center which delivers the message to the recipient. A gateway allows users/applications to send messages from a web browser.

SMSC (Short Message Service Center): is the portion of the wireless network that handles routing, forwarding, and storing of incoming text messages. SMSCs are connected via SMS gateways. Different carriers have different SMSC message protocols and most often an SMSC is dedicated to handle the traffic of a single wireless carrier.

End user: Refers to the party who is the primary recipient of messages in a text message program.

Opt in: The option of a recipient to start participation by sending a text message of a dedicated opt-in key word to the program's short code.

Opt out: The option of a recipient to end participation in the text message program and stop receiving further messages.

Conditional branch logic: coding that allows software to match a specific feedback response to an incoming message (e.g. If A then respond with B).

Appendix B

Tool 1: Checklist for Assessing Functionality Needs
This tool can be used along with the *SMS System Feature Checklist and Guide* and will help you identify what features you will need in your text messaging platform.

1. What type of system will you be interfacing with?
   - ☐ None
   - ☐ Spreadsheet/data application such as Excel
   - ☐ Electronic Health Records (EHR)

2. What type of messaging will you be using?
   - ☐ One way, outgoing messages only
   - ☐ Outgoing and incoming, 2-way messaging
   - ☐ 2-way with customized responses
     - o Tailored responses requiring branching
     - o Personalized responses

3. What are your needs regarding timing of messages?
   - ☐ None
   - ☐ Requires scheduling
   - ☐ Requires message staggering
   - ☐ Requires message queuing

4. What type of data will you be collecting?
   - ☐ Messaging statistics
     - o Number of messages sent/received
     - o Times sent
     - o Number of messages bounced
     - o Other_____
   - ☐ Responses
     - o Closed ended
     - o Text typed by respondent

5. How will you manage your groups?
   - ☐ Opt-in: Participants will initiate a text to join
   - ☐ Opt-out: Participants will be added from a list and given the option to stop

6. What type of number will the message be sent from?
   - ☐ Short code (shared or dedicated)
   - ☐ Long code

7. Level of security will you need in your system?
   - ☐ Minimal: the program will not transmit protected health information
   - ☐ Requires secure system: the program will transmit protected health information

Tool 2: Platform Type Decision Making Checklist

This checklist is intended to provide a starting point to determine what type of system your project requires. Customizability and functionality vary among different platforms, so available vendor and API options should also be considered. Therefore, this tool can be used in combination with *the Platform Comparison Matrix* to determine customizability needs.

	Off-the-shelf Application	Customized Application	Completely Customized or Home-Built System
What resources are available for this project? (Funding, time, expertise)	☐ Low	☐ Low to moderate	☐ High
What are my needs for customizability and required functions? (Varies—check vendor and API options)	☐ Low customizability: Simple, one-way or two-way with limited customizability	☐ Moderate customizability: Requires customized responses and scheduling, statistics tracking, and list management	☐ High customizability: Will accommodate most functions
What control do I need over security of data and where will I store protected health information?	☐ Externally, on a vendor's database; lowest control over security	☐ Internally, but passes through an external gateway; low to moderate control over security	☐ Internally, may or may not pass through an external gateway; most control over security
What types of data need to be collected?	☐ Message statistics: when and how many messages were sent, number of bounced, some response data	☐ Message statistics, all types of responses	☐ Message statistics, all types of responses, including data to go into EHRs
What type of system will I need to interface with?	☐ May interface with spreadsheet programs such as Excel	☐ Allows for interface with more complex database systems	☐ Allows for interface with any larger system, including EHRs

Less customizable → More customizable

Tool 3: SMS System Implementation Planning Tool
This worksheet was designed to assist with SMS system planning. It offers questions to guide you through the assessment and decision making process, and can be completed as you read through each of the sections in this toolkit.

Identify Purpose and Target Audience	• What are your desired project outcomes? • What data will you need to gather? • What are the needs and preferences of your audience?
Conduct a Needs Assessment	• How much customizability will your project require? • What resources do you have available (funding, time, expertise)? • What privacy & security issues do you need to consider?
Develop a Plan	• Will you use an off-the-shelf, customizable, or a ground-up system? • Will your system be hosted internally or externally? • How will you protect patient privacy and confidentiality?

Tool 4: SMS Application Vendor Comparison Matrix

This matrix can be used for the comparison of SMS service providers and platforms to help with the decision making process. It can be adapted and customized according to your list of required features and implementation plan.

Platform / provider	Message personalization	Auto-reply function	Scheduling	Conditional branch logic	Data collection / tracking	Short / long code	Opt-in / opt-out	Cost	Contact
Vendor A	No	Yes, No,	Yes	Yes	Messages sent / received / bounced	Short code	Opt-in	.10 per message	John 800-555-1212

Appendix C
Text Messaging Bibliography

Systematic Reviews (Annotated)

Cole-Lewis H, Kershaw T. Text messaging as a tool for behavior change in disease prevention and management. Epidemiol Rev. 2010;32:56-69. PM:20354039
> This systematic review provides an overview of behavior change interventions for disease management and prevention delivered through text messaging.

Deglise C, Suggs LS, Odermatt P. Short message service (SMS) applications for disease prevention in developing countries. J Med Internet Res. 2012;14:e3. PM:22262730
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Fjeldsoe BS, Marshall AL, Miller YD. Behavior change interventions delivered by mobile telephone short-message service. Am J Prev Med. 2009;36:165-173. PM:19135907
> This review analyzes the application of SMS for delivering health behavior change interventions to establish what can be learned from research conducted to date and make recommendations for future research. SMS-delivered interventions have positive short-term behavioral outcomes.

Holtz B, Lauckner C. Diabetes Management via Mobile Phones: A Systematic Review. Telemed J E Health. 2012;18:175-184. PM:22356525
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> The objective of this study was to evaluate the evidence on the impact of cell phone interventions for persons with diabetes and/or obesity in improving health outcomes and/or processes of care for persons with diabetes and/or obesity. Providing care and support with cell phones and text message interventions can improve clinically relevant diabetes-related health outcomes by increasing knowledge and self-efficacy to carry out self-management behaviors.

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Lau PW, Lau EY, Wong dP, Ransdell L. A systematic review of information and communication technology-based interventions for promoting physical activity behavior change in children and adolescents. J Med Internet Res. 2011;13:e48. PM:21749967
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Appendix D

Table of Text Messaging Studies

Purpose of Text Communication	Disease/Condition of Focus	Setting	Population
Lifestyle (diet, exercise)	Obesity[1-10] Smoking cessation[11-16] Cardiovascular disease[17, 18] Postnatal inactivity[19] Nutrition[6, 20] Diabetes[21] COPD[22] Exercise[23-25]	Public health[2, 5, 6, 6, 7, 11-14, 16, 20, 23, 24, 26] Dietician[25]	Children[1, 4-6, 26] Adolescents[3, 4, 6, 6, 8, 9, 11-13, 17, 20, 26] Young adults[11-13, 20] Women[5, 18, 19] Adults[2, 7, 10]
Disease self-management/ adherence	HIV/AIDS[27-31] Athsma[32-36] Brain Injury[37] Inflammatory bowel disease[38] Prenatal support[39] Hypertension[40] Schizophrenia[41] Diabetes[42]	Global health[27-30] Primary care[27, 29, 30, 32, 34, 36, 37, 40, 43, 44] Psychiatry[41]	Women[27, 39] Adults[28] Children[36] Adolescents[35, 36] Low income/minority[35]
Prevention/ Education	HIV/AIDS[28] Disease prevention[45] Sexual health[46-48] Sun safety[47, 49] Cancer[50] Malaria reminder[51] Dental[52]	Public health[28, 31, 45-50, 52] Military[51]	General[45] Adolescents/ young adults[33, 46, 47] Adults[33, 49] Children[52] Latino youth[48]
Reminders	Immunizations[53, 54] Athsma[36, 55] Family planning[56, 57] Appointment attendance[37, 44, 58-63] Acne[64] HIV/AIDS[29, 65] Mammogram[66] Malaria prevention[51] Medication[67, 68]	Primary care[33, 36-38, 44, 53-55, 58-60, 62-65, 67, 68] Family planning center[56, 57] Health promotion center[44] Health insurance[66] Dental[61] Military[51]	Children[6, 36, 53, 61] Adolescents[36, 38, 56] Young women[56] General[58, 68] Adults[44] Women[66]
Monitoring/ collecting research data	Back Pain[69-71] General[72] Alcohol use[73, 74] Infant feeding[75] Disease outbreaks[76]	Primary care[70-72, 77] Public health[75, 75, 76]	Young adults[73, 74] Adolescents[74] New mothers[75]

Disease maintenance/ communication between patient and provider	Eating disorders[43] Diabetes[78, 79] Activity level[80] Athsma[34]	Primary care[34, 43, 78]	
Useability studies	Prenatal support[39] Activity level[80, 81] Athsma[35] Smoking cessation[16]	Clinical practice (general)[34]	Women[39] Adults[80]

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