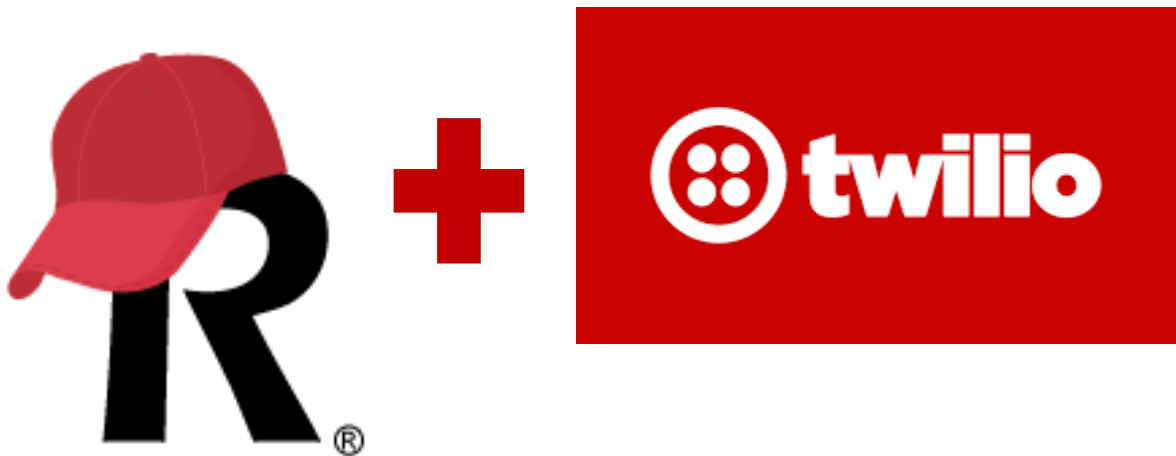


# Twilio Guide for Vanderbilt/Meharry End Users



Written by Laura McLeod/Vanderbilt University Medical Center

## Acknowledgements

*This guide is adapted from guides developed by REDCap Administrators Amanda Miller/University of Colorado Denver and Taryn Stoffs/University of Florida as well as input from REDCap administrators Andy Arenson/Indiana University, Chris Battiston/Women's College Hospital, Erik Benton/OHSU, Leila Deering/Marshfield Clinic Research Institute, Ruthie Knowles/National Jewish Health, Eduardo Morales/Partners Healthcare, Maxx Somers/Cincinnati Children's Hospital, Rob Taylor/Vanderbilt University Medical Center, and Shang Wei/UC Davis.*

## Table of Contents

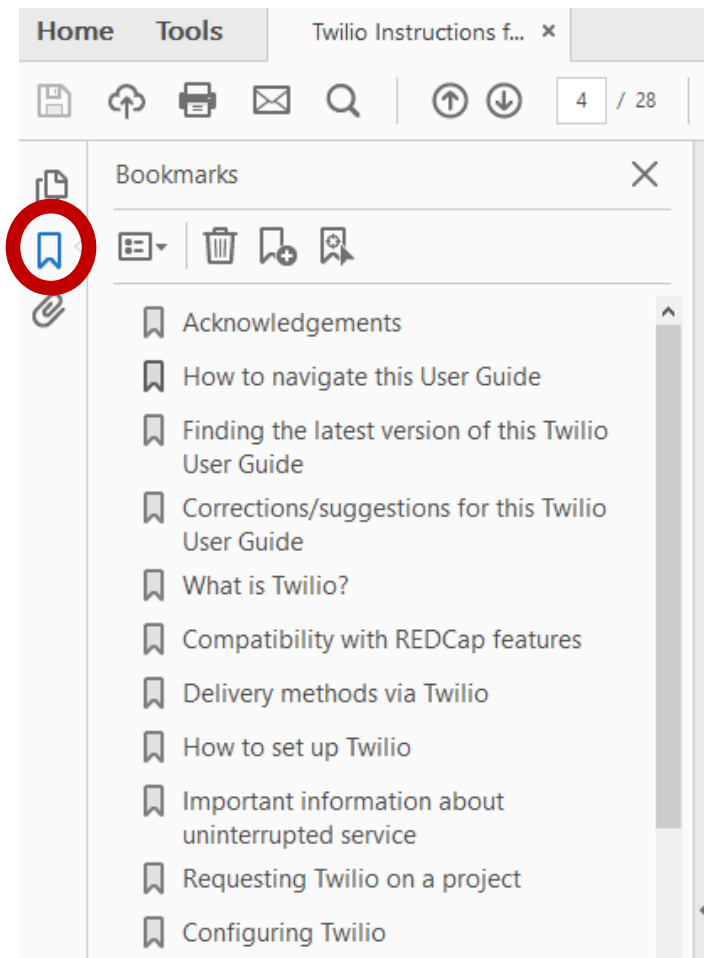
Acknowledgements.....	1
How to navigate this User Guide .....	5
Finding the latest version of this Twilio User Guide .....	5
Corrections/suggestions for this Twilio User Guide .....	5
What is Twilio?.....	6
Compatibility with REDCap features.....	6
Delivery methods via Twilio .....	7
How to set up Twilio .....	8
Important information about uninterrupted service .....	8
Requesting Twilio on a project .....	8
Configuring Twilio .....	9
Language/Gender for Voice calls .....	9
Modules in which Twilio will be enabled.....	10
Survey-specific settings.....	10
Default invitation preference.....	11
Using a multiple choice field to designate delivery preference .....	11
Designate a phone number.....	12
Append response instructions to questions .....	12
Overlapping SMS invitations .....	13
For One-way communication .....	14
For two-way communication .....	14
Project Design .....	14
If collecting survey responses via text/call .....	14
Analyze surveys for SMS & Voice Calls .....	15
Message delivery .....	16
Public Survey Link .....	16
To set a participant’s delivery preference manually.....	18
To set a participant’s delivery preference automatically .....	19
To change a participant’s delivery preference .....	20
Composing the survey invitation via Participant List.....	22
If the Invitation type is Use participant’s preference (default invitation type) or SMS invitation (contains phone number to call) or SMS invitation (reply via SMS to receive voice call) .....	23
If the invitation type is SMS invitation (contains survey link) or SMS invitation (take survey via SMS) .....	24

If the invitation type is Voice call (participant receives voice call) .....	24
Using a data entry form to build a participant list.....	24
Setting the delivery preference .....	25
Automated Survey Invitations .....	25
If the Invitation type is Use participant’s preference (default invitation type) or SMS invitation (contains phone number to call) or SMS invitation (reply via SMS to receive voice call) .....	25
Stop Logic in Automated Invitations.....	26
Datediff/today calculations in Automated Invitations .....	27
Alerts & Notifications.....	27
Setting up your project to use Twilio in Alerts & Notifications .....	28
To create an Alert that uses Twilio .....	28
Stop Logic in Alerts.....	29
Checking the Notification Log for past and future alerts.....	30
Datediff/Today calculations in Alerts.....	30
Message design and content tips .....	31
Line breaks .....	31
Character limits.....	31
Message content limitations.....	32
Carrier Filtering .....	32
Project Management tips .....	32
Change in participant phone number .....	32
If using the Participant List.....	32
If using a phone-validated number field.....	32
Longitudinal Projects .....	32
Overlapping messages .....	34
Troubleshooting errors .....	34
Incoming messages from participants.....	35
Best practices/Tips.....	35
Testing.....	35
Twilio Registry.....	36
Fully complete any survey invitations that you send to your own cell phone .....	36
Ask your participants to add the Twilio number to their phone’s address book .....	36
Reasoning.....	37
Advising your participant that charges may apply.....	37
Asking participants to confirm that they agree to be contacted by text or phone .....	37

Carrier Filtering ..... 37  
Checking Survey Invitation Log/Notification Log ..... 37  
How Twilio and REDCap work together ..... 38  
SMS Regulatory Guidelines and best practices ..... 38  
Security ..... 38  
Authentication ..... 39  
Risk Assessment ..... 39

## How to navigate this User Guide

- You can use Ctrl+F to search for a keyword within this User Guide
- You can click on the Bookmark icon to find the section you would like to jump to:



## Finding the latest version of this Twilio User Guide

This User Guide may be updated from time-to-time. To make sure you are referencing the most recent version, please visit [the Vanderbilt Meharry resource page](#). You can get to that website by clicking the hyperlink above. You can also always find the link to it on the login screen or at the top of the Help & FAQ tab within REDCap.

## Corrections/suggestions for this Twilio User Guide

If you have corrections/suggestions for this Twilio user guide, please email them to [redcap@vumc.org](mailto:redcap@vumc.org).

## What is Twilio?

- A third party program ([www.twilio.com](http://www.twilio.com)) whose service can be enabled on a REDCap project
- When a REDCap project has Twilio enabled on it, a user on the project can send information and/or survey invitations to participants as a text message or as a voice call
- Twilio is secure to use, but be sensitive about PHI and sensitive information—think about who might have access to your participant’s phone

## Compatibility with REDCap features

Most of REDCap's survey features still function much the same when taking a survey via SMS or as a voice call. This includes the enforcement of required fields, field validation, branching logic, using the Survey Queue for multiple surveys (only works with Auto-Start enabled), survey email notifications and confirmations, the Participant List, Automated Survey Invitations, survey Stop Actions, and computer adaptive tests (CATs) downloaded from the REDCap Shared Library. One of the few survey features that is not compatible is the Survey Login feature.

Additionally, if you are using an adaptive instrument from the REDCap shared library (like a PROMIS instrument), some of those instruments contain hidden fields. Hidden fields may cause the survey to stop for the participant (they won't receive sequential questions via text). If that is the case, you will NOT want to have the participant complete the survey via text response, since adaptive instruments are not editable.

## Delivery methods via Twilio

### Voice Call options via Participant List

1. Initiate survey as voice call	REDCap calls the respondent. They take the survey via phone, using the number pad for answers. Questions can only be in choice single answer format (yes/no, true/false, multiple choice radio button) or a number-validated text field.
2. Invite via SMS to take as voice call (respondent calls REDCap)	REDCap texts the respondent a Twilio phone number, which is purchased in and affiliated with your Twilio account. The respondent calls that Twilio number when they are ready to take the survey. <b>They take the survey via phone, using the number pad for answers.</b> Questions can only be in multiple choice single answer format or a number-validated text field.
3. Invite via SMS to take as voice call (REDCap calls respondent)	You provide your respondent with a Twilio phone number, which is purchased in and affiliated with your Twilio account. The respondent texts that number with a pre-defined message when they are ready to start the survey. REDCap then calls the respondent. <b>They take the survey via phone, using the number pad for answers.</b> Questions can only be in choice single answer format (yes/no, true/false, multiple choice radio button) or a number-validated text field. <i>NOTE: this option is sometimes preferable to option 2 above because some phone carriers do NOT charge their customers for incoming calls.</i>

### SMS text options

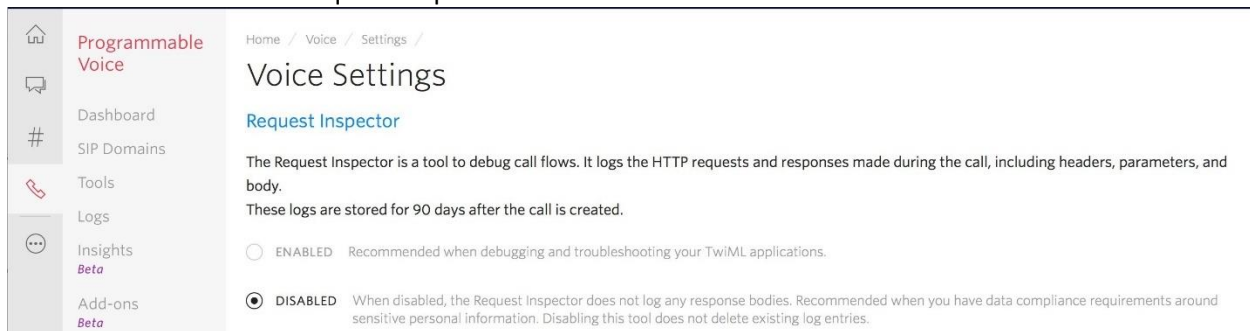
Initiate survey as SMS conversation	REDCap texts the respondent the actual survey questions. The respondent uses the number pad and keyboard for their answers. Questions can only be in multiple choice single answer format or a number-validated text field. <b>NOTE: THIS IS NOT HIPAA-COMPLIANT AND IS NOT RECOMMENDED FOR MOST PROJECTS</b>
Send survey invitation via SMS	REDCap texts the respondent their survey link. The respondent clicks that link to open their survey in a browser. They take the survey as usual, just as if they had clicked the survey link in an email.
Send information via SMS	Using the alerts & Notifications application within your REDCap project, you can use Twilio to send information (not collect responses) to a participant. It is critical that you NOT send any PHI in a message.

Effectively, this leads to three new ways that a participant can take a survey:

1. Mobile browser, via texted link, instead of emailed link
2. Voice
3. SMS/text (***insecure***)

## How to set up Twilio

- Go to [www.twilio.com](http://www.twilio.com) and create an account
- Set up a payment method—you can use a credit card or PayPal
- Buy a phone number; numbers are \$1/month
  - Please [verify cost with Twilio](#) – their rates may be subject to change
  - Each phone number is specific to a REDCap project – you need to buy a Twilio phone number for each REDCap project for which you want Twilio functionality
  - You can select specific capabilities for the phone number (text, multi-media messages)
  - You can select a [local, national, toll free or mobile number](#)
- Turn off the Request Inspector feature
  - This feature stores data on Twilio’s server and is not HIPAA-compliant, so it must be off to use Twilio with REDCap
  - Find it at this path (see image below):
    - Dashboard
    - Programmable voice
    - Settings
    - Request Inspector



Disabling the request inspector disables the logging of phone and SMS Records in Twilio. This will allow REDCap to be the only place where records and logs are kept. REDCap will programmatically not allow set up unless this setting is disabled in your account. **Disabling the request inspector (logging) is an important part of HIPAA Compliance.** See [the Security section](#) of this document for more information.

## Important information about uninterrupted service

There is a monthly fee that Twilio charges and additionally they charge a small fee for each message sent. You can view the rates for your Twilio account on their website. That is not something that REDCap has any purview over.

Keeping your Twilio account funded is important. If the account runs out of funds, the messages will not be sent. Funding a Twilio account happens outside of REDCap. So it is the user’s responsibility to make sure it is funded at all times.

## Requesting Twilio on a project

At the Vanderbilt/Meharry REDCap installation, a REDCap administrator is responsible for enabling Twilio on a project. To request Twilio for your project, please fill out [this survey](#). It will likely take a few



business days between your request is submitted and when Twilio is available on your project. That is because there are several verifications steps the REDCap admin team needs to take in enabling Twilio on your project.

## Configuring Twilio

After Twilio is enabled on your project, a new box will appear on the **Project Setup** page allowing you to configure Twilio:

### ⊕ Twilio SMS and Voice Call services

To begin utilizing the Twilio SMS and Voice Call services in this project, click the 'Configure' button below. Once you have the Twilio service enabled, the Configuration popup will allow you to enable Twilio for 1) Alerts & Notifications and/or 2) surveys and survey invitations. If using Twilio for surveys, you will need to first designate an instrument as a survey in this REDCap project, after which you may click the 'analyze surveys' button to run an analysis on all your surveys to determine if they can be used as an SMS survey or as a Voice Call survey.

Go to  or

When you click on the Configure Twilio settings button you will see these sections:

### Language/Gender for Voice calls

If you are using Twilio to contact participants via voice call, you can indicate the language/gender for the voice calls. This is a partial list of your choices:

### ⊕ Twilio configuration settings

#### Language and gender used for voice calls

Choose the language of your survey question text and/or alert message, and select the regional dialect in which you want it to be spoken (used in voice calls only).

English, United States (Male voice) ▼

**Male voice**

- English, United States (Male voice)
- English, UK (Male voice)
- Spanish, Spain (Male voice)
- French, France (Male voice)
- German, Germany (Male voice)
- Italian, Italy (Male voice)

**Female voice**

- Danish, Denmark (Female voice)
- German, Germany (Female voice)
- English, Australia (Female voice)
- English, Canada (Female voice)
- English, UK (Female voice)
- English, India (Female voice)
- English, United States (Female voice)
- Catalan, Spain (Female voice)
- Spanish, Spain (Female voice)
- Spanish, Mexico (Female voice)
- Finnish, Finland (Female voice)
- French, Canada (Female voice)

## Modules in which Twilio will be enabled

<b>Select the project modules in which the Twilio service will be enabled</b>	ALL: Surveys and survey invitations + Alerts & Notifications ▾ Surveys and survey invitations only (default) Alerts & Notifications only ALL: Surveys and survey invitations + Alerts & Notifications
---	--

If you are using Twilio to send survey invitations, you can select any of the options in that drop-down list. Please see the section [For two-way communication](#) for tips on project design if you are using Twilio for surveys.

If you are only using Twilio to send a message that does not involve a survey, you can select the “Alerts & Notifications only” option. Please see the section [For One-way communication](#) for tips on project design if you are only using Twilio to send messages.

You would also select the “Surveys and survey invitations only (default)” or the “ALL” option if you are using an Automated Invitation to send information only (e.g. not including the smart variable survey link).

## Survey-specific settings

You can select different options in this section of Configure Twilio Settings if you are using Twilio for surveys. If you are only using Twilio to send one-way messages (and NOT using an Automated Invitation as a vehicle to send a one-way message), you do not need to tick any of the boxes in this section.

<b>Survey-specific settings:</b>	
<b>Choose survey invitation types to use</b> You may select several different ways for participants to be invited to take surveys and also the medium in which they will take the surveys  <i>* Only REDCap administrators are allowed to enable the Twilio option to initiate a survey as an SMS conversation. Much like email, SMS is not considered a secure form of communication, so you may not want to administer surveys as SMS conversations if the participant will be submitting identifying information (PHI or PII) unless you have been granted special permission from the participant to do so. Given such sensitive privacy issues, only your local REDCap administrator can enable the optional setting to use SMS surveys. Please notify your administrator about this if you wish to have this option enabled.</i>	<b>Survey as webpage</b> <input checked="" type="checkbox"/> Send survey invitation with survey link via SMS  <b>Survey as voice call</b> <input checked="" type="checkbox"/> Initiate survey as voice call <input checked="" type="checkbox"/> Send survey invitation via SMS to take survey as voice call (respondent makes call) <input checked="" type="checkbox"/> Send survey invitation via SMS to take survey as voice call (respondent receives call when replying via SMS)  <b>Survey as SMS conversation</b> <input checked="" type="checkbox"/> Initiate survey as SMS conversation *

## Default invitation preference

**Choose the default invitation preference for new survey participants**

If new participants are created via data entry form (rather than via survey), then you may select their default survey invitation preference that will get assigned to them when their record is created. This is useful if you are creating records using a data import or on a data entry form, but wish to send survey invitations later for SMS surveys or voice call surveys, in which this setting automatically sets their invitation preference for you. Without this setting, you would otherwise have to set each participant's preference individually in the Participant List. Also, this value will be used as the pre-selected setting of the delivery preference on the Participant List page when adding new participants to the list.

SMS invitation (contains survey link) ▼ ?

- Email invitation
- SMS invitation (contains survey link)**
- SMS invitation (take survey via SMS)
- Voice call (participant receives voice call)
- SMS invitation (contains phone number to call)
- SMS invitation (reply via SMS to receive voice call)

When adding participants to the participant list, you can choose the default invitation preference for how they will be sent their invitation. An individual's invitation preference can be changed at any time in the participant list. Then when you are ready to send your survey invitations to participants, you can choose the delivery method used for sending that batch of invitations. The preference does not have to be used when you are sending invitations, but it is provided as a convenience in case you have participants with several different invitation preferences.

### Using a multiple choice field to designate delivery preference

You can create a multiple choice field in your REDCap project that can be used to automate the delivery preference of a participant. When creating the multiple choice field, you would need to use the following as the choice codes:

EMAIL, Email invitation  
SMS\_INVITE\_WEB, SMS invitation (contains survey link)  
SMS\_INITIATE, SMS invitation (take survey via SMS)  
VOICE\_INITIATE, Voice call (participant receives voice call)  
SMS\_INVITE\_MAKE\_CALL, SMS invitation (contains phone number to call)  
SMS\_INVITE\_RECEIVE\_CALL, SMS invitation (reply via SMS to receive voice call)

So the **codes** (the string of text written prior to the comma (in all caps and with underscores) need to be written exactly as written above. You can modify the choice **labels** (the content that comes after the comma) any way you wish.

Once you have that multiple choice field in your project, you can go to Project Setup/Configure Twilio settings and in the Survey-specific Settings section, select your multiple choice field from the drop-down list that corresponds with the 'Control each participant's invitation preference using a multiple choice field section:

**Control each participant's invitation preference using a multiple choice field**

If survey participants require using different methods (e.g., email, SMS w/ link, voice call survey) for receiving survey invitations and/or taking surveys, you can select a multiple choice field (radio and drop-down fields only) whose choices represent each survey invitation delivery method. After mapping the invitation preferences to a field, whenever the value of the field is added or modified, the participant's invitation preference will automatically be changed accordingly. **IMPORTANT:** The multiple choice codings for the selected field must be defined exactly as delineated on the right, although their corresponding choice labels can be modified to be whatever text you wish.

NOTE: Not all of the options above need to be set for the field's choices but only the ones needed. Also be aware that if the value of the field selected above is set to blank/null, then the invitation preference for the participant will revert to the project's default invitation preference. Additionally, if a participant's invitation preference is modified via the Participant List, that change will also change the value of the mapping field selected above.

deliverypreference "What is the participant's delivery pre" ▼

Required choice codes with example choice labels:

**EMAIL**, Email invitation  
**SMS\_INVITE\_WEB**, SMS invitation (contains survey link)  
**SMS\_INITIATE**, SMS invitation (take survey via SMS)  
**VOICE\_INITIATE**, Voice call (participant receives voice call)  
**SMS\_INVITE\_MAKE\_CALL**, SMS invitation (contains phone number to call)  
**SMS\_INVITE\_RECEIVE\_CALL**, SMS invitation (reply via SMS to receive voice call)

In the above example, the multiple choice field that was created was called 'deliverypreference'. To see a demo of this feature, click [here](#).

### Designate a phone number

**(Optional) Designate a phone number field for survey invitations**

You may capture phone numbers for sending invitations to your survey participants by designating a field in your project. This can be done in addition to (or as an alternative to) entering phone numbers directly into the Participant List. So if a participant does not have a phone number that was added to the Participant List, it will use the value of this field when sending survey invitations via SMS or as voice calls.

phone ("Phone number") ▼  
 --- select a field ---  
 phone ("Phone number")

Similar to designating an email field for survey invitations, you can designate a phone number for survey invitations. Any text box field that has phone number validation will display in your drop-down list.

### Append response instructions to questions

**Automatically append response instructions to questions?**

If this option is set to 'No', then the survey respondent will be given only a question's field label and option choices' text as-is, which means that you will need to modify your question text to say 'For chocolate, press 1. For vanilla, press 2...'. But if you set this option to 'Yes', you may leave your existing question text 'Chocolate, Vanilla, ...', and REDCap will automatically add 'Press 1' to the end of the 'Chocolate' choice text for a voice call, for example. And for an SMS message, it will add '(1)' to the beginning of the choice text in the message.

Yes, auto-append response instructions ▼  
 No, do not append  
 Yes, auto-append response instructions

If you are planning to have all your respondent take the survey using only one medium (via webpage, SMS, or voice call), then it is often best to set this option to 'no' and customize each question's text for that medium. But if you will be utilizing two or more different mediums to collect responses, then setting

it to 'yes' can provide more flexibility because REDCap will display the text appropriately for each medium.

### Overlapping SMS invitations

You have some choices for overlapping messages if your project contains multiple surveys.

#### Behavior for overlapping SMS invitations

If you will be sending SMS invitations for multiple surveys within this project, then you will need to choose the default behavior for when a participant has received SMS invitations to multiple surveys at the same time, in which they will be replying to the same SMS thread for multiple invitations. (This is rare but must still be accounted for.) If the participant has received multiple SMS invites, you can have it behave according to the option selected in the drop-down to the right.

Allow participant to choose which survey to take next ▼
Use only most recent invitation (ignore previously sent invitations)
Take surveys in same order as participant received the invitations
Allow participant to choose which survey to take next

## For One-way communication

If you wish to use the project to simply send information to participants you don't need surveys enabled on the project. Instead, you can use the Alerts & Notifications application to create the messages that you want to send to the participants.

In Twilio configuration settings (found on the Project Setup page), select the options Alerts & Notifications only in the project modules section:

Select the project modules in which the Twilio service will be enabled	ALL: Surveys and survey invitations + Alerts & Notifications ▾
	Surveys and survey invitations only (default)
	Alerts & Notifications only
	ALL: Surveys and survey invitations + Alerts & Notifications

If you have your Twilio Configuration Settings set for Alerts & Notifications only, if a recipient replies to a Twilio text, they will receive this message: [Auto-Reply: This SMS phone number is not monitored]. That text is hard-coded so you do not need to do anything to set that up. You also are not able to customize that text.

See [Message Delivery/Alerts & Notifications section](#) of this User Guide for instructions on how to set up an alert to send your message.

If you are working with an older project and you have been using an Automated Invitation to send a one-way message, then you simply need to remember to remove the smart variable survey link that automatically gets added to the message section of the invitation. You will be prompted to add it in – you will need to keep dismissing the warning until it lets you save the message.

## For two-way communication

If you wish to collect data from participants (either by sending them a survey link via text or by asking them to answer survey questions via text or phone call) there are some project design elements to keep in mind.

### Project Design

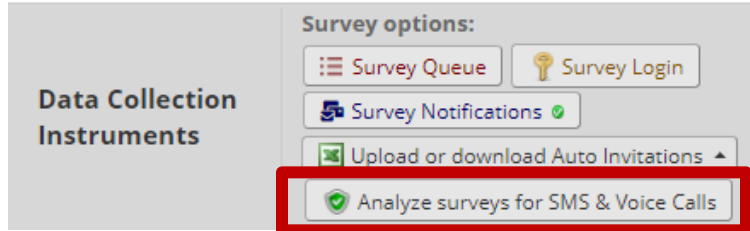
- Surveys need to be enabled on the project
- Keep in mind that Action tags are not functional via Twilio
- For all voice and SMS text distribution options, we suggest keeping question language non-specific. Field labels should ideally not refer to specific sensitive or confidential data.

### If collecting survey responses via text/call

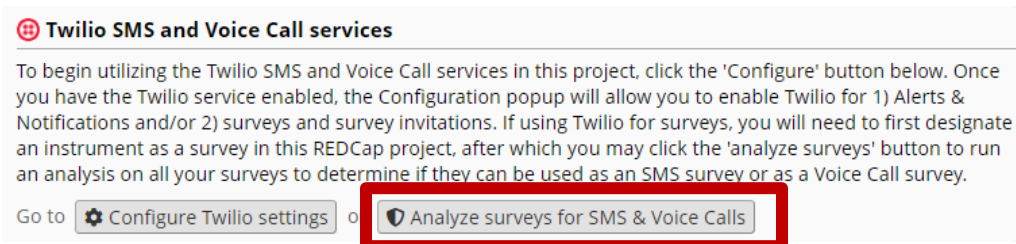
The survey questions need to be designed using multiple choice field types and/or text boxes validated for number. **No other field types are compatible with this module.**

## Analyze surveys for SMS & Voice Calls

As mentioned above, if you are collecting survey responses via voice call or text, the fields in your surveys can only be multiple choice or number-validated text box fields. To double-check that your questions are compatible with Twilio, you can click on the Analyze surveys for SMS & Voice Calls button on either the Designer page:



or the Project Setup page:



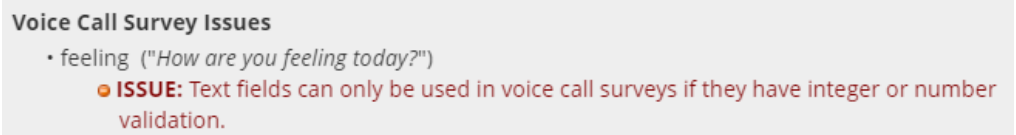
You will see a list of your instruments that have been enabled as surveys. If there are any compatibility issues, the cell in the Voice Call Survey Issues column will be red and will indicate the number of errors:

### Analyze surveys for SMS & Voice Calls

The table below displays any issues that might be experienced if using a survey as a voice call survey or as an SMS survey. To see the details of any issue, click the 'view' link next to it, which will display the field with the issue, as well as a description of why this field would be problematic. NOTE: If a survey below is administered as a voice call survey or SMS survey, then **any field having an issue will be skipped** in the survey unless the issue described below is remedied by changing or removing the field.

Voice Call Survey Issues	SMS Survey Issues	Survey Title
❗ 1 <a href="#">view</a>	✅ 0	Asthma Symptoms
✅ 0	✅ 0	PROMIS Ped Bank v2.0 - Asthma Impact

You can click on the 'view' link to see what the issue is. In this example, there is a question in the survey that is a text box field type but it does not have number validation on it:



That is your cue to go into Designer for that survey and edit the field so that it complies with design requirements.

## Message delivery

### Public Survey Link

If the first instrument in your project is a survey, you have the option to invite participants to complete the public survey via voice call or SMS. To do this, click on Survey Distribution Tools on the left-hand navigation bar and you will see this in the bottom portion of your right-hand workspace:

**Voice Calling and SMS options for the Public Survey**

You may invite participants to complete the public survey via voice call or SMS. If you wish to invite them directly \*right now\*, click the button below to open a popup for entering phone numbers to call or send an SMS text message to the participants.

**1) Invite participants now:**

Alternatively, if you instead want the participants to initiate the survey themselves, then you may provide your participants with the instructions below.

**2) Participant makes voice call to initiate the survey**  
Call the phone number  and enter the code

**3) Participant receives voice call after sending an SMS message to initiate the survey**  
Send the code  as an SMS message to the phone number

**4) Participant initiates survey as SMS conversation**  
Send the code  as an SMS message to the phone number

When you click on the 'Invite participants via Voice Call or SMS button, you will see this:

**Invite participants via Voice Call or SMS**

In the text box below, enter the phone numbers of the respondents to which you wish to send survey invitations, either as a voice call or SMS text message.

Enter phone numbers below with one number per line

Choose how these participants will take the survey and be invited:

Enter custom SMS message:

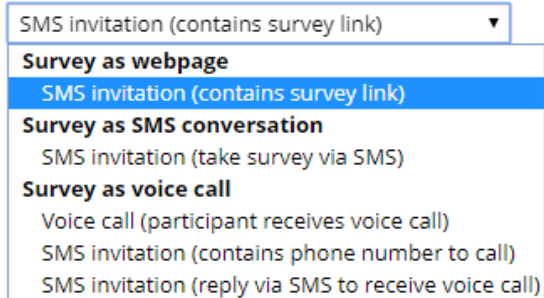
NOTE: Invitations here are sent out in real time, so please be patient if you are sending out many invitations as it may take a couple seconds to send each one at a time.



You enter the phone numbers one per line, just like you would enter email addresses one per line when using the Participant List to send survey invitations via email.

You can select the delivery method from the drop-down list:

Choose how these participants will take the survey and be invited:

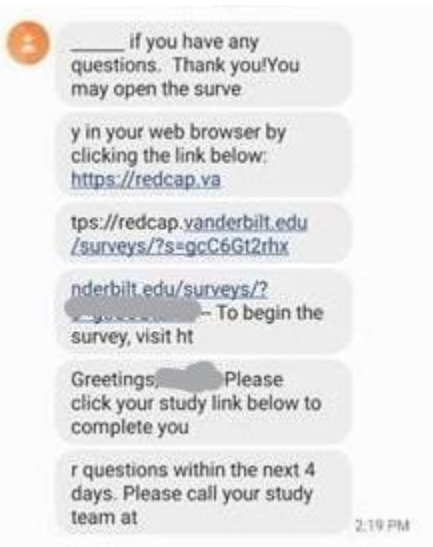


The image shows a dropdown menu for selecting a survey delivery method. The current selection is "SMS invitation (contains survey link)". The menu is open, showing several options:

- Survey as webpage**
  - SMS invitation (contains survey link)
- Survey as SMS conversation**
  - SMS invitation (take survey via SMS)
- Survey as voice call**
  - Voice call (participant receives voice call)
  - SMS invitation (contains phone number to call)
  - SMS invitation (reply via SMS to receive voice call)

Note that there is a message box into which you can enter survey instructions. The participant will see those instructions in the text message they receive. This is separate from the Survey Instructions that the participant will see if a survey link is included and they click on that to take the survey.

**It is best to keep your message very brief – the cell phone carrier may break up the message into separate texts if the message length is too long and it's possible the texts may arrive out of order, like this:**



So consider only providing the survey link and a few words about it. Any further instructions can be included in the Survey Instructions which you set via Survey Settings.

### To set a participant's delivery preference manually

If you know the participant's contact information ahead of time, you can add them to the Participant List and set their delivery preference. To do this, click on Survey Distribution Tools and then the Participant List tab. If you have several entries, consider sorting them by delivery preference so that you are bulk adding them according to their delivery preference.

For instance, if you have the following participants:

Name	Delivery preference	Email address	Phone number
Jena	Email	<a href="mailto:jena@test.com">jena@test.com</a>	518-555-5555
Nicole	Text survey link	<a href="mailto:nicole@test.com">nicole@test.com</a>	518-555-6666
Barbara	Text survey link	<a href="mailto:barbara@test.com">barbara@test.com</a>	518-555-7777
Steve	Email	<a href="mailto:steve@test.com">steve@test.com</a>	518-555-8888
Alecia	Voice call	<a href="mailto:alecia@test.com">alecia@test.com</a>	615-555-5555
Zinnia	Email	<a href="mailto:zinnia@test.com">zinnia@test.com</a>	404-555-5555
Joe	Voice call	<a href="mailto:joe@test.com">joe@test.com</a>	615-555-6666
Kristin	Text survey link	<a href="mailto:kristin@test.com">kristin@test.com</a>	206-555-5555

...you would want to sort them by delivery preference, so your list would look like this:


Name	Delivery preference	Email address	Phone number
Jena	Email	<a href="mailto:jena@test.com">jena@test.com</a>	518-555-5555
Steve	Email	<a href="mailto:steve@test.com">steve@test.com</a>	518-555-8888
Zinnia	Email	<a href="mailto:zinnia@test.com">zinnia@test.com</a>	404-555-5555
Nicole	Text survey link	<a href="mailto:nicole@test.com">nicole@test.com</a>	518-555-6666
Barbara	Text survey link	<a href="mailto:barbara@test.com">barbara@test.com</a>	518-555-7777
Kristin	Text survey link	<a href="mailto:kristin@test.com">kristin@test.com</a>	206-555-5555
Alecia	Voice call	<a href="mailto:alecia@test.com">alecia@test.com</a>	615-555-5555
Joe	Voice call	<a href="mailto:joe@test.com">joe@test.com</a>	615-555-6666

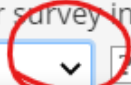
Next, you would take the first group (delivery preference = email) and add those to the participant list. You do that by clicking on the Add Participants button on the Participant List page and entering the email address and phone number for each person. Note that you put a comma between the email address and phone number:

## Add Emails or Phone Numbers to Participant List

Copy and paste your list of participant email addresses or phone numbers, **one per line**.

```
jena@test.com, 518-555-5555  
steve@test.com, 518-555-8888  
zinnia@test.com. 404-555-5555
```

 Specify the default invitation preference for survey invitations for these participants:

Email invitation 

- Survey as webpage**
- Email invitation
- SMS invitation (contains survey link)
- Survey as SMS conversation**
- SMS invitation (take survey via SMS)
- Survey as voice call**
- Voice call (participant receives voice call)
- SMS invitation (contains phone number to call)
- SMS invitation (reply via SMS to receive voice call)

NOTE: number (or both). If the participant has a phone number.

You then click on the drop-down arrow and select 'email invitation' as the default invitation preference.

Next, you can select the group of people whose delivery preference is text survey link and add them to the Participant List. You'll select 'Survey as a webpage – SMS invitation (contains survey link)'.

In essence, you're bulk-adding participants, sorting by delivery preference.

To set a participant's delivery preference **automatically**

You can select a multiple choice field (radio or drop-down fields only) whose choices represent each survey invitation delivery method. You will then map this field in your Twilio configuration settings.

For this to work, you will first create the multiple choice field, with the following choice codes:

- EMAIL, Email invitation
- SMS\_INVITE\_WEB, SMS invitation (contains survey link)
- SMS\_INITIATE, SMS invitation (take survey via SMS)
- VOICE\_INITIATE, Voice call (participant receives voice call)
- SMS\_INVITE\_MAKE\_CALL, SMS invitation (contains phone number to call)
- SMS\_INVITE\_RECEIVE\_CALL, SMS invitation (reply via SMS to receive voice call)

You can change the wording of the choice labels (the part that comes after the comma), but the choice codes (highlighted in yellow above), must be written exactly as depicted above.

That field can be anywhere in your project, including on a public survey link. In this example, let's say we named the field 'deliverypreference'.

Next, go to the Project Setup page (via the Project Home and Design section on the left-hand navigation bar) and click on 'Configure Twilio settings' in the Twilio SMS and Voice Call services section. In the Survey-specific settings scroll down to the "Control each participant's invitation preference..." section and click on the drop-down arrow for 'map the invitation preference to a field':

**Control each participant's invitation preference using a multiple choice field**

If survey participants require using different methods (e.g., email, SMS w/ link, voice call survey) for receiving survey invitations and/or taking surveys, you can select a multiple choice field (radio and drop-down fields only) whose choices represent each survey invitation delivery method. After mapping the invitation preferences to a field, whenever the value of the field is added or modified, the participant's invitation preference will automatically be changed accordingly.

**IMPORTANT:** The multiple choice codings for the selected field must be defined exactly as delineated on the right, although their corresponding choice labels can be modified to be whatever text you wish.

**NOTE:** Not all of the options above need to be set for the field's choices but only the ones needed. Also be aware that if the value of the field selected above is set to blank/null, then the invitation preference for the participant will revert to the project's default invitation preference. Additionally, if a participant's invitation preference is modified via the Participant List, that change will also change the value of the mapping field selected above.

--- map the invitation preference to a field ---

Required choice codes with example choice labels:

- EMAIL**, Email invitation
- SMS\_INVITE\_WEB**, SMS invitation (contains survey link)
- SMS\_INITIATE**, SMS invitation (take survey via SMS)
- VOICE\_INITIATE**, Voice call (participant receives voice call)
- SMS\_INVITE\_MAKE\_CALL**, SMS invitation (contains phone number to call)
- SMS\_INVITE\_RECEIVE\_CALL**, SMS invitation (reply via SMS to receive voice call)

From that list, select the field you created ('deliverypreference') and click the save button.

Now, when a record is added and the delivery preference is set via that field, you will see the delivery preference mirrored on the Participant List page.

To change a participant's delivery preference

To change how a participant receives the invitation, go to Survey Distribution Tools and click on the Participant List tab. Look in the Invitation preference column for the participant and click on the icon:

Participant Identifier	Invitation preference	Responded?	Invitation Schedule
Disabled			-


**Change participant's invitation preference:**

SMS invitation (take survey via SMS)

**NOTE:** Changing the preference here will change it for ALL surveys in this project for this participant.

Save Cancel

Clicking on the drop-down list will reveal these choices:

 **Change participant's invitation preference:**

SMS invitation (take survey via SMS) ▼

**Survey as webpage**  
Email invitation  
SMS invitation (contains survey link)

**Survey as SMS conversation**  
SMS invitation (take survey via SMS)

**Survey as voice call**  
Voice call (participant receives voice call)  
SMS invitation (contains phone number to call)  
SMS invitation (reply via SMS to receive voice call)

Please note: if an Automated Survey Invitation (ASI) or Alert is used to schedule an invitation, the delivery preference set at the time the ASI or alert was scheduled will remain in force, even if the user manually changes the preference after the fact. That is because REDCap does not know to check the preference again, after the invitation has been scheduled.

If you used the automated delivery preference setting with a multiple choice field, you can also go to that multiple choice field and change the preference by changing the answer to the question.

## Composing the survey invitation via Participant List

When adding participants to the participant list, you can choose the default invitation preference for how they will be sent their invitation. An individual's invitation preference can be changed at any time in the participant list. Then when you are ready to send your survey invitations to participants, you can choose the delivery method used for sending that batch of invitations. The preference does not have to be used when you are sending invitations, but it is provided as a convenience in case you have participants with several different invitation preferences. Listed below are all the invitation types that are available in a Twilio-enabled project:

- Email invitation
- SMS invitation (contains survey link)
- SMS invitation (take survey via SMS)
- Voice call (participant receives voice call)
- SMS invitation (contains phone number to call)
- SMS invitation (reply via SMS to receive voice call)
- Use participants preference

These are the elements of composing the survey invitation:

### Send a Survey Invitation to Participants

#### Info

**Survey title:** Asthma Symptoms



#### Invitation type - How the participant is invited

Use participant's preference ▼



#### When should the emails be sent?

Immediately

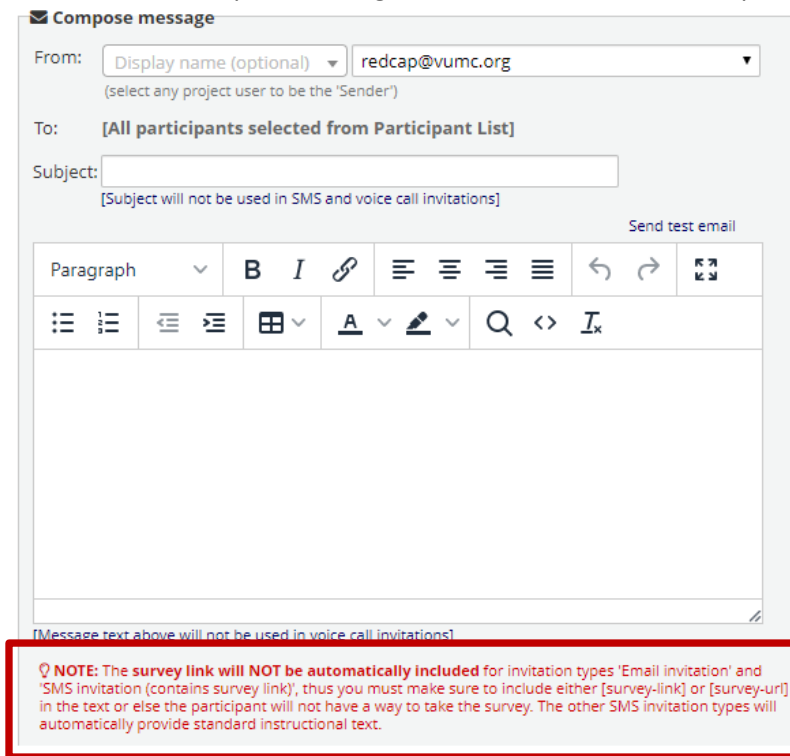
At specified time:    M/D/Y H:M

The time must be for the time zone **America/Chicago**, in which the current time is **04/02/2020 14:35**.

#### Enable reminders

Re-send invitation as a reminder if participant has not responded by a specified time?

If the Invitation type is Use participant's preference (default invitation type) or SMS invitation (contains phone number to call) or SMS invitation (reply via SMS to receive voice call)  
You will see a Compose Message box with some text in red – please read that text! (see image below)



Compose message

From:  redcap@vumc.org  
(select any project user to be the 'Sender')

To: [All participants selected from Participant List]

Subject:   
[Subject will not be used in SMS and voice call invitations]

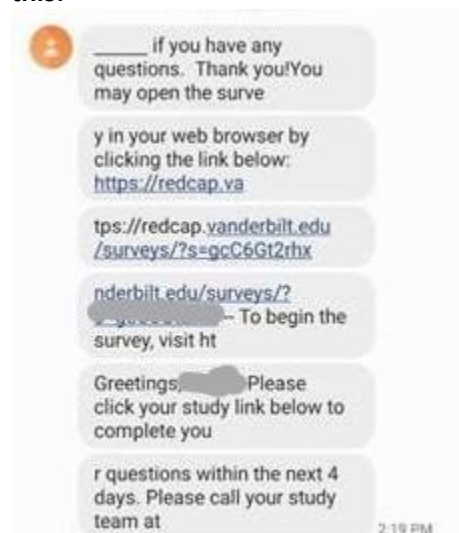
Send test email

Paragraph **B** *I*

[Message text above will not be used in voice call invitations]

**NOTE:** The survey link will NOT be automatically included for invitation types 'Email invitation' and 'SMS invitation (contains survey link)', thus you must make sure to include either [survey-link] or [survey-uri] in the text or else the participant will not have a way to take the survey. The other SMS invitation types will automatically provide standard instructional text.

It is best to keep your message very brief – the cell phone carrier may break up the message into separate texts if the message length is too long and it's possible the texts may arrive out of order, like this:



So consider only providing the survey link and a few words about it. Any further instructions can be included in the Survey Instructions which you set via Survey Settings.

If the invitation type is SMS invitation (contains survey link) or SMS invitation (take survey via SMS)

REDCap will pre-populate your message box with the smart variable for the survey link. You must leave that smart variable ([survey-link]) in the message. You are welcome to edit any of the other text.

If the invitation type is Voice call (participant receives voice call)

There is not a subject line or message box for you to complete. Instead, the information that the computer speaks to the participant is taken from Survey Instructions and the field labels for each question.

Participant List				Actions: -- check/uncheck participants --				
(those who have not responded completely)								
<input type="checkbox"/>	Email	(1 selected)	Phone	Participant Identifier	Invitation preference	Scheduled?	Sent?	Responded?
<input type="checkbox"/>						-		<input type="radio"/>
<input checked="" type="checkbox"/>						-		<input type="radio"/>

### Using a data entry form to build a participant list

You can create a data entry form that has a phone-validated text box field in it. With this setup, you would enter the participant’s phone number into a record. That information essentially builds your participant list for you.

This is the field that you would designate in the Twilio Configuration settings (via the project setup page):

**(Optional) Designate a phone number field for survey invitations**

You may capture phone numbers for sending invitations to your survey participants by designating a field in your project. This can be done in addition to (or as an alternative to) entering phone numbers directly into the Participant List. So if a participant does not have a phone number that was added to the Participant List, it will use the value of this field when sending survey invitations via SMS or as voice calls.

phone ("Phone number")

Listed above are all Text fields having either Integer validation or Phone (U.S.) validation.



## Setting the delivery preference

To set how a participant receives the survey invitation, go to Configure Twilio Settings on the Project Setup page:

**Choose the default invitation preference for new survey participants**

If new participants are created via data entry form (rather than via survey), then you may select their default survey invitation preference that will get assigned to them when their record is created. This is useful if you are creating records using a data import or on a data entry form, but wish to send survey invitations later for SMS surveys or voice call surveys, in which this setting automatically sets their invitation preference for you. Without this setting, you would otherwise have to set each participant's preference individually in the Participant List. Also, this value will be used as the pre-selected setting of the delivery preference on the Participant List page when adding new participants to the list.

SMS invitation (reply via SMS to receive voice call) ?

- Email invitation
- SMS invitation (contains survey link)
- SMS invitation (take survey via SMS)
- Voice call (participant receives voice call)
- SMS invitation (contains phone number to call)
- SMS invitation (reply via SMS to receive voice call)

Alternatively, you can use a multiple choice field to automate the delivery preference of a participant. You can find instructions about how to do that by going to Configure Twilio Settings (via the Project Setup page) and in the Survey-specific settings section, look for this:

**Control each participant's invitation preference using a multiple choice field**

If survey participants require using different methods (e.g., email, SMS w/ link, voice call survey) for receiving survey invitations and/or taking surveys, you can select a multiple choice field (radio and drop-down fields only) whose choices represent each survey invitation delivery method. After mapping the invitation preferences to a field, whenever the value of the field is added or modified, the participant's invitation preference will automatically be changed accordingly. **IMPORTANT:** The multiple choice codings for the selected field must be defined exactly as delineated on the right, although their corresponding choice labels can be modified to be whatever text you wish.

NOTE: Not all of the options above need to be set for the field's choices but only the ones needed. Also be aware that if the value of the field selected above is set to blank/null, then the invitation preference for the participant will revert to the project's default invitation preference. Additionally, if a participant's invitation preference is modified via the Participant List, that change will also change the value of the mapping field selected above.

deliverypreference "What is the participant's delivery pre" ▾

Required choice codes with example choice labels:

- EMAIL**, Email invitation
- SMS\_INVITE\_WEB**, SMS invitation (contains survey link)
- SMS\_INITIATE**, SMS invitation (take survey via SMS)
- VOICE\_INITIATE**, Voice call (participant receives voice call)
- SMS\_INVITE\_MAKE\_CALL**, SMS invitation (contains phone number to call)
- SMS\_INVITE\_RECEIVE\_CALL**, SMS invitation (reply via SMS to receive voice call)

To see a demo of this feature, click [here](#).

## Automated Survey Invitations

If you wish to use Automated Invitations, you will need to have an instrument in the project that contains a field for the participant's phone number. That instrument can be

- a data entry form, into which a user enters the participant's phone number
- a public survey link, into which the participant enters their phone number
- a condition that will trigger the invitation.

You have the option to send out automated invitations via email, SMS, or the participant's preference.

If the Invitation type is Use participant's preference (default invitation type) or SMS invitation (contains phone number to call) or SMS invitation (reply via SMS to receive voice call)

You will see a Compose Message box with some text in red – please read that text! (see image below)

**STEP 1: Invitation type** - How the participant is invited

Use participant's preference [v] [?]

---

**STEP 2: Compose message**

From: [Display name (optional)] redcap@vumc.org [v]  
(select any project user to be the 'Sender')

To: [All participants who meet the conditions defined]

Subject: Daily survey [v]  
[Subject will not be used in SMS and voice call invitations]

Send test email

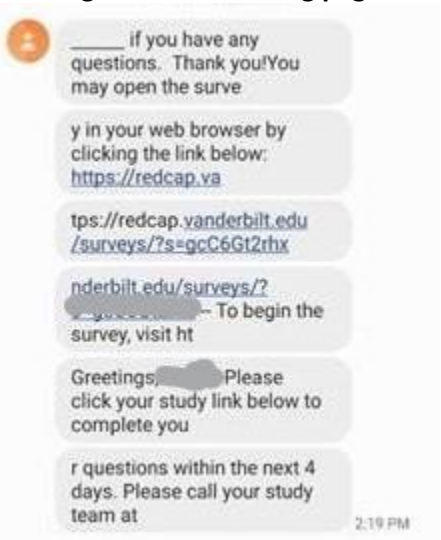
Paragraph [v] **B** *I* [link icon] [list icon] [list icon] [list icon] [list icon] [undo icon] [redo icon] [full screen icon]

[bulleted list icon] [numbered list icon] [left align icon] [right align icon] [table icon] [text color icon] [background color icon] [search icon] [code icon] [italic icon]

[Message text above will not be used in voice call invitations]

**NOTE:** The survey link will NOT be automatically included for invitation types 'Email invitation' and 'SMS invitation (contains survey link)', thus you must make sure to include either [survey-link] or [survey-url] in the text or else the participant will not have a way to take the survey. The other SMS invitation types will automatically provide standard instructional text.

**It is best to keep your message very brief – the cell phone carrier may break up the message into separate texts if the message length is too long and it’s possible the texts may arrive out of order, like the image on the following page:**



So consider only providing the survey link and a few words about it. Any further instructions can be included in the Survey Instructions which you set via Survey Settings.

**Stop Logic in Automated Invitations**

It is highly recommended that you include 'stop logic' in the conditional logic section of Step 3 in an Automated Invitation. With that in place, REDCap will automatically cancel any future schedule

invitations, should the participant no longer need to receive them. This is particularly relevant if you think your participant may withdraw from a study or become ineligible in some way.

The 'stop logic' could be a complex set of conditional logic, or it could be as simple as a single field in the project (i.e., the kill switch). For example, if you are wanting a survey invitation to be scheduled when a participant is at least 18 years old, your logic might be '[age] >= 18'. And if you want to add the 'stop logic' to be able to manually delete a scheduled invitation, you could have '[age] >= 18 and [remove\_alert] <> 1', in which the field 'remove alert' is a Yes/No field. So in this instance, if you wanted to have the scheduled invitation deleted, you could simply go to the data entry form where the 'remove alert' field is located, and set it to 'Yes'. This can be done a variety of different ways. This is merely a simple example to introduce this concept. **Remember, the key to using 'stop logic' is that the 'ensure logic is still true' checkbox MUST be checked.**

#### [Datediff/today calculations in Automated Invitations](#)

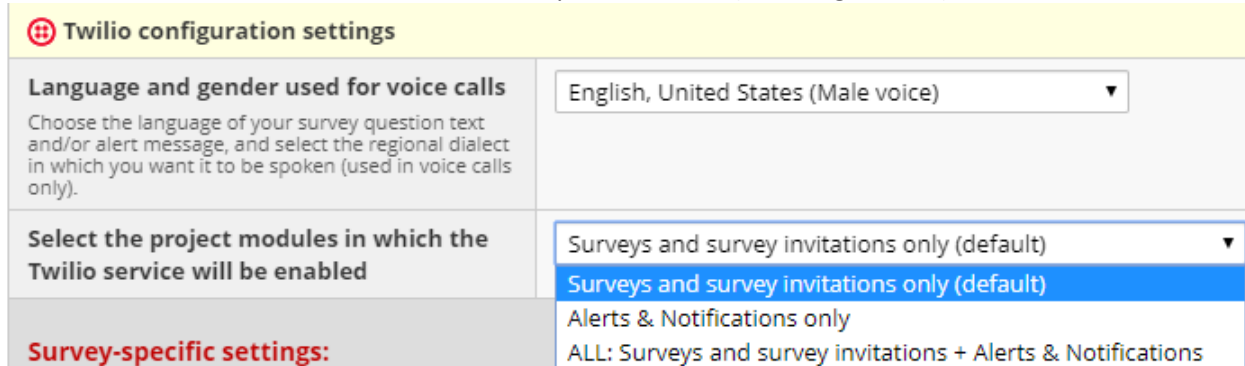
Please note, if you are using conditional logic to send a survey invitation and it contains a datediff/today calculation, the future invitation will not display on the Survey Invitation Log. That is because the invitation does not display until it has been scheduled. And technically the condition for a datediff/today calculation hasn't been met yet. So it will only show up on the day that condition has been met.

#### [Alerts & Notifications](#)

You can create an Alert via the Alerts & Notifications application to send a text or voice call to a participant.

## Setting up your project to use Twilio in Alerts & Notifications

To have the ability to use Twilio via the Alerts & Notifications application, you will need to change a setting on the Project Setup page. On that page, click on the 'Configure Twilio Settings' button (in the Twilio SMS and Voice Call services section). For the second setting, Select the project modules in which the Twilio service will be enabled, click the drop-down arrow (see image below):



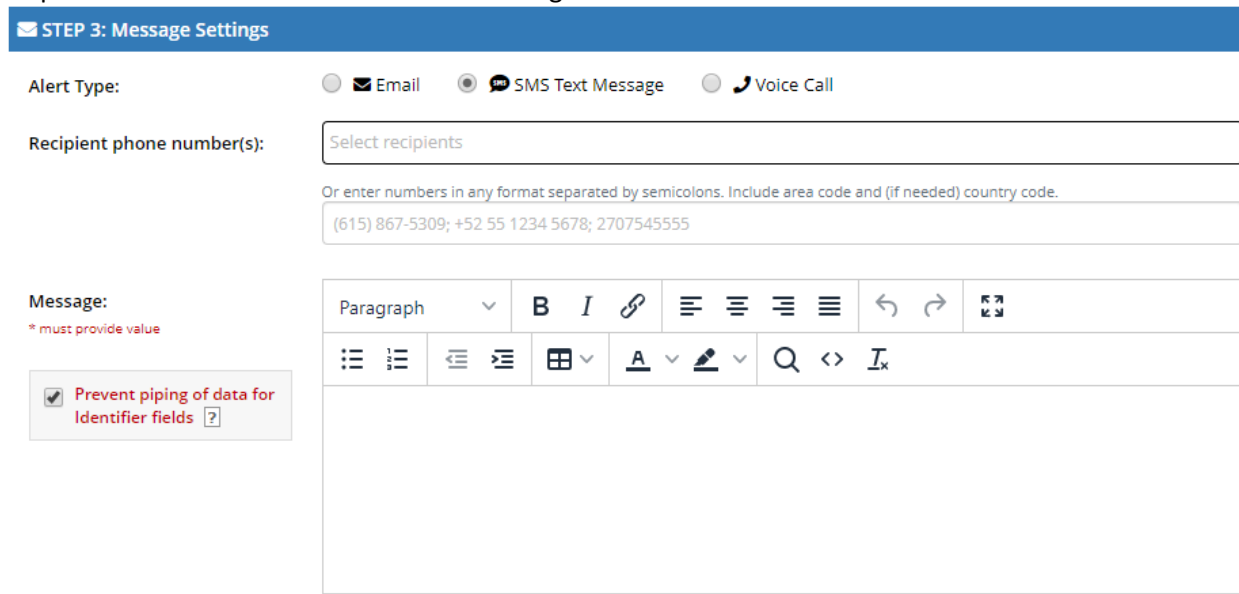
The image shows a 'Twilio configuration settings' panel. It has a yellow header with a red cross icon and the text 'Twilio configuration settings'. Below the header are three sections:

- Language and gender used for voice calls**: A dropdown menu showing 'English, United States (Male voice)'. Below it is a descriptive text: 'Choose the language of your survey question text and/or alert message, and select the regional dialect in which you want it to be spoken (used in voice calls only).'
- Select the project modules in which the Twilio service will be enabled**: A dropdown menu with three options: 'Surveys and survey invitations only (default)', 'Surveys and survey invitations only (default)' (highlighted in blue), and 'Alerts & Notifications only'.
- Survey-specific settings:**: A dropdown menu with one option: 'ALL: Surveys and survey invitations + Alerts & Notifications'.

The setting defaults to 'Surveys and survey invitations only'. You will need to change it to one of the other options that includes Alerts.

## To create an Alert that uses Twilio

You can create the Alert just as you would any other alert. However, now you will have the option in Step 3 to send the alert as an SMS Text Message or a Voice Call:



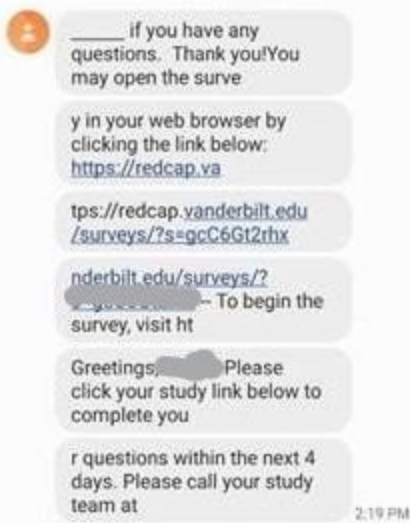
The image shows a 'STEP 3: Message Settings' form. It has a blue header with a white envelope icon and the text 'STEP 3: Message Settings'. Below the header are three sections:

- Alert Type:** Three radio buttons: 'Email', 'SMS Text Message' (selected), and 'Voice Call'.
- Recipient phone number(s):** A dropdown menu with the text 'Select recipients'. Below it is a text box with the placeholder text 'Or enter numbers in any format separated by semicolons. Include area code and (if needed) country code.' and the example text '(615) 867-5309; +52 55 1234 5678; 2707545555'.
- Message:** A rich text editor with a toolbar containing icons for Paragraph, Bold, Italic, Link, Bulleted List, Numbered List, Indent Left, Indent Right, Undo, and Redo. Below the toolbar is a text area. To the left of the text area is a checkbox labeled 'Prevent piping of data for Identifier fields' with a question mark icon.

You will note that you can click on the 'Select Recipients' drop-down list to see a list of users and phone-validated fields on the project. Additionally, there is a box where you can manually enter a phone number.

Also note that there is no subject line for the message.

**It is best to keep your message very brief – the cell phone carrier may break up the message into separate texts if the message length is too long and it's possible the texts may arrive out of order, like the image on the following page:**



If providing a survey link, consider only providing the survey link and a few words about it. Any further instructions can be included in the Survey Instructions which you set via Survey Settings.

### Stop Logic in Alerts

It is highly recommended that you include 'stop logic' in the conditional logic section of Step 1 in an Alert. With that in place, REDCap will automatically cancel any future scheduled alerts, should the participant no longer need to receive them. This is particularly relevant if you think your participant may withdraw from a study or become ineligible in some way.

The 'stop logic' could be a complex set of conditional logic, or it could be as simple as a single field in the project (i.e., the kill switch). For example, if you are wanting to schedule an alert when a participant is at least 18 years old, your logic might be '[age] >= 18'. And if you want to add the 'stop logic' to be able to manually delete a scheduled alert, you could have '[age] >= 18 and [remove\_alert] <> 1', in which the field 'remove alert' is a Yes/No field. So in this instance, if you wanted to have the scheduled alert deleted, you could simply go to the data entry form where the 'remove alert' field is located, and set it to 'Yes'. This can be done a variety of different ways. This is merely a simple example to introduce this concept. **Remember, the key to using 'stop logic' is that the 'ensure logic is still true' checkbox MUST be checked.**

**The stop logic feature is something that a user on a project can manage (by marking the stop logic field on a project) or you can set it up so that the participant has the ability to opt-out.**

### Participant-driven opt-out

You can create language in the text message invite offering an opt-out method for participants who may be receiving automated invites unnecessarily.

This can be accomplished by the participant responding to the SMS survey invite with the word "Stop". All future invites will be halted from reaching the participants device although automated invites will still attempt to send until the participants number is removed from the project

### Checking the Notification Log for past and future alerts

You can go to the Alerts & Notification application and click on the Notification Log to see past alerts that were triggered and also future alerts that are scheduled.

### Datediff/Today calculations in Alerts

Please note, if you are using conditional logic to send an alert and it contains a datediff/today calculation, the future invitation will not display on the Notification Log. That is because the alert does not display until it has been scheduled. And technically the condition for a datediff/today calculation hasn't been met yet. So it will only show up on the day that condition has been met.

## Message design and content tips

### Line breaks

Beware that REDCap removes all line breaks in messages. So the text you send in a message will come across all together, without line or paragraph breaks.

So this message:

How are you feeling today?

1,Excellent

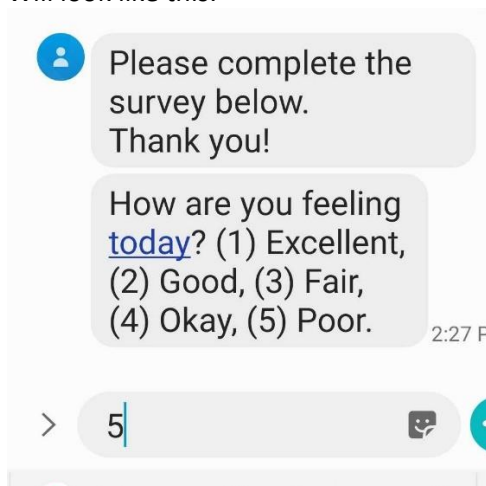
2,Good

3,Fair

4,Okay

5,Poor

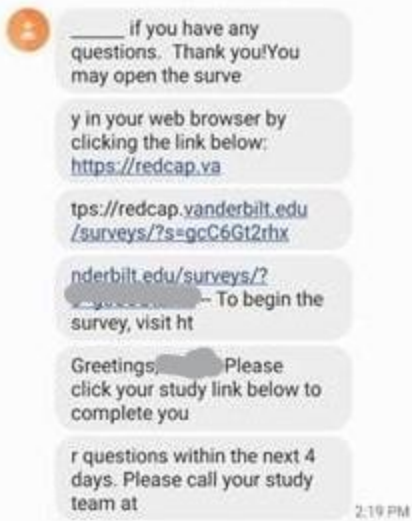
Will look like this:



### Character limits

Each text message (messages, survey invitations and survey questions, if applicable) is limited to 160 characters. Keep in mind that smart variables of survey links translate into the actual survey link, which will be many characters longer than the smart variable.

**It is best to keep your message very brief – the cell phone carrier may break up the message into separate texts if the message length is too long and it's possible the texts may arrive out of order, like the image on the following page:**



So if sending a survey link, consider only providing the survey link and a few words about it. Any further instructions can be included in the Survey Instructions which you set via Survey Settings.

### Message content limitations

On April 9, 2020 we were notified that when using Twilio to send SMS messages/survey invitations, some mobile carriers are blocking texts containing the word "COVID". We are not yet sure which specific carriers are doing the blocking.

### Carrier Filtering

Some cell phone carriers filter SMS messages. Please consult Twilio's Help Center for more information about what that is, how it works and what you might need to do to ensure your SMS messages get through to your participant. You can find an article on that topic [here](#).

## Project Management tips

### Change in participant phone number

If a participant's phone number changes in the middle of a study, you will need to update it in the project.

#### If using the Participant List...

Go to the Participant list and edit the number there. It will update the phone number for all upcoming surveys.

#### If using a phone-validated number field...

Navigate to that field in the project and edit the phone number in that field. The previous phone number will be stored via the Data History widget.

## Longitudinal Projects











If you are using Twilio in a longitudinal project, as always, you will need to prepend any variable name or smart variable name with the event name. You can find the event name by going to the Project Setup



page and clicking on the Define My Events button (in the Define your events and designate instruments for them' section):

Arm 1: Arm 1 +Add New Arm

Arm name: **Arm 1** [Rename Arm 1](#)

	Event #	Event Name	Custom Event Label (optional)	Unique event name (auto-generated)
 	1	Day 1		day_1_arm_1
 	2	Day 2		day_2_arm_1
 	3	Day 3		day_3_arm_1
 	4	Day 4		day_4_arm_1
 	5	Day 5		day_5_arm_1
<input type="button" value="Add new event"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
	Descriptive name for this event		Custom Event Label (optional) Example: [visit_date], [weight] kg	

The string of text in the 'Unique event name' column is the text you need to write in square brackets and place before the variable name. This way, REDCap knows exactly which event you are referencing for that variable.

## Overlapping messages

When designing your project, keep in mind what the experience will be like for the recipient, particularly if they are to receive several messages/calls in the same day. For instance, if they are sent the same survey 3 times a day, you might want to make it very clear how the three messages are different.

**Behavior for overlapping SMS invitations**

If you will be sending SMS invitations for multiple surveys within this project, then you will need to choose the default behavior for when a participant has received SMS invitations to multiple surveys at the same time, in which they will be replying to the same SMS thread for multiple invitations. (This is rare but must still be accounted for.) If the participant has received multiple SMS invites, you can have it behave according to the option selected in the drop-down to the right.

Allow participant to choose which survey to take next ▾

Use only most recent invitation (ignore previously sent invitations)

Take surveys in same order as participant received the invitations

Allow participant to choose which survey to take next

## Troubleshooting errors

REDCap will log the invitations it has sent out via the Survey Invitation Log. The below image demonstrates what you might see if there are Twilio errors. Note the far right column with the header "Errors (if any)". You see these errors: "ERROR SENDING SMS" and "ERROR MAKING VOICE CALL"

**Survey Distribution Tools**

Public Survey Link | Participant List | **Survey Invitation Log**

Listed below are the survey invitations that have already been sent or have been scheduled to be sent to survey participants in this project. For each invitation it displays the participant email, participant identifier (if exists), survey name, and the date/time in which the invitation was (or will be) sent. You may even view the invitation email itself by clicking the icon in the 'View Email' column. Please note that all times below correspond to the time zone "America/Los\_Angeles", in which the current time is 07/25/2019 10:52am.

**Survey Invitation Log**  
(in ascending order by time sent)

Displaying 1 - 4 of 4

Begin time: 07/25/2019 10:5 End time: (M/D/Y H:M)

Display All invitation types and All response statuses

Display All surveys

Display All records

Display invitation reminders?

Apply filters | Reset | Download log (as seen below) | Delete all selected

Invitation send time	View Invite	Participant Email	Participant Phone	Record	Participant Identifier	Survey	Survey Link	Responded?	Errors (if any)	
07/25/2019 10:50am		eddie@munsters.com	+1 530-746-	4		Basic Demography Form Demo Event 1 (Arm 1: Demo Arm 1)			ERROR SENDING SMS	
07/25/2019 10:50am		grandpa@munsters.com	530-746-	3		Basic Demography Form Demo Event 1 (Arm 1: Demo Arm 1)			ERROR SENDING SMS	
07/25/2019 10:50am		lily@munsters.com	+1 530-746-	2		Basic Demography Form Demo Event 1 (Arm 1: Demo Arm 1)			ERROR MAKING VOICE CALL	
07/25/2019 10:50am		herman@munsters.com	530-746-	1		Basic Demography Form Demo Event 1 (Arm 1: Demo Arm 1)			ERROR SENDING SMS	

Those errors indicate that REDCap received an error from Twilio when attempting to send the SMS or make the voice call. This might happen if you're using a test/sandbox Twilio account, if your Twilio account runs out of money, or if the phone number is somehow not correct or not formatted properly.

You might consider looking at Twilio's error logs in your account to see if it provides a description of that error.

## Incoming messages from participants

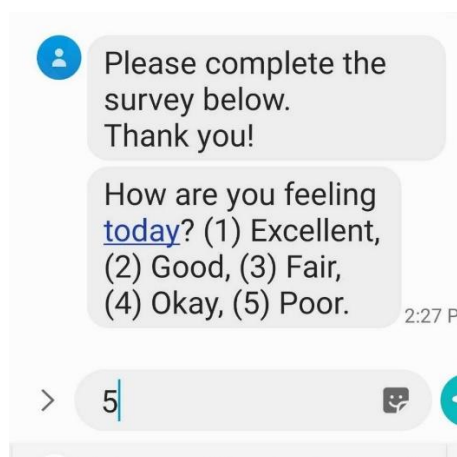
If a participant replies to a Twilio text with anything other than a response to a question, the content of their text does not get stored anywhere. This is because Twilio does not store logs of any of the messaging and there is not a place to capture/store a non-quantitative response from a participant in a REDCap project.

## Best practices/Tips

### Testing

It's extremely important to test the Twilio feature before using it with participants. Test out the different delivery methods to see how it will look to the participant and determine which method will work best for your project.

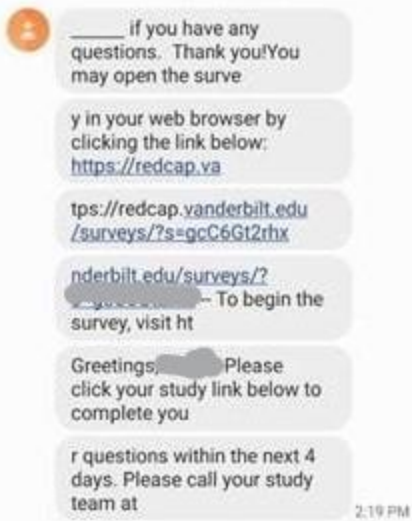
For instance, if your participant is answering survey questions by replying to your Twilio text message, this is how it will appear to them:



From seeing that test message, you might consider adding in additional instructions so that the participant knows to enter the corresponding number.

It's also a good idea to test your project on different cell phone carriers. You could poll your study team to find out their different cell phone carriers. And then test messaging with their phone numbers, noting any differences as to how the message looks according to which carrier a person has.

**It is best to keep your message very brief – the cell phone carrier may break up the message into separate texts if the message length is too long and it's possible the texts may arrive out of order, like the image on the following page:**



So if you include a survey link, consider only providing the survey link and a few words about it. Any further instructions can be included in the Survey Instructions which you set via Survey Settings.

### Twilio Registry

Twilio now allows you to create a business profile which can be assessed by a third party. Your profile will receive a Trust Score. If your Trust Score is medium or high, it is less likely your messages will be filtered by carriers (e.g. they won't think it's spam). You can read more about this in the following Twilio support article:

<https://support.twilio.com/hc/en-us/articles/1260803225669-Message-throughput-MPS-and-Trust-Scores-for-A2P-10DLC-in-the-US>

So you might register your business profile to earn a trust score to increase the likelihood of your messages getting to your recipients.

### Fully complete any survey invitations that you send to your own cell phone

If you send an invitation to begin a survey via SMS Conversation, REDCap notes that the survey has begun if you respond back the first time and it will remember that process in the survey (to know which question you're on). If you don't complete that first SMS survey and then you send another invitation (which might be another SMS Conversation type or possibly another type – e.g. SMS w/ survey link), then REDCap's progress tracking for the participant's cell phone number gets muddled a bit and REDCap gets confused about what to do. And so it ends up thinking that you're not done with the previous survey while simultaneously trying to perform actions for the new invitation that was sent to you too. So the SMS messages get doubled up, and when you respond to one, it thinks you're responding to it and the other and gives the participant the error message about entering the wrong value, for instance.

### Ask your participants to add the Twilio number to their phone's address book

Tell your participants the phone number from which they will receive texts (the Twilio phone number you purchased). Ask them to add that phone number to their phone's address book.

## Reasoning

Initial messages seem to go through to all participants but repeated weekly or daily messages containing links and repetitive text that the respondent does not interact with via SMS (i.e., messages with links, respondent only interacts with the link) seem to get blocked around the fifth (approximate) repeated instance. Having the respondent add the Twilio Study Phone number to their contacts list "unblocked" the messages and new messages went through to the cell phone. We have anecdotal evidence this is limited to iPhone cell phones (carriers were Sprint and T-Mobile but possibly all carriers).

## Advising your participant that charges may apply

Depending on the participant's cell phone plan, they may be charged for texts they receive (and send, if applicable). You might consider advising the participants of this.

## Asking participants to confirm that they agree to be contacted by text or phone

You might consider adding a field that says, 'I agree to be contacted by text or phone' and have the participant answer that question. Then you have evidence in your project that the participant is consenting to being contacted by phone.

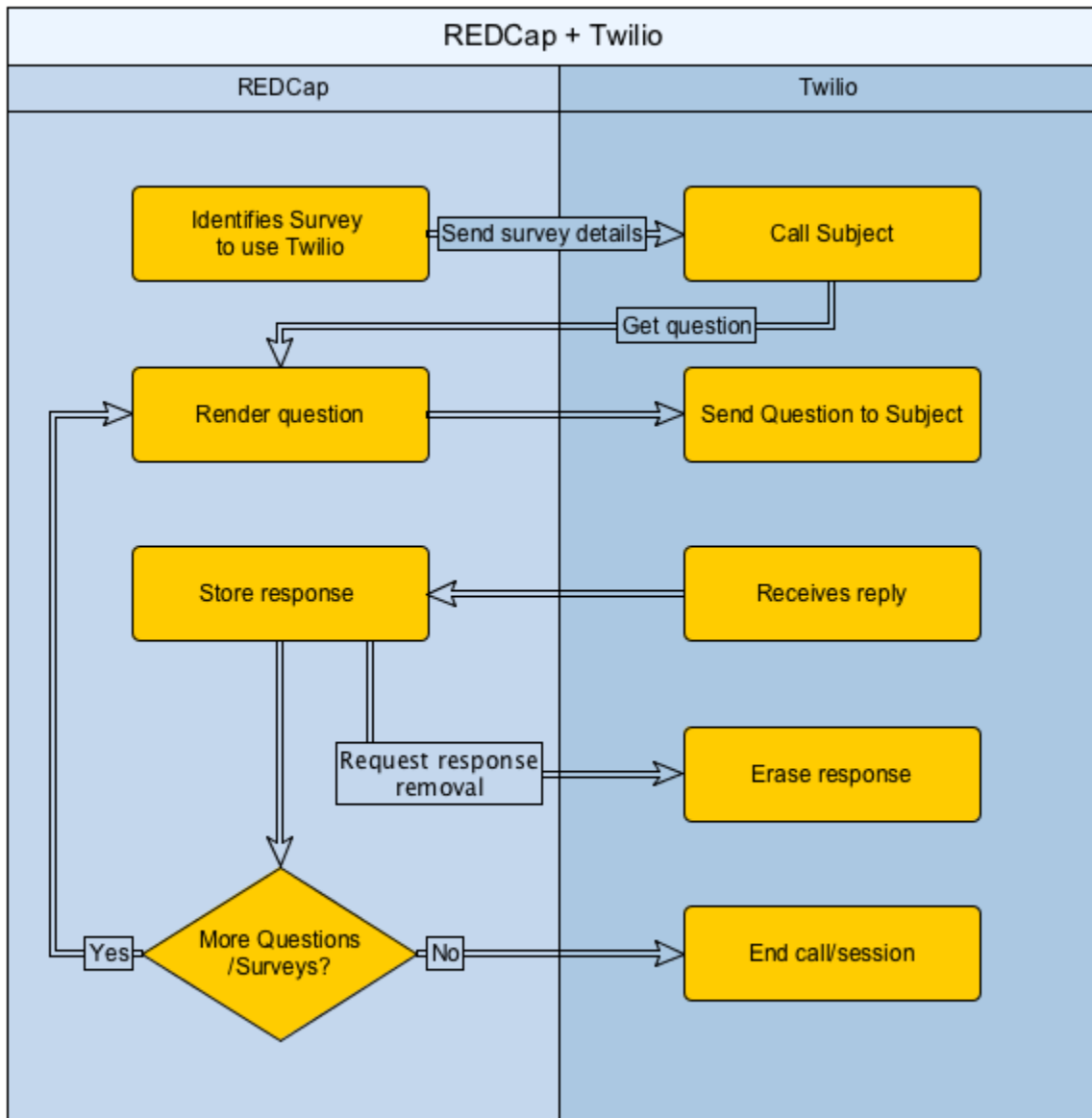
## Carrier Filtering

Be aware that some cell phone carriers filter SMS messages. Please consult Twilio's Help Center for more information about what that is, how it works and what you might need to do to ensure your SMS messages get through to your participant. You can find an article on that topic [here](#).

## Checking Survey Invitation Log/Notification Log

To verify that your messages are being scheduled as expected, you can check the Survey Invitation log or, if using Alerts & Notifications, the Notification Log. Some users make it a practice to check the log on a regular basis, to make sure invitations/messages are going out as expected.

## How Twilio and REDCap work together



## SMS Regulatory Guidelines and best practices

Twilio offers a summary of regulatory guidelines for each country. To see the summary for the US, check [here](#). (You can change click on the 'back to guidelines' link to change it to a different country.)

## Security

- In order to make sure that no REDCap data is ever stored on the Twilio servers, it is up to the REDCap user to disable Twilio's Request Inspector. The Request Inspector is a tool provided by Twilio that lists all requests made between Twilio and an external application.
- With the Request Inspector disabled, the only data that Twilio retains is metadata about SMS messages and calls, and this data is scrubbed by a cron job that REDCap runs every 120 seconds.

(Cron is standard software on Linux-based computers that allows for the scheduled execution of software-defined tasks that can be repeated).

- Twilio provides specific HTTP headers that are encoded and are verifiable to ensure that they are truly coming from the Twilio server, which is further corroborated by the following Twilio API reference: <https://www.twilio.com/docs/api/security#validating-requests> .
- Relevant whitepaper from the Twilio Support team: Ensuring HIPAA compliancy with Twilio-made applications: <https://support.twilio.com/hc/en-us/articles/223136467-Ensuring-HIPAA-compliancy-with-Twilio-made-applications>
- Relevant whitepaper on Twilio Security: [https://s3.amazonaws.com/ahoy-assets.twilio.com/Whitepapers/Twilio\\_Whitepaper\\_Security-Architecture.pdf](https://s3.amazonaws.com/ahoy-assets.twilio.com/Whitepapers/Twilio_Whitepaper_Security-Architecture.pdf)
- White paper regarding the HIPAA conduit exception rule: <http://www.healthcarebusinessstech.com/hipaa-conduit-exception-rule/>

## Authentication

1. REDCap uses the Twilio API to issue a request to Twilio (over TLS) from a project using the AuthToken and the project-specific SID and phone number. Credentials are sent using HTTP authentication.
2. Twilio sends an HTTP POST to REDCap’s RESTful web service without HTTP authentication but with arguments.
3. REDCap validates both that the POST has come from Twilio and is for a particular project (SID/phone number). This is done by taking the POST arguments, prepending the URL that had been given to Twilio to use when sending a POST to REDCap, signing the result using the AuthToken, base64 encoding the resulting hash, and comparing the signature to an X-Twilio-Signature header that's passed in the POST request.

## Risk Assessment

	Item	Risk	Risk Level	Mitigating Factors
1	RC initiates survey as voice call	Exposure of voice to text response data on Twilio servers	Low	It is possible to disallow persistent storage of PHI on Twilio servers. REDCap also uses a cron job to delete metadata every 120 seconds.
2	RC conducts survey via SMS conversation	PHI in SMS conversation (potential exposure to SMS provider and others)	High	

3	RC sends survey invitation link via SMS	The link is exposed/invitation goes to the wrong participant	Low	Does not expose PHI.
4	RC sends survey invitation via SMS to take survey as voice call (respondent makes call)	The link is exposed/invitation goes to the wrong participant	Low	Does not expose PHI.
		Exposure of voice to text response data on Twilio servers	Low	It is possible to disallow persistent storage of PHI on Twilio servers. REDCap also uses a cron job to delete metadata every 120 seconds.
5	RC sends survey invitation via SMS to take survey as voice call (respondent receives call)	The link is exposed/invitation goes to the wrong participant	Low	Does not expose PHI.
		Exposure of voice to text response data on Twilio servers	Low	It is possible to disallow persistent storage of PHI on Twilio servers. REDCap also uses a cron job to delete metadata every 120 seconds.
6	Communication between REDCap and Twilio	Exploitation of REDCap's RESTful web service from non-Twilio sources	Low	REDCap validates POST requests from Twilio over TLS and ensures that the POST is for a particular SID/phone number.
		The user's Twilio credentials are compromised. An adversary accesses the Twilio account and intercepts PHI there.	Medium	Twilio allows 2-factor authentication. It is possible to disallow persistent storage of PHI on Twilio servers. REDCap also uses a cron job to delete metadata every 120 seconds.
		Traffic between Twilio and REDCap is not secured	Low	Twilio uses TLS to encrypt the communication channel.
7	REDCap Twilio module	Software security of the module	Low	The REDCap development team created and vetted the security of the module.
8	Survey questions	Exposure of PHI in a dynamically generated survey question based on a previous answer	Low	This only has the potential of exposing a survey participant's PHI to the participant (and is not specific to Twilio).



9	Voice calls	PHI is exposed during transit, e.g. in VoIP	Medium	Depends on the technology used for voice calls. End to end security is not within administrator's control.
10	Use of mobile device	PHI exposed orally by survey participant. Likelihood of participants taking surveys in a relatively public location higher with a mobile device.	High	
11	Authenticating REDCap to Twilio server	HTTP Auth is not enabled	Medium	<p>1. While enabling HTTP Auth allows the Twilio server to use a REDCap account to authenticate REDcap, it also exposes REDCap to attacks from Twilio.</p> <p>2. Requires modifying REDCap source code, which is undesirable.</p>