IES Institute of Education Sciences

Appendix

Can Texting Parents Improve Attendance in Elementary School? A Test of an Adaptive Messaging Strategy

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Can Texting Parents Improve Attendance in Elementary School? A Test of an Adaptive Messaging Strategy

Appendix

September 2020

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APPENDIX A: MORE ON THE TEXT MESSAGING STRATEGY

Rationale for the Adaptive Text Messaging Strategy

The adaptive text messaging strategy was meant to address districts' need to reduce chronic absenteeism (Bauer, Liu, Whitmore Schanzenbach, & Shambaugh, 2018), often working with limited resources. The strategy built on prior research that suggested a low-cost approach – providing parents with basic information about attendance – could work, but tested the idea that messaging about attendance may be more effective if it adapted over time to add more information and motivation for those who need it. As described in the sections that follow, the study was designed to answer questions about the feasibility and effectiveness of text messaging about attendance, the benefit of using an adaptive approach, and how to best convey attendance-related information.

Research has found that lower-cost approaches can improve attendance. For example, studies have found that periodic paper-based mailings that inform parents about the general importance of attendance and provide specific information about children's attendance can reduce absences in grades 1-12. One study found a single mailing reduced average absences by 0.13 days over one semester.[1] Another study found that up to 5 mailings reduced average absences by 1 day over two semesters.[2] However, research on the effectiveness of texting about attendance – another potentially low-cost approach – is limited, and result have been mixed. One study texted parents of high school students in New York City over one semester and observed no impact on attendance.[3] A second study texted parents of kindergarteners in one school in Pittsburgh and saw initial promising results.[4] No studies had examined the impact of texting parents in all elementary grades across whole school districts.

Despite the limited research, texting is of particular interest to districts and others interested in improving education outcomes using low-cost approaches. Unlike mailings, texts can reach most parents quickly; cell phone ownership is high, and most received texts are read within minutes.[5] Additionally, current technology makes it possible to easily identify parents that need more support and adapt texting to try and better meet their needs. For example, text messages can be used to easily initiate two-way interaction with parents or to offer customized information addressing particular challenges.

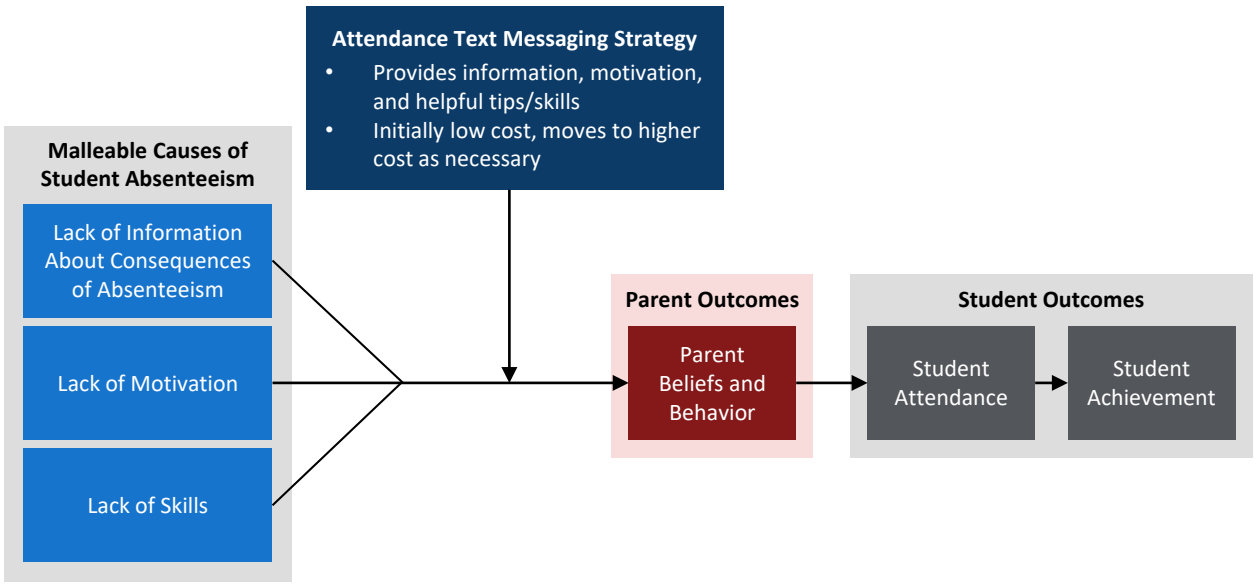
This study tested an adaptive text messaging strategy that was informed by the attendance-focused mailings studies just discussed, research on texting about other aspects of education (for example, college enrollment), and by research in other fields. For example, like the Rogers et al. studies, the adaptive text messaging strategy presented both general information about the importance of attendance and specific information about parents' own children's absences. The texts also drew on research suggesting that behaviors can be changed with the use of planning prompts and goal commitment.[6] The study also drew on evidence from public health and prevention about using texting to change behavior. Specifically, as done in public health, the study used an "information-

[1] Rogers, Duncan, Wolford, Ternovski, Subramanyam, & Reitano, 2017.
[2] Rogers & Feller, 2018.
[3] Balu, Porter, & Gunton, 2016.
[4] Smythe-Leistico & Page, 2018.
[5] In 2018, more than 95 percent of the U.S. adult population owned cell phones, and more than 77 percent owned smart phones (http://www.pewinternet.org/fact-sheet/mobile/). In 2017, one-in-five adults whose annual household income fell below $30,000 were smartphone-only Internet users (http://www.pewresearch.org/fact-tank/2017/06/28/10-facts-about-smartphones/). In addition, 95 percent of business text messages are read within 5 minutes of being sent (https://www.textrequest.com/blog/complete-overview-business-texting).
[6] Castleman, 2015; Mayer, Kalil, Oreopoulous, & Gallegos, 2015; York & Loeb, 2014. See Exhibit A.2 for more detailed information about the research findings that informed the components of the adaptive text messaging strategy.

motivation-behavioral skills (IMB) model"[7] to identify factors related to elementary school students' attendance that could potentially be changed by texting parents.

Based on the IMB model, the study identified three main factors that text messaging might address: (1) information deficit (for example, a lack of adequate information about the consequences of chronic absence or not knowing how many days a child has missed school), (2) lack of personal or social motivation (for example, not believing school will make a difference in the child's future), and (3) lack of behavioral skills (for example, not using or knowing effective strategies to help children get to school on time, such as making sure to set an alarm) (see Exhibit A.1). According to the logic model for the study, changes in parents' beliefs, motivations, and behaviors should improve student attendance and reduce chronic absence. Then, more time in the classroom because of regular attendance should theoretically improve students' academic achievement outcomes because they are in school more and have more opportunities to learn.

Exhibit A.1. Logic model for the study's attendance text messaging strategy



Description of the Adaptive Text Messaging Strategy

The adaptive text messaging strategy had two phases. The first phase began in October 2017, when families were randomly assigned to one of two basic messaging approaches, *Benefits-Framed Basic Messaging* or *Consequences-Framed Basic Messaging*, or to the no-messaging control group. The second phase began in January 2018, when families whose children were frequently absent in the fall - despite the fall messaging - were randomly assigned to one of two intensified messaging approaches: *School Staff Outreach* or *Goal Commitment messaging*. Intensified messaging was in addition to continued basic messaging for the rest of the school year. Children were considered "frequently absent" if they missed 8 percent or more of school days in the fall, between October 1 and the end of

[7] Fisher & Fisher, 1992.

December. Parents whose children missed fewer than 8 percent of school days continued to receive just the basic messages for the rest of the school year.[8]

The study focused on elementary aged students (grades K–5) because chronic absence in the early grades is an ongoing problem, and the impact of texting about attendance had not been previously examined at these grade levels. Almost 4 million elementary school students were chronically absent during the 2015–2016 school year, and missing this much school in early grades is linked with lower reading and math achievement by Grade 3 and higher absenteeism in middle and high school.[9] The messages that were part of the adaptive texting strategy, described next, were expressly designed for parents of elementary school aged children.

Basic Messaging

The purpose of the basic messaging was to communicate with parents about the importance of school attendance and to provide information about their own children's absences in more meaningful and personalized ways than existing attendance communications between schools and parents. When communicating this type of information, a school district or provider needs to consider the tone or framing of the messages. Some evidence suggests that framing in terms of potential loss is more effective than framing in terms of potential gain,[10] but it was not clear if this would hold true in the context of texting parents about attendance. The study messages were designed to test whether it is better to frame attendance-related information in terms of positive benefits of consistent attendance, or negative consequences of absenteeism.[11,12]

Benefits-Framed Basic Messaging included (a) preventive weekly messages sent on Sundays, and (b) same-day notifications to parents on school days when their child was absent, and when their child was present after a prior-day absence.

a. *Weekly preventive messaging.* Parents of all students in the benefits-framed basic messaging group received an automated message on Sunday nights about the importance and positive benefits of consistent attendance, with "tips" about avoiding common reasons for absences that included links to additional resources on external websites.[13]

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[8] An 8 percent absence rate, instead of the 10 percent commonly used to identify students as chronically absent, was chosen as the criterion for intensified messaging because absence rates can increase over the year. The study team erred on the side of casting a wider net for identifying "at risk" students rather than potentially missing some who might become chronically absent later in the year.

[9] Applied Survey Research, 2011; Ehrlich et al., 2014; Ready, 2010.

[10] Castleman, 2015.

[11] Other investigations have tested the impact of providing personalized information relative to social norms, for example, in energy usage (Allcott, 2011). In their study of attendance-related mailings for parents of students in grades 1-12, Rogers and Feller (2018) provided attendance information with and without absolute or relative norms. While the study found that the mailings reduced absences overall, the use of social norms did not have an added benefit.

[12] As described in this section, basic messaging had two components: general weekly preventive messaging and personalized same-day notifications. The study focused on testing two different approaches to framing basic messaging, not parsing out the effects of general weekly preventive messaging and personalized same-day notifications.

[13] Resources used for the content of the tips messages were drawn from national and local websites and materials that covered topics such as the school calendar and information about the district's attendance policy; how to get children ready for school in the morning; transportation (e.g., schedule to public transportation, importance of backup plans, how to report late/no-show buses); homework completion and resources for getting help with homework; health-related information, including influenza and vaccinations, allergies, toothaches, and how to decide when a child is too ill to go to school; bullying; and school anxiety/avoidance.

b. *Same-day notifications.* When a child was recorded as absent by the school in the district's student information system, an automated text message was sent to the parents notifying them of the absence. These same-day notifications were personalized with the child's name and included the number of days absent so far during the school year and a positively stated benefit of regular attendance. If a child missed four consecutive days of school, parents received a text informing them that the same-day notifications would end and asked them to contact the child's school about their child's absence if they had not done so already. When a child was marked absent the day before and then marked present on the current day, a "welcome back" message was sent to parents to acknowledge their child's attendance.

Consequences-Framed Basic Messaging also included weekly preventive messages, and same-day notifications to parents when their child was absent and when their child was present after a prior-day absence.

a. *Weekly preventive messaging.* The Sunday automated messages for consequences-framed basic messaging noted the importance of regular attendance and consequences of chronic absenteeism and, like benefits-framed basic messaging, included tips with links to additional resources.
b. *Same-day notifications.* As with benefits-framed basic messaging these automated messages were personalized with the child's name and included the number of days absent so far, but instead of a positively stated benefit of regular attendance, the message included a briefly stated negative consequence of missing school. As with benefits-framed basic messaging, parents whose child was absent four consecutive days were informed that the same-day notifications would end, and when a child was marked absent one day and present the next, the parent was sent a message to acknowledge their child's return to school.

Intensified Messaging

The two intensified messaging approaches (January–June) were (1) *School Staff Outreach* and (2) *Goal Commitment messaging*. Both intensified messaging approaches were intended to offer more tailored information and resources to parents and to increase parent motivation to make sure their child attends school regularly. The two intensified approaches reflect common messaging strategies that have some promising evidence for changing behavior but had not been successful in all studies and had not been tested in education: increased personalization with more tailored information provided by an identified contact person (School Staff Outreach) and providing more tailored information together with goal commitment (Goal Commitment).

School Staff Outreach involved school staff attempting to initiate contact with parents through text messaging. The School Staff Outreach approach aimed to (a) increase parents' motivation to make sure their child attends school each day through person-to-person contact with the school, and (b) improve their behavioral skills related to getting their child to school each day through tailored support and resources that address their specific needs and circumstances.

School leaders and a district coordinator identified a staff person in each school to conduct the outreach. School staff were trained by the study team to conduct outreach in December 2017, with additional booster training in January 2018. The training provided information about how to access the platform, send and reply to text messages, and update parent contact information. School staff members were instructed to attempt to contact parents of all students who were assigned to the School Staff Outreach condition once a week for four weeks starting in mid-to-late January and once a month thereafter if parents did not respond within the first four weeks of outreach.[14] When parents responded to the school staff member, school staff were encouraged to continue to engage with parents through texting or to communicate with parents through other means (for example, phone,

[14] The start time for the School Staff Outreach approach varied by district schedule and weather-related school closings during the first two weeks of January.

e-mail, in person) to better understand the underlying reasons for student absences and to refer parents to school, district, or community supports.

Goal Commitment messaging entailed weekly goal-setting messages and options for obtaining more tailored tips and resources. Goal Commitment messaging aimed to (a) increase parents' motivation to ensure their child's attendance through weekly goal-setting with weekly feedback, and (b) improve their behavioral skills related to their child's attendance with the addition of options to receive more tips or resources on topics of relevance to them.

Parents in this group were sent a text message on Sundays asking them to commit to a goal of perfect attendance for the upcoming week. This message was interactive, requesting that parents reply 'yes' to commit to the goal. On Fridays parents who had replied 'yes' or did not reply were sent a message stating whether they had met the week's goal of perfect attendance. Parent who had responded 'no' did not receive the Friday "feedback" message. When the child met the weekly attendance goal, the feedback praised them for the perfect attendance; when the child missed the goal, the feedback encouraged them to meet the goal the following week.

Parents in Goal Commitment messaging also were sent an interactive version of Sunday's tip messages. These messages invited parents to request additional tips by texting back a code word. Parents were able to request a total of three additional tips for each week's topic.

The higher cost intensified messaging approaches were reserved for the parents of children who were above the high absence threshold despite basic messaging in the fall. While all of the messaging approaches that were part of the adaptive text messaging strategy were generally low-cost (relative to other types of school-based interventions that require teacher training, materials, technology, or other resources), the intensified messaging approaches were costlier than the basic messaging approaches. School Staff Outreach added direct outreach from school staff to parents and thus took more staff time and effort than automated text messages. Goal Commitment messaging, though automated, added two additional components that asked for more parent time and effort: weekly goal setting and options to obtain tailored tips and resources. In addition to cost, the basic and intensified messaging approaches differed in emphasis with respect to the information-motivation-behavioral skill model. Basic messaging was primarily informational, while both intensified messaging approaches aimed to increase parent motivation and behavioral skills related to their children's attendance.

Exhibit A.2 describes the different messaging approaches, their purpose, and existing evidence for why these messaging approaches might be effective. Exhibits A.3 to A.7 provide examples of the text messages that were sent to parents in the two basic messaging approaches (benefits-framed and consequences-framed) and two of the basic plus intensified messaging combinations in the spring (benefits-framed basic messaging with School Staff Outreach, and consequences-framed basic messaging with Goal Commitment messaging).

Exhibit A.2. Description of the messaging components, the purpose and evidence for each component, and example messages

Component	Description	Purpose	Research evidence	Example messages
Benefits-framed or Consequences-framed basic messaging				
Weekly informational messages	All parents, regardless whether their child was absent, received benefits-framed or consequences-framed messages on Sunday afternoons about the importance of attendance.	Inform parents about the importance of regular attendance or about the importance of avoiding absences [addressing information in the information-motivation-behavioral skills (IMB) model].	An evidence base for informational interventions is emerging in health and prevention (Perry, Chhatralia, Damesick, Hobden, & Volpe, 2015) and education (Bergman, 2014; Castleman & Page, 2014; 2016; Kraft & Dougherty, 2013; Kraft & Rogers, 2015; Rogers & Feller, 2018). Some evidence suggests that framing in terms of potential loss is more effective than framing in terms of potential gain (Castleman, 2015), especially for health-related information. However, the effect of framing had not been tested in the context of student attendance communications.	Benefits-framed message: Regular attendance at school helps children learn good study habits. Consequences-framed message: Missing school makes it hard for children to learn good study habits.
Weekly tip messages	Provided parents information on Sunday afternoons about how to overcome common reasons for absences in the form of easy-to-understand tips and links to additional resources (e.g., websites).	Provide parents "tips" about avoiding common reasons for absences; prevent absences due to issues parents can address themselves (addressing behavior in the IMB model).	Planning prompts help people make the link between a future event (getting child to school) and an action they need to take (getting child up on time) (Castleman, 2015).	Some kids want to skip school because of unfinished homework. For homework help ideas, go to [LINK].

Component	Description	Purpose	Research evidence	Example messages
Same-day notifications	Acknowledged child's absence with a text sent that day, personalized with names. Provided parents a brief benefits-framed reason that attending school is important.	Being sent the message the same day that the child misses school informs parents that the district monitors student attendance and considers it a priority (addressing information in the IMB model).	Text messages operate as a notification that tends to attract people's attention (Castleman, 2015). The just-in-time aspect of the same-day absence notifications and updated absence information emphasizes that the information is important (Abroms et al., 2015). Message personalization also has been found to be effective in health (Abroms et al., 2015; Head, Noar, Iannarino & Harrington, 2013; Klasnja & Pratt, 2012; Militello, Kelly & Melnyk, 2012).	Benefits-framed message: We missed [CHILD] in school today. [CHILD] has missed a total of [X] days of school this year. Going to school every day will help [CHILD] learn important reading and math skills. Consequences-framed message: We missed [CHILD] in school today. [CHILD] has missed a total of [X] days of school this year. Missing school makes it harder for [CHILD] to learn important reading and math skills.
Stop texting rule	If child was marked absent for four consecutive days, parents were sent a message informing them that their child has now missed four days in a row and that the texting will stop until the child has returned to school.	The "stop texting" rule is intended to acknowledge that some students may have chronic illnesses and parents may become frustrated with daily messages.		[CHILD] has missed 4 days of school in a row. If you have not contacted the school about the absences, please call [NUMBER] to notify your child's school.
Positive feedback message	Send parents positive notification when their child returns to school.	Messages use positive reinforcement to keep parents reading the texts.		We were glad to have [CHILD] back to school today. Daily attendance helps [CHILD] reach their full potential.

Component	Description	Purpose	Research evidence	Example messages
Intensified messaging: School Staff Outreach				
School-staff-initiated, two-way communication	A text message was sent from school staff to parents offering more personalized help. The text messages could have been followed up with other means of communication. If parents did not respond, school staff were expected to follow up weekly for one month and then monthly after that. Staff were expected to provide information about the types of supports the school and district could provide and link parents to the supports as needed.	Increase parent motivation through personal attention; increase parent awareness of local resources; offer more tailored support to address their child's attendance problems, by inviting communication in a non-invasive manner. The goal was for the staff to identify the barriers to regular attendance and link families with appropriate supports/services. (The staff were provided an inventory of locally-available supports/services for different barriers, with contact information.) (Addressing information and motivation in the IMB model.)	The evidence on supplemental in-person communication in health research is mixed, with some support for benefits of in-person communication. Studies have found that the identity of the provider of the information is important.[a] Attention to the identity of the provider of information is thought of as a "tailoring" strategy in the health fields (Abroms et al., 2015; Head, Noar, Iannarino & Harrington, 2013). (In this study the school staff outreach messages were sent by a named, identifiable person in the school, and the messages provided an opportunity for two-way communication.)	Dear [PARENT NAME], This is [name and position]. [CHILD] has missed [X] days of school so far this year. Please text me at [NUMBER] or call me at [NUMBER] so we can set up a time to talk. I am here to help. Thank you

Component	Description	Purpose	Research evidence	Example messages
Intensified messaging: Goal Commitment				
Parent engagement: interactive commitment device with weekly summary	Offered parents an opportunity to commit to an attendance goal of zero absences for a school week. Parents were sent a commitment text at the beginning of each week. Parents were asked to commit to the goal or not - parents who committed via text and parents who did not commit received a summary report at the end of the week whether the attendance goal was met or not. The end-of-week summary provided additional encouragement and functioned as a reward for the interactive commitment device.	Engage parents and encourage them to commit to an attendance goal (addressing information and motivation in the IMB model).	Commitment devices have mixed support (Perry et al., 2015), but potential for broad and specific application to help people achieve goals (Castleman, 2015). Some studies have found parent commitment or engagement strategies to be effective for pre-school children (Mayer, Kalil, Oreopoulos & Gallegos, 2015; York & Loeb, 2014) but commitment to attendance goals had not been tested with elementary school aged children.	Weekly invitation to commit message: Children lose opportunities to learn when they miss school. Will you make it a goal that [CHILD] attends school every day this week? Reply YES to join other parents in setting this goal. 'Met Goal' feedback message: [CHILD] had perfect attendance this week! Keep up the great work. 'Did Not Meet Goal' feedback message: [CHILD] missed the weekly attendance goal this week. Please help us meet this goal next week!

[a] However, even with mixed results, including two-way communication as part of the messaging strategy was important for the following reasons:

- Many, if not all, schools and districts provide in-person supports and resources for parents with chronically absent children, and it was important that the text messaging strategy aligned and did not conflict with existing supports that are more intensive. Many districts have already adopted a multi-tiered system of support for promoting attendance. The two-way communication option could help bridge parents to supports that are more intensive.
- Not all parents will receive the text messages (e.g., they may not have paid their phone bills, the phone may be broken, or they may have changed numbers). Providing an option for reaching out to parents who are not responsive to the basic text messaging approaches may increase the effectiveness of the strategy.

Exhibit A.3. Benefits-framed basic messaging (two hypothetical weeks in fall 2017)

Day	Event	Message
First week		
Sunday	Informational message	Children who attend school every day or miss at most 1 day a month, are more likely to read on or above grade level. Some kids want to skip school because of unfinished homework. For homework help ideas, go to [LINK]
Monday	NA	
Tuesday	NA	
Wednesday	NA	
Thursday	Student absent	We missed [CHILD] in school today. [CHILD] has missed a total of [X] days of school this year. Going to school every day will help [CHILD] learn important reading and math skills.
Friday	NA	
Second week		
Sunday	Informational message	Going to school regularly helps children learn how to finish the tasks they start. Some children are hard to get out of bed in the morning. For more information, click [LINK].
Monday	NA	
Tuesday	Student absent	We missed [CHILD] in school today. [CHILD] has missed a total of [X] days of school this year. Going to school every day will help [CHILD] learn important study skills.
Wednesday	Student returns	We were glad to have [CHILD] back to school today. Daily attendance helps [CHILD] learn and succeed.
Thursday	NA	
Friday	NA	

Exhibit A.4. Consequences-framed basic messaging (two hypothetical weeks in fall 2017)

Day	Event	Message
First week		
Sunday	Informational message	Attendance Matters! Students who miss 2 or more school days a month are less likely to read on or above grade level. For more information about the importance of attendance and district attendance policies, go to [LINK].
Monday	NA	
Tuesday	Student absent	We missed [CHILD] in school today. [CHILD] has missed a total of [X] days of school this year. Missing school makes it harder for [CHILD] to learn how to work well with peers.
Wednesday	Student absent	We missed [CHILD] in school today. [CHILD] has missed a total of [X] days of school this year. Missing school means [CHILD] cannot participate in class activities.
Thursday	Student absent	We missed [CHILD] in school today. [CHILD] has missed a total of [X] days of school this year. Missing school makes it harder for [CHILD] to get good grades.
Friday	Student absent	[CHILD] has missed 4 days of school in a row. If you have not contacted the school about the absences, please call [NAME] at [NUMBER].
Second week		
Sunday	Informational message	Missing school makes it hard for children to learn good study habits. Some students may get stomachaches because they are worried or nervous about school. For more information, go to [LINK].
Monday	NA	We were glad to have [CHILD] back to school today. Daily attendance helps [CHILD] learn the skills needed to move on to the next grade level.
Tuesday	NA	
Wednesday	NA	
Thursday	NA	
Friday	Student absent	We missed [CHILD] in school today. [CHILD] has missed a total of [X] days of school this year. Missing school makes it harder for [CHILD] to learn the skills needed to move on to the next grade.

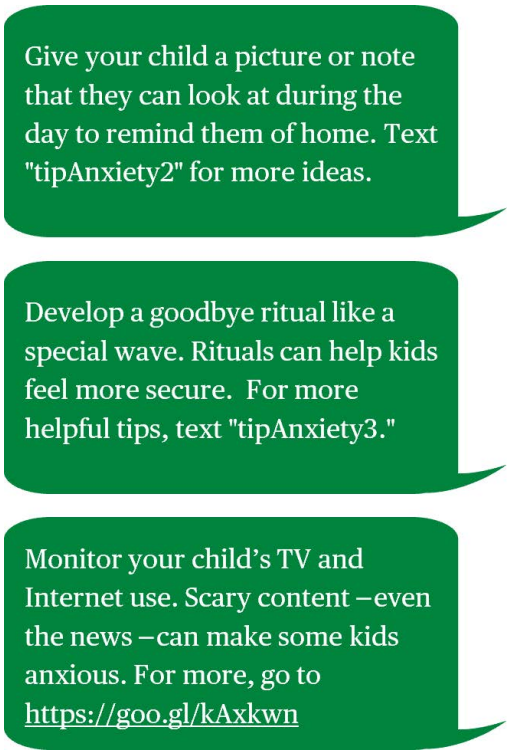
Exhibit A.5. Benefits-framed basic messaging with School Staff Outreach (two hypothetical weeks in spring 2018)

Day	Event	Message
First week		
Sunday	Informational message	Regular school attendance is one of the biggest factors that can help a child's academic success. Some children have a hard time transitioning from home to school. For more information, go to [LINK].
Monday	Student absent	We missed [CHILD] in school today. [CHILD] has missed a total of [X] days of school this year. Going to school every day will help [CHILD] participate in class activities.
Tuesday	Student absent	We missed [CHILD] in school today. [CHILD] has missed a total of [X] days of school this year. Going to school every day will help [CHILD] learn the skills needed to move to the next grade level.
Wednesday	School Staff Outreach	Dear [PARENT NAME], This is [name and position]. [CHILD] has missed [X] days of school so far this year. Please text me at [NUMBER] or call me at [NUMBER] so we can set up a time to talk. I am here to help. Thank you.
Thursday	Student returns	We were glad to have [CHILD] back to school today. Daily attendance helps [CHILD] reach their full potential.
Friday	NA	
Second week		
Sunday	Informational message	Children who attend school every day or miss at most 1 day a month, are more likely to graduate from high school. It's important to know the school calendar. Visit [LINK] before planning family events or travel.
Monday	NA	
Tuesday	NA	
Wednesday	Student absent	We missed [CHILD] in school today. [CHILD] has missed a total of [X] days of school this year. Going to school every day will help [CHILD] learn important study skills.
Thursday	Student returns	We were glad to have [CHILD] back to school today. Daily attendance helps [CHILD] learn and succeed.
Friday	School Staff Outreach	Dear [PARENT NAME], This is [name and position], trying again to reach you. [CHILD] has missed [X] days of school so far this year. Please text me at [NUMBER] or call me at [NUMBER] so we can set up a time to talk. I am here to help!

Exhibit A.6. Consequences-framed basic messaging with Goal Commitment messaging (two hypothetical weeks in spring 2018)

Day	Event	Message
First week		
Sunday	Informational message and Goal Commitment message	It can be hard to get your child to school on time. Text "TIP" for tips on how to get out the door in the morning. Children lose opportunities to learn when they miss school. Will you make it a goal that [CHILD] attends school every day this week? Reply YES to join other parents in setting this goal.
Monday	NA	
Tuesday	NA	
Wednesday	NA	
Thursday	NA	
Friday	Weekly attendance feedback	[CHILD] had perfect attendance this week! Keep up the great work
Second week		
Sunday	Informational message and Goal Commitment message	Spring allergies can trigger asthma in some kids. Text "TIP" for ways to keep asthma under control. Children lose opportunities to learn when they miss school. Will you make it a goal that [CHILD] attends school every day this week? Reply YES to join other parents in setting this goal.
Monday	NA	
Tuesday	NA	
Wednesday	NA	
Thursday	Student absent	We missed [CHILD] in school today. [CHILD] has missed a total of [X] days of school this year. Missing school makes it harder for [CHILD] to feel like an important part of the school.
Friday	Student returns, Weekly attendance feedback	We were glad to have [CHILD] back to school today. Daily attendance helps [CHILD] reach their full potential. [CHILD] missed the weekly attendance goal this week. Please help us meet this goal next week.

Exhibit A.7. Example of interactive messages that were part of the Goal Commitment messaging strategy



Development of the Adaptive Text Messaging Strategy

Message Content Development and Usability Testing

The study team developed the messaging content by drawing on behavioral science research and literature on the relationship between absences and later academic and social outcomes. To develop the content for the weekly tip messages, the study team identified national and local websites and resources. In addition, some messages provided parents direct access to these resources via links embedded in the texts.

As part of the development process, the study team gathered parent feedback about the messages by conducting three rounds of focus groups. The study team recruited parents who had children in elementary grades from a large urban school district. During the usability testing sessions, study team members sent the text messages to parents' cell phones to gather information on how the texts would appear and parent opinions about the messages. The first two rounds of usability testing focused on the tone, clarity, and length of the messages as well as initial impressions of the different messaging approaches. All parents that participated in the first two rounds of usability testing indicated that they did not want 'cheerful,' 'cute,' or 'playful' language, but rather preferred short, factual messages. The study team revised the content and tone of the messages after the first two rounds of feedback. The third round of usability testing focused on 'acceptability,' whether parents would find specific messaging approaches or message components (e.g., tips, same-day notifications, interactive goal commitment) off-putting. Most parents indicated that they found the same-day notifications that informed them about their child's number of absences to be most useful. Parents did not have a negative reaction to the informational messages (e.g., pre-scheduled messages with tips). Most parents noted that some of the messages would not be relevant to their personal circumstances, but also acknowledged that they had friends or knew parents who could benefit from the information.

Translation of Messages to Different Languages

The text messages were translated to multiple languages based on district requirements, including Amharic, Arabic, Chinese, French, Korean, Russian, Spanish, Somali, and Vietnamese. The text messages were professionally translated and also proofread and checked for clarity by study team staff who were native speakers of the languages.

The home language for each student was recorded in the district's student information system. Exhibit A.8 shows the percentage of students in the study who had each language recorded as their primary language spoken at home. The text messaging platform used the information in the student information system to send messages in the recorded home language. If parents updated the home language information, for example from English to Spanish, the text messaging platform would automatically adjust the language of the sent messages to match the updated information.

Exhibit A.8. Percentage of students in each messaging group with different primary languages spoken at home

Home language	Students assigned to basic messaging only	Students assigned to intensified messaging: School Staff Outreach	Students assigned to intensified messaging: Goal Commitment	All students in messaging conditions
Amharic	0.0	0.0	0.0	0.1
Arabic	0.6	0.3	0.0	0.2
Chinese	0.0	0.0	0.4	0.1
English	75.3	80.2	83.1	80.3
French	0.1	0.2	0.0	0.1
Russian	0.1	0.0	1.2	0.4
Somali	0.7	0.0	1.0	0.4
Spanish	22.9	19.0	12.6	17.7
Vietnamese	0.5	0.3	1.6	0.7

SOURCE: District administrative records.
NOTES: The analytic sample included students who were enrolled for 100 percent of the school days and had 15,269 students; 11,097 students assigned to basic messaging only; 2,115 students assigned to basic messaging with School Staff Outreach, and 2,057 students assigned to basic messaging with Goal Commitment. Although one district requested to have the messages translated into Korean, there were no students in the study sample whose home language was indicated as Korean in the districts' student information systems.

District Approval

Prior to starting any text messaging in fall 2017, district staff reviewed the messages to approve their content. The study team also requested district staff confirm that the messages related to school calendars were accurate. All four participating districts approved the messaging content without significant changes. Changes requested by districts included adding a district-specific attendance slogan into the messages, if they had one (such as "Attendance Matters!"), and specific changes to school district calendar information (such as the length of the winter break).

Description of the Text Messaging Platform

The study text messages were sent out to parents in participating districts from a platform provided by a text messaging vendor. The study team selected the vendor, SchoolMessenger (Intrado), through a competition. The SchoolMessenger system allowed pre-scheduled messages to be uploaded into the platform by study team staff, who set the specific times for messages to be sent out. The system also allowed automated "conditional" messaging, meaning that whether a message was sent was triggered by the combination of daily attendance data (whether a student was in school or not) together with the study condition indicators. (That is, whether a student was assigned to benefits- or consequences-framed basic messaging and whether a student was also assigned to School Staff Outreach or Goal Commitment intensified messaging.) SchoolMessenger worked with the study team and each of the participating districts to establish procedures for transferring districts' daily attendance data into the SchoolMessenger system so that the messages could be automatically sent according to the study design.

The study team worked with SchoolMessenger to develop an additional platform module for the school attendance counselors to use for personalized outreach. The platform module limited school counselors to texting only the families of those students who were part of the School Staff Outreach group, and allowed school counselors to use templates to send out individual messages to multiple parents simultaneously as well as to customize their messages. The platform module could be accessed from a desktop, laptop, or iPad and aimed to be easy to use to reduce the need for extensive training.

For the text messages to be sent out successfully, districts needed to have a student information system into which daily attendance was entered and that had the capacity to transfer daily attendance data to the text messaging platform. The transfer process involved correctly programming data queries that would create attendance variables needed for the daily attendance notifications, and then send the created dataset daily to the messaging platform on time to trigger attendance notifications. All districts in the study had a student information system that was updated daily with attendance information and a data analyst who facilitated the programming of queries and transferring data.

The most common reasons messages were not sent or incorrect messages were sent were (a) errors in district programmed data queries that would define the attendance data variables used to trigger same-day absence notifications, (b) failure of the data queries to successfully create the dataset and send it to the text messaging platform on time, and (c) inadequate capacity of the text messaging system to send all the messages at the same time which caused some of the messages to not be delivered within the timeframe set by the study (not past 8 pm local time). The programming errors in data queries and the capacity problem of the text messaging platform were generally limited to the first two weeks of the study. The district data analyst re-programmed queries as needed, and the limited message sending capacity was corrected by SchoolMessenger by adding more server capacity and by staggering sending of pre-programmed messages. Problems with data queries not creating the daily datasets on time persisted on and off throughout the year in one of the four participating districts.

Identifying and Training School Staff to Implement School Staff Outreach

District and school contacts identified a school staff person to conduct the School Staff Outreach. In one district, the outreach for students in multiple schools was conducted by district-level attendance analysts. In the other three districts, one or more school-based staff in each school conducted the outreach. Exhibit A.9 shows the number and percent of different types of school personnel who conducted the outreach in the study schools.

Exhibit A.9. Number and percentage of school staff in outreach position, by role

Roles	N	Percent
District attendance counselors	6	5.5
School attendance counselors	7	6.4
Parent liaisons	13	11.9
School social workers/guidance counselors	33	30.3
Other school staff	50	45.9

SOURCE: School Messenger School Staff Outreach Accounts.
NOTES: Sample size = 109 school staff members assigned to conduct School Staff Outreach.

APPENDIX B: MORE ON THE STUDY DESIGN

Overview of the Design

The evaluation used a sequential multiple assignment randomized trial (SMART) design, depicted in Exhibit B.1.[15] SMART designs are used to compare adaptive interventions that tailor the type, dosage, or timing of an intervention based on study participants' characteristics or initial response to the intervention. This study used a SMART design to compare interventions that adapted based on students' fall absences to see which intervention best improved student attendance. In late September 2017, the study team randomly assigned families (and their students) within elementary schools to one of the three initial messaging conditions: benefits-framed basic messaging or consequences-framed basic messaging, or to the no-messaging control condition. Between October 1 and the end of the fall semester, families received messages consistent with their basic messaging condition. Depending on their child's absence rate during the fall, they then either continued with their basic messaging for the rest of the year, or they received additional intensified messaging during the spring semester. Specifically, families whose child(ren) missed fewer than 8 percent of the school days between October and the end of December 2017 continued with their basic messaging from January 2018 through the end of the school year. Families with at least one child who missed 8 percent or more of school days during this same period in the fall despite basic messaging were re-randomized in January 2018 to one of the two intensified messaging conditions: School Staff Outreach or Goal Commitment messaging. These intensified messaging strategies were added on top of basic messaging (benefits-framed or consequences-framed), which continued through the end of the school year. The combinations of basic and intensified messaging form four adaptive interventions shown in Exhibits B.2 to B.5. Note the main study report refers to these adaptive interventions as "four versions of the adaptive text messaging strategy."

The two sequential randomizations in the SMART design allow for causal comparisons of (1) the basic messaging strategies to each other and the no-messaging control condition, (2) the two intensified messaging strategies to each other, and (3) the four adaptive interventions to the no-messaging control condition and each other. Only families with at least one child who met the eligibility condition based on the pre-set tailoring variable were included in the second randomization. A primer published by the Institute of Education Sciences (Nahum-Shani & Almirall, 2019) offers additional details on SMART designs in education.

[15] For more information about SMARTs, see Almirall, Nahum-Shani, Sherwood, & Murphy (2014); Murphy & Almirall (2009); and Nahum-Shani et al. (2012).

Exhibit B.1. Sequential multiple assignment randomized trial (SMART) design for testing four versions of the adaptive text messaging strategy

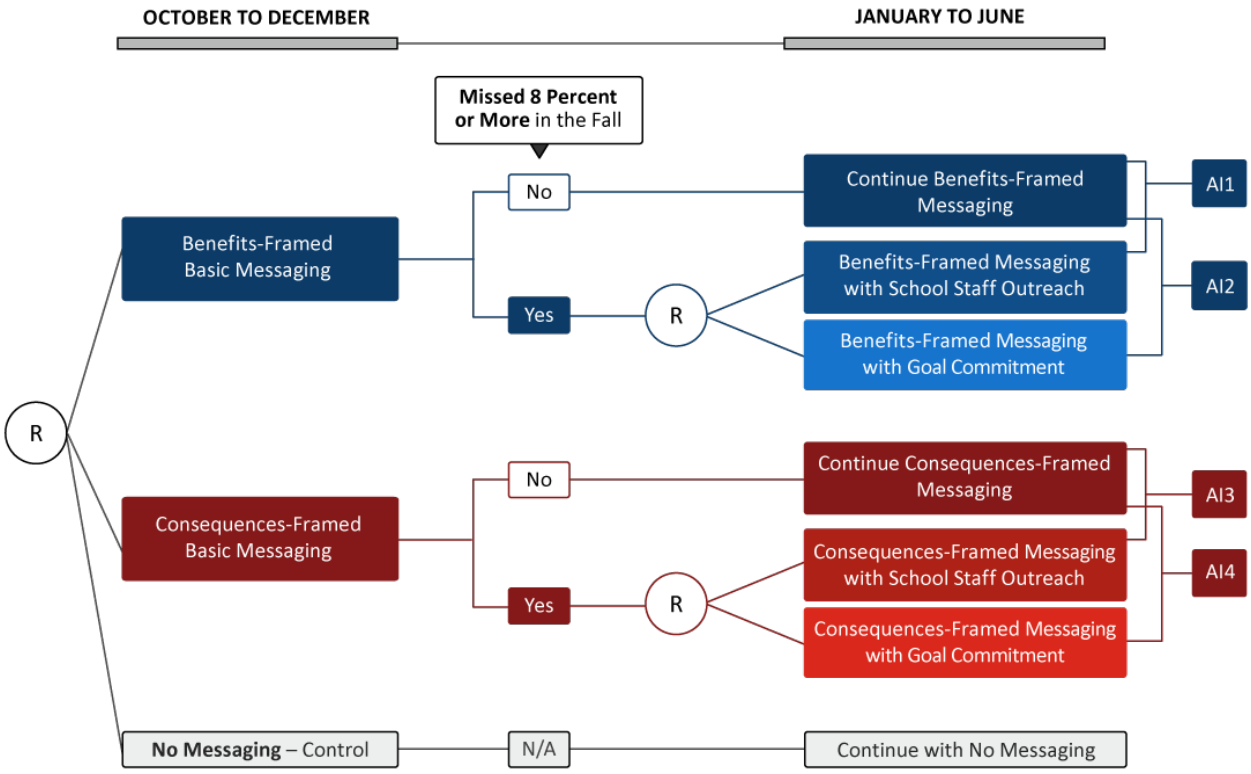


Exhibit B.2. Adaptive intervention #1 (AI-1): Benefits-framed basic messaging with School Staff Outreach

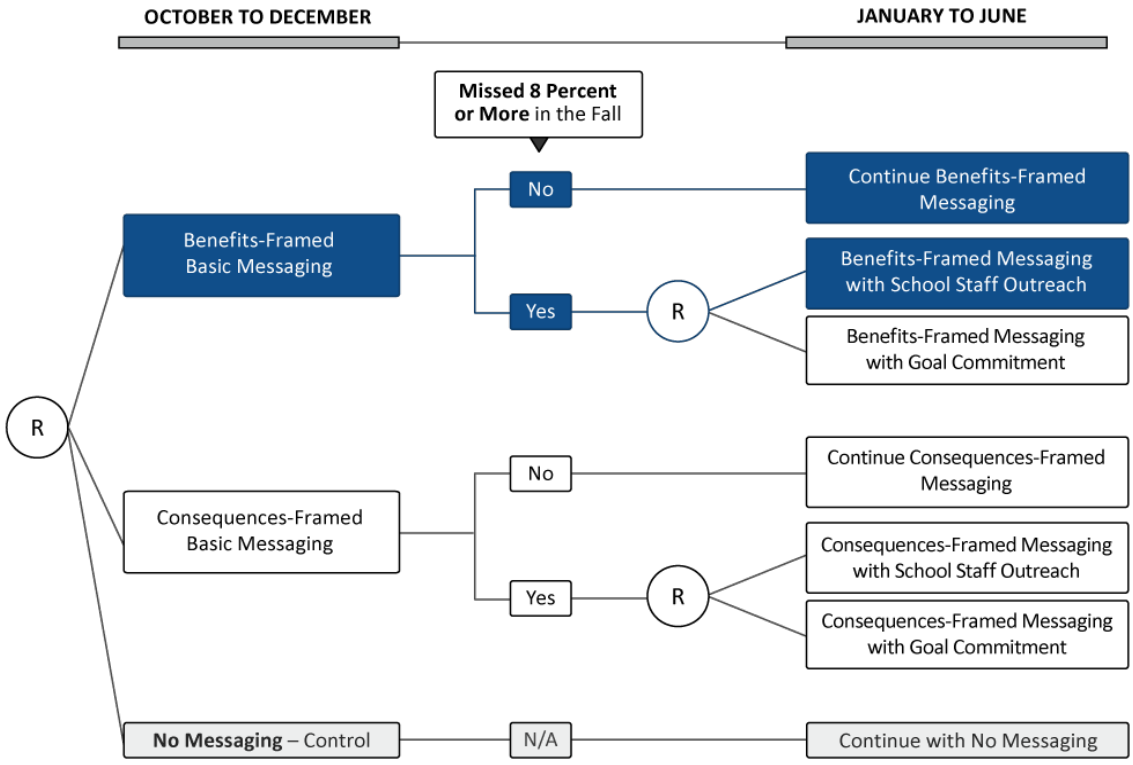


Exhibit B.3. Adaptive Intervention #2 (AI-2): Benefits-framed basic messaging with Goal Commitment messaging

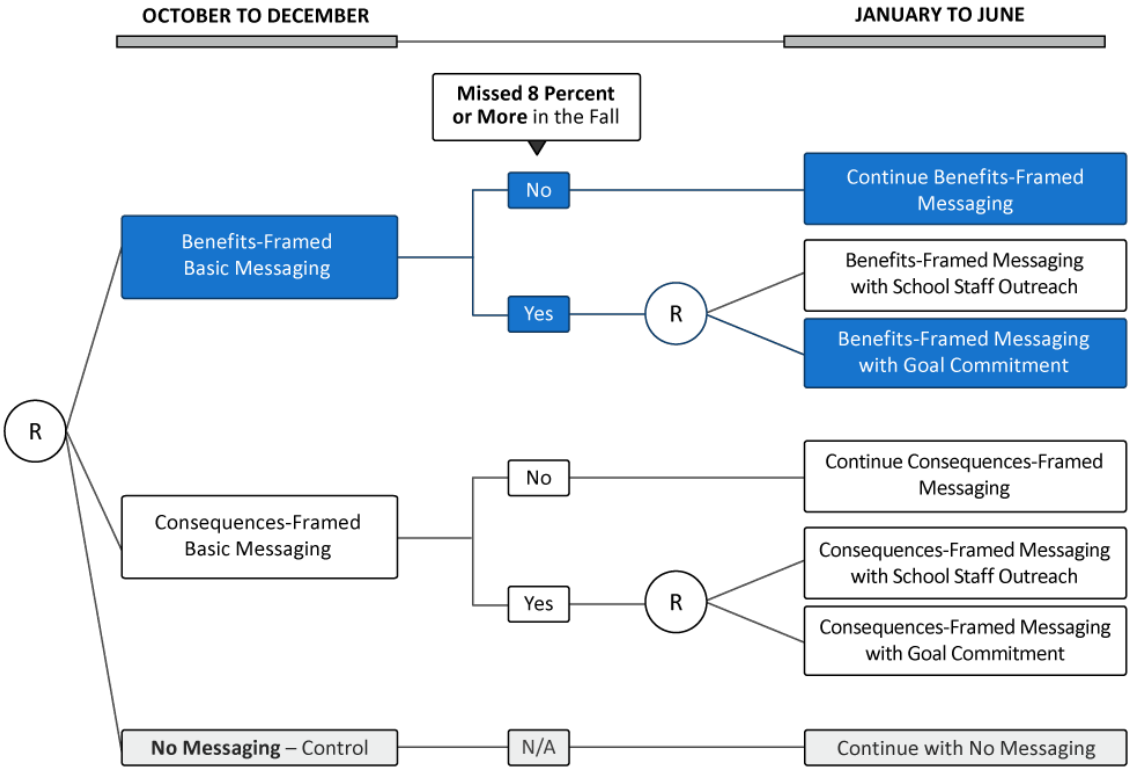


Exhibit B.4. Adaptive intervention #3 (AI-3): Consequences-framed basic messaging with School Staff Outreach

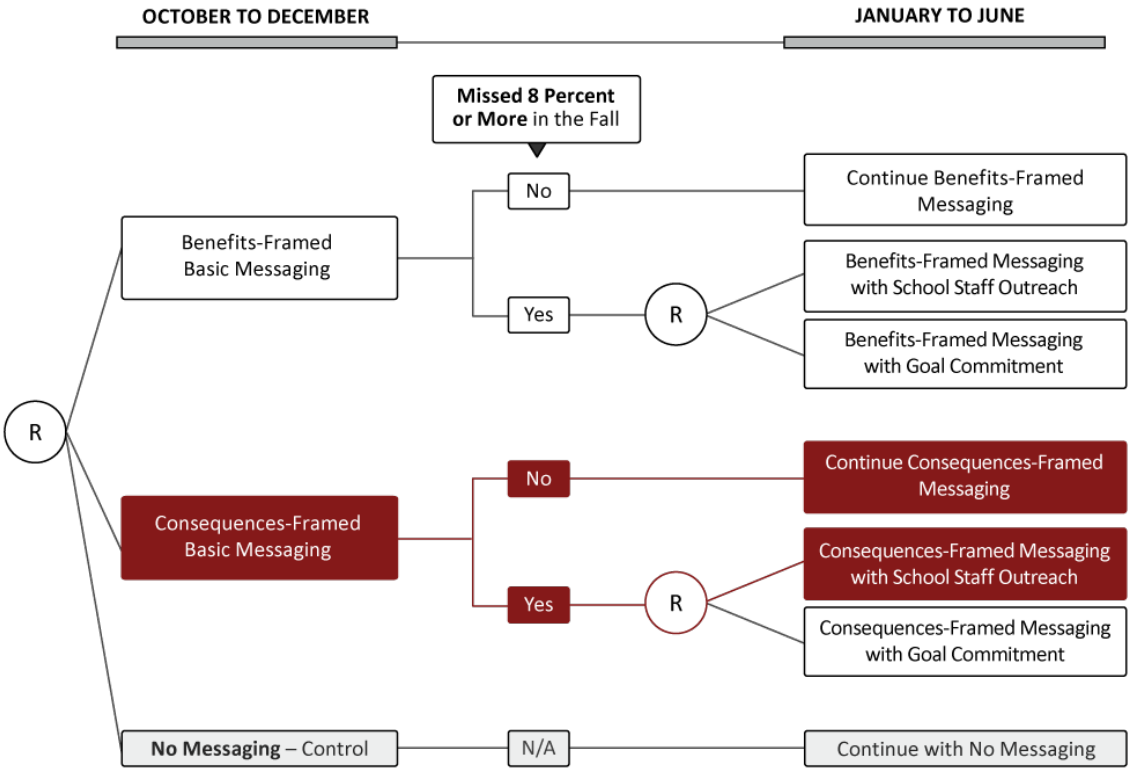
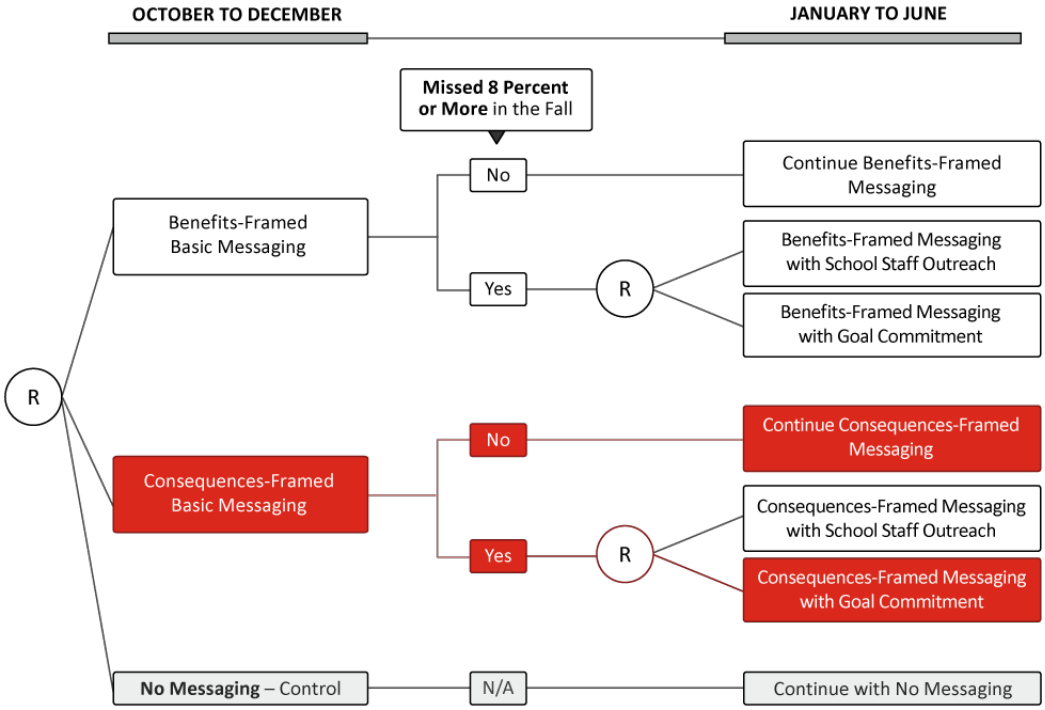


Exhibit B.5. Adaptive intervention #4 (AI–4): Consequences-framed basic messaging with Goal Commitment messaging



NOTES: "R" refers to random assignment of families (and their students) to one of the messaging conditions. "Eligible for intensified messaging" was defined as a family having at least one child who missed 8 percent or more of school days between October 1 and the end of December.

Description of the District and School Samples

Recruitment

The study established the following eligibility criteria for district and school participation:

- The district had at least 10 low-performing[16] elementary schools with high levels of absenteeism (i.e., more than 15 percent of students chronically absent), since these were the types of districts most likely to benefit from a text messaging approach of the kind studied.
- The district and schools did not systematically send text messages to parents about attendance during the 2016–17 school year and were not planning to start systematic text messaging to parents about attendance during the 2017–18 school year, so as not to have multiple texting systems at the same time.[17]

[16] The U.S. Department of Education was specifically interested in a study that would improve outcomes for disadvantaged students. Although the study did not set a strict participation eligibility threshold for academic performance based on proficiency rates or other achievement measures, the study team examined the relative achievement levels of the potentially eligible schools and districts to ensure that the study took place in sites that reflected the target population of elementary schools with high absenteeism and low academic performance. For example, the average percentage of students proficient on English/language arts state standardized assessments in 2016–17 in each of the four participating districts was 18 percent, 25 percent, 38 percent, and 46 percent.

[17] Systematic text messaging was defined as (1) text messaging about attendance that was conducted through a district parent notification system either by district or school staff to all parents who met preset criteria—for example, every parent whose child is absent gets a text the same day; all parents whose child has missed 5 days of school receive a text message; or (2) school staff sending text messages consistently to all parents who meet specific preset criteria by using their own cell phones (not the district system).

- The text messaging intervention provided by the study would supplement and not conflict with the district's current approach to improving student attendance.
- The district was willing to work with the designated text messaging provider.
- The district was able to share attendance and other relevant data with the study team.

The study team used U.S. Department of Education data (*Common Core of Data*, 2015–16 and the Office for Civil Rights data, 2013–14) to identify the pool of districts that had at least 10 low-performing elementary schools (grades K–5/6) with high levels of absenteeism. The study team first reached out to these districts via e-mail and phone calls. The study team then visited those districts that expressed sufficient interest and appeared to meet the eligibility criteria described above. The final selection of four districts was based on their ability to meet the eligibility criteria above and to accommodate required research and Institutional Review Board protocols.

A total of 108 elementary schools in these four districts participated in the study. Exhibit B.6 provides descriptive statistics about the participating schools next to those of similarly sized school districts serving grades K–5.

Exhibit B.6. Background characteristics of schools in the study sample, schools serving grades K–5 in similarly sized districts

Characteristics	Schools in study sample	Schools serving grades K–5 in similarly-sized urban districts
Urbanicity (percent)		
Urban	97.2	88.0*
Suburban	2.8	9.0*
Town	0.0	0.2
Rural	0.0	2.5
Title I status (percent)	89.8	80.5*
Students eligible for free or reduced-price lunch (percent)	83.4	69.9*
Racial/ethnic composition (percent)		
White, non-Hispanic	16.1	24.4*
Black, non-Hispanic	47.5	25.6*
Hispanic	29.9	38.8*
Asian/Pacific, non-Hispanic	2.7	6.5*
Other, non-Hispanic	3.8	4.7
Total school enrollment, mean	448.1	552.3*
Percent of students chronically absent	27.7	12.0*

SOURCE: Common Core of Data 2015-16 school year, Office for Civil Rights Data for the 2013-14 School Year
NOTES: Sample size = 108 schools in study sample, 8,193–9,379 schools serving grades K-5 in similarly-sized urban districts, with the number of schools varying across different characteristics due to data availability. The percentage of students eligible for free or reduced-price lunch in the study sample was based on only 83 of the 108 study schools because these data were not available in the Common Core of Data for one of the four study districts (which had 25 study schools).
Percentage values for characteristics with multiple categories may not sum to 100 because of rounding.
p-values are based on comparisons against schools in study sample using a one-sample test of proportions for measures of urbanicity and Title I status, and a one-sample t test for the other variables: * Statistically significant at $p < .05$.

Random Assignment and Analytic Sample

Families (and their students) were randomly assigned to one of the two basic messaging approaches or the control group within schools with equal probability. Students were grouped in "families" to prevent parents with multiple children in grades K–5 from getting different types of messages for their different children. In the simplest case, students who shared the same last name, address, and phone number were grouped together. Students who shared the same phone number and address but had different last names were also grouped together. The study team hand-coded all cases where students shared the same address but did not share the same phone number or last name. Multiple families in one address location were typically linked to homeless shelters.

In addition to blocking by school (i.e., grouping families and their students by school, and then conducting random assignment within schools), two other blocking variables were used to ensure that each of the three initial study conditions had equal proportions of families with baseline characteristics relevant for the study's intervention: (1) whether the family had one or more children who had a history of high absences, and (2) whether the family had at least one valid cell phone number with short message service (SMS), which was necessary for receiving the study's text messages. A family was considered to have had a history of high absences if they had one or more children who had (1) missed 10 percent or more instructional days in the 2016–17 school year *or* (2) missed 10 percent of instructional days between the start of the 2017–18 school year and September 15, 2017. A family was identified as having at least one working SMS number based on records collected in August–September, when text messages were sent out to parents in participating districts and schools, informing them about the study and giving them the chance to opt out of participating prior to random assignment to messaging groups or the no-messaging group.

The sample at the time of first random assignment included 36,706 students in grades K–5 nested within 26,843 families.[18] The study randomly selected one child per family to be included in the analytic sample.[19] Exhibit B.7 shows the number of students in each initial study condition, overall and by district. By design, the conditions had similar proportions of families with one or more children with a history of high absences and with a working SMS number.

Exhibit B.7 also shows the number of students in each initial study condition who were in the sample used to analyze the effectiveness of the texting strategy, a total of 23,133 students. Students were in the analytic sample if they were enrolled for 100 percent of the school year, had complete demographic information at baseline, and were randomly selected for inclusion in the analytic sample if the family had multiple children in grades K–5. The main analyses restricted the sample to students who were enrolled for 100 percent of the school days to avoid the problem of missing attendance data. Missing attendance data complicates the definition of the attendance outcome measures, including chronic absence (missing 10 percent or more of school days between October 1 and

[18] Of the 108 participating schools, 68 included students in prekindergarten, and 19 schools included students in grades 6, 7, or 8. Families with students only in prekindergarten or only in grades 6–8 were included in the random assignment process, at the request of the districts; however, they were blocked separately from families with students in grades K–5 and were not included in the analyses.

[19] The study did not randomly assign individual children to messaging condition to avoid sending parents with more than one child in grades K–5 different types of messages for their different children. However, the study team randomly selected one child per family for the sample used to analyze the effectiveness of the texting strategy. Doing so simplified the analytic models used to assess the impact of the messaging because it allowed the study to avoid including a "family level" in the analytic models. Including a family level would have complicated estimation because most families in the study had only one child in the relevant grades. The selection of one child per family for the analytic sample occurred after the implementation of text messaging was completed.

the end of the school year). In addition, the complete baseline demographic data allows inclusion of the baseline characteristics as covariates in the analytic models, which increases the precision of the impact estimates. The study team conducted sensitivity analyses using different sample definitions and different missing data analysis approaches. The principal conclusions are consistent with the ones from the analytic sample used for main analyses. (See Appendix E for sensitivity analyses.) Students whose parents opted them out of the study after random assignment were excluded from the analytic sample altogether. (See next section on Attrition.)

Exhibit B.7. Number of students (and their families) in each initial study condition at the time of first random assignment in late September 2017 (after selecting one child per family for the analysis) and number of students (and their families) in each initial study condition in the final analytic sample

District	Sample	Number of students (families) by initial study condition			
		Benefits-framed basic	Consequences-framed basic	Control group	Total
1	RA	2,221	2,226	2,223	6,670
	Analytic	1,934	1,963	1,986	5,883
2	RA	2,582	2,576	2,573	7,731
	Analytic	2,117	2,057	2,239	6,413
3	RA	1,550	1,549	1,537	4,636
	Analytic	1,423	1,419	1,431	4,273
4	RA	2,607	2,600	2,599	7,806
	Analytic	2,191	2,167	2,206	6,564
All districts	RA	8,960	8,951	8,932	26,843
	Analytic	7,665	7,606	7,862	23,133

SOURCE: Study records.
NOTES: "RA" is the sample at random assignment. "Analytic" is the analytic sample.

After the basic messaging took place between October 1 and late December 2017, the study team identified families for random assignment to the intensified messaging approaches (School Staff Outreach or Goal Commitment messaging). Families were randomly assigned to intensified messaging if they had been randomly assigned to basic messaging for the fall (either benefits or consequences-framed) and then had at least one child who exceeded the 8 percent absence threshold. Families with multiple children were eligible for intensified messaging based on the child with the highest number of absences, regardless of whether this child was randomly selected for the analytic sample. This meant that in some cases, the student randomly selected for the analytic sample, after implementation of the intervention was complete, was not the student with the highest number of absences in the family. The second randomization was also blocked by school. Exhibit B.8 shows the number of students in each intensified messaging group at the time of the second random assignment (January 2018), and the number of students in each intensified messaging group who were in the analytic sample.

Exhibit B.8. Number of students (and their families) in each intensified messaging group at the time of second random assignment in January 2018 (after determining eligibility for intensified messaging) and in each intensified messaging group in the final analytic sample

District	Sample	Number of students/families				
		Benefits-framed basic with School Staff Outreach	Benefits-framed basic with Goal Commitment	Consequences-framed basic with School Staff Outreach	Consequences-framed basic with Goal Commitment	Total
1	RA	233	234	227	222	916
	Analytic	210	219	223	217	869
2	RA	336	336	332	330	1,334
	Analytic	302	293	299	278	1,172
3	RA	410	406	394	394	1,604
	Analytic	343	308	313	319	1,283
4	RA	253	253	258	246	1,004
	Analytic	219	214	207	209	849
All	RA	1,232	1,229	1,205	1,192	4,858
	Analytic	1,074	1,034	1,042	1,023	4,173

SOURCE: Study records.
NOTES: "RA" is the sample at random assignment, "Analytic" is the analytic sample.

Attrition

Attrition occurs when participants who are originally in the study are not included in the analysis due to missing outcome data or another reason. Attrition can cause problems in impact evaluations because generalizability of findings can be limited if certain types of students are not represented in the analysis. Attrition can also introduce bias in study results if different types of students are more likely to be missing from one messaging group than another.

In this study, there were three reasons for attrition (students from families that were randomly assigned to basic messaging in September 2017 but were not included in the study's final analytic sample): (1) if their family opted out of the study after randomization,[20] (2) if the students moved out of the district during the school year, or (3) if the students did not have complete demographic information in the datasets provided by districts, which were needed for the analysis. If parents unsubscribed from the text messaging for a given phone number after texting began, their child was still included in the analytic sample because they received at least some exposure to the strategy, and it was possible another family member was still receiving texts.

The overall attrition rate was 13.8 percent. Exhibit B.9 shows the attrition rates for students in the seven possible pathways in the study: benefits-framed basic messaging only, consequences-framed basic messaging only, benefits-framed basic messaging with School Staff Outreach, benefits-framed basic messaging with Goal Commitment, consequences-framed basic messaging with School Staff Outreach, consequences-framed basic

[20] Parents in all participating schools had the opportunity to opt out of the study through information provided via text messages and paper forms in early and mid-September 2017. Most opt-outs occurred prior to random assignment. These opt-outs were not considered to be attrition. The opt-outs that came after random assignment were considered to be attrition.

messaging with Goal Commitment, and no messaging (control). Based on the U.S. Department of Education, Institute of Education Sciences' What Works Clearinghouse Standards Version 4.0, the overall and differential attrition rates correspond to tolerable levels of potential bias, even under cautious assumptions. Therefore, potential bias due to attrition seems unlikely to be driving the study results.

Exhibit B.9. Attrition rates by study pathway

Condition	Attrition Rate
Benefits-framed basic messaging only throughout the year	14.1
Consequences-framed basic messaging only throughout the year	14.7
Benefits-framed basic messaging with School Staff Outreach	12.1
Benefits-framed basic messaging with Goal Commitment messaging	15.8
Consequences-framed basic messaging with School Staff Outreach	13.4
Consequences-framed basic messaging with Goal Commitment messaging	13.5
No-messaging control	11.7
Overall	13.8

SOURCE: Study records.

The characteristics of students in the analysis sample were similar to those of the full sample of students at the time of the first random assignment in September 2017, suggesting that attrition did not affect the generalizability of the results (Exhibit B.10).

Exhibit B.10. Background characteristics of students in the analytic sample compared to all students at baseline

Characteristics	Analytic sample	All students at baseline	Estimated difference	*p*-value
Grade	2.5	2.5	0.0	0.382
Female (percent)	48.2	48.3	0.1	0.778
Race/ethnicity (percent)				
White, non-Hispanic	16.6	16.6	0.1	0.740
Black, non-Hispanic	44.4	44.3	-0.1	0.663
Asian, non-Hispanic	2.1	2.1	0.0	0.815
Hispanic	32.1	32.3	0.2	0.559
American Indian/Alaskan Native, Native Hawaiian, non-Hispanic	0.6	0.6	0.0	0.949
Multi-racial, non-Hispanic	4.2	4.1	-0.1	0.485
English language learner (percent)	14.1	14.2	0.1	0.788
Special education status (percent)	15.9	15.9	0.1	0.813
2016-17 Mathematics achievement (standardized)	-0.231	-0.219	0.012	0.414
2016-17 Reading/English/language arts achievement (standardized)	-0.221	-0.213	0.009	0.564
Chronically absent in 2016-17 (percent)	20.2	20.0	-0.2	0.533

Characteristics	Analytic sample	All students at baseline	Estimated difference	*p*-value
Chronically absent from beginning of the year to random assignment (percent)	14.4	14.1	-0.4	0.116

NOTES: Sample size = 108 schools; 7,069–23,133 students in the analytic sample; 7,684–25,834 students in the all students at baseline sample, with the sample size varying across different characteristics due to data availability. The analytic sample includes students who were enrolled for 100 percent of the school days and had complete demographic data. Achievement data were available only for students in grades 3-5, so sample sizes were smaller for achievement-related characteristics. The number of students for whom demographic data were available also varied.
The analyses are based on a regression model controlling for block fixed effects.

Exhibit B.11 shows the number of students in the sample throughout the study and sample attrition over the school year for the initial study conditions. Exhibit B.12 shows the same information for the intensified messaging groups.

Exhibit B.11. Number of students in each initial study condition at the time of the first random assignment, removed from the analytic sample due to opting out, moving out of district, or not having complete demographic information, and ultimately included in the analytic sample, by district and overall

Sample characteristic	District				All districts
	1	2	3	4	
Eligible students	7,100	8,746	4,920	8,866	29,632
Students opted out before September randomization	430	1,015	284	1,060	2,789
Students at random assignment	6,670	7,731	4,636	7,806	26,843
Benefits-framed basic messaging					
Assigned to benefits-framed messaging	2,221	2,582	1,550	2,607	8,960
Opted out after random assignment, or no longer in the district by the end of the school year, or did not have complete demographic information[21]	287	465	127	416	1,295
Enrolled 100 percent of the school year with complete demographic information (analytic sample)	1,934	2,117	1,423	2,191	7,665
Consequences-framed basic messaging					
Assigned to consequences-framed messaging	2,226	2,576	1,549	2,600	8,951
Opted out after random assignment, or no longer in the district by the end of the school year, or did not have complete demographic information	263	519	130	433	1,345
Enrolled 100 percent of the school year with complete demographic information (analytic sample)	1,963	2,057	1,419	2,167	7,606
Control					
Assigned to control group	2,223	2,573	1,537	2,599	8,932

[21] Attrition categories are combined for privacy reasons. Most of the students in this group moved out of the district; opting out after random assignment and not having complete demographic information were relatively rare.

Sample characteristic	District				All districts
	1	2	3	4	
Opted out after random assignment, or no longer in the district by the end of the school year, or did not have complete demographic information	237	334	107	393	1,070
Enrolled 100 percent of the school year with complete demographic information (analytic sample)	1,986	2,239	1,431	2,206	7,862
Total sample					
Initial random assignment	6,670	7,731	4,636	7,806	26,843
Opted out after random assignment, or no longer in the district by the end of the school year, or did not have complete demographic information	787	1,318	363	1,242	3,710
Enrolled 100 percent of the school year with complete demographic information (analytic sample)	5,883	6,413	4,273	6,564	23,133

SOURCE: Study and district administrative records.

Exhibit B.12. Number of students in each of the spring 2018 study conditions at the time of the second random assignment, removed from the analytic sample due to opting out, moving out of district, or not having complete demographic information, and ultimately included in the analytic sample, by district and overall

Sample characteristic	District				All districts
	1	2	3	4	
Students from families below absence threshold on January 2					
Continuing in benefits-framed messaging					
In benefits-framed messaging on January 2	1,640	1,692	1,055	1,755	6,142
Opted out after January 2, or no longer in the district by the end of the school year, or did not have complete demographic information	135	170	65	215	585
Enrolled 100 percent of the school year with complete demographic information (analytic sample)	1,505	1,522	990	1,540	5,557
Continuing in consequences-framed messaging					
In consequences-framed messaging on January 2	1,647	1,664	1,061	1,764	6,136
Opted out after January 2, or no longer in the district by the end of the school year, or did not have complete demographic information	124	184	58	229	595
Enrolled 100 percent of the school year with complete demographic information (analytic sample)	1,523	1,480	1,003	1,535	5,541
Students from families above absence threshold on January 2					
Benefits-framed messaging with School Staff Outreach					
Assigned on January 2	253	336	233	410	1,232
Opted out after January 2, or no longer in the district by the end of the school year, or did not have complete demographic information	43	34	14	67	158
Enrolled 100 percent of the school year with complete demographic information (analytic sample)	210	302	219	343	1,074
Consequences-framed messaging with School Staff Outreach					
Assigned on January 2	252	332	227	394	1,205
Opted out after January 2, or no longer in the district by the end of the school year, or did not have complete demographic information	29	33	20	81	163
Enrolled 100 percent of the school year with complete demographic information (analytic sample)	223	299	207	313	1,042

Sample characteristic	District				All districts
	1	2	3	4	
Benefits-framed messaging with Goal Commitment					
Assigned on January 2	253	336	234	406	1,229
Opted out after January 2, or no longer in the district by the end of the school year, or did not have complete demographic information	34	43	20	98	195
Enrolled 100 percent of the school year with complete demographic information (analytic sample)	219	293	214	308	1,034
Consequences-framed messaging with Goal Commitment					
Assigned on January 2	246	330	222	394	1,192
Opted out after January 2, or no longer in the district by the end of the school year, or did not have complete demographic information	29	52	13	75	169
Enrolled 100 percent of the school year with complete demographic information (analytic sample)	217	278	209	319	1,023
Control					
In Control on January 2	2,176	2,512	1,515	2,582	8,785
Opted out after January 2, or no longer in the district by the end of the school year, or did not have complete demographic information	190	273	84	376	923
Enrolled 100 percent of the school year with complete demographic information (analytic sample)	1,986	2,239	1,431	2,206	7,862
Total Sample					
Students in sample on January 2	6,467	7,202	4,547	7,705	25,921
Opted out after January 2, or no longer in the district by the end of the school year, or did not have complete demographic information	584	789	274	1,141	2,788
Enrolled 100 percent of the school year with complete demographic information (analytic sample)	5,883	6,413	4,273	6,564	23,133

SOURCE: Study and district administrative records.

Baseline Equivalence

It is important to demonstrate that the groups of students in each of the study conditions have similar characteristics at baseline. If they do not, for example, if one group is more "at risk" than another, then the estimates of the strategy's effect may be biased. Random assignment assures that groups are statistically equivalent at baseline *on average*, but not necessarily in every instance, which is why it is good practice to always check for baseline equivalence.

The study observed baseline equivalence on all measured background characteristics among initial basic messaging conditions, according to What Works Clearinghouse (WWC) standards. Exhibit B.13 shows the characteristics of students by initial messaging condition, in original units, and Exhibit B.14 shows the differences

in characteristics by initial messaging condition translated to standard deviation units.[22] Although there were statistically significant differences by basic messaging condition in the percentage of students who were White, Black, Hispanic, and who were English Language learners (Exhibit B.13), the magnitudes of these differences were all less than 0.05 standard deviations (Exhibit B.14).[23]

Exhibit B.15 shows the background characteristics of students by intensified messaging group, in both original units and standard deviation units. In the analytic sample of students from families assigned to intensified intervention conditions, the study observed baseline equivalence on all background characteristics (Exhibit B.15).

Although the WWC standards do not require it, the study's analyses included covariate adjustments for all of the baseline characteristics. These adjustments help eliminate potential small biases due to imperfect randomization, and also improve the precision of the impact estimates.

Exhibit B.13. Student background characteristics, by initial study condition

Characteristic	Benefits-framed basic mean	Consequences-framed basic mean	Control mean	Estimated difference		
				Benefits-framed basic vs. control	Consequences-framed basic vs. control	Benefits-framed basic vs. Consequences-framed basic
Grade	2.5	2.5	2.5	0.0	0.0	0.0
Female (percent)	48.9	48.9	47.7	1.2	1.1	0.0
Race/ethnicity (percent)						
White, non-Hispanic	17.3	16.8	18.3	-1.0*	-1.4*	0.5
Black, non-Hispanic	42.2	44.5	43.5	-1.3*	1.0	-2.3*
Asian, non-Hispanic	2.1	2.0	2.1	0.1	-0.1	0.1
Hispanic	33.6	32.0	31.7	1.9*	0.2	1.6*
American Indian/Alaskan Native, Native Hawaiian, non-Hispanic	0.5	0.6	0.5	0.0	0.1	-0.1
Multi-racial, non-Hispanic	4.2	4.0	3.9	0.4	0.2	0.2
English language learner (percent)	14.8	14.4	13.5	1.3*	0.9	0.4
Special education status (percent)	15.3	15.8	16.3	-1.0	-0.5	-0.5
2016–17 Mathematics achievement (standardized)	-0.178	-0.202	-0.181	0.003	-0.021	0.024

[22] WWC standards for baseline equivalence are based on differences expressed in standard deviation units.

[23] According to WWC standards, a study demonstrates baseline equivalence if differences in baseline characteristics are no greater than 0.05 standard deviations (WWC Standards Handbook, version 4.1, *p*. 13). Differences between 0.05 and 0.25 standard deviations are also acceptable but require statistical adjustment (e.g., inclusion as covariates in outcome analyses).

Characteristic	Benefits-framed basic mean	Consequences-framed basic mean	Control mean	Estimated difference		
				Benefits-framed basic vs. control	Consequences-framed basic vs. control	Benefits-framed basic vs. Consequences-framed basic
2016–17 Reading/ English/language arts achievement (standardized)	-0.186	-0.215	-0.165	-0.021	-0.049	0.029
Chronically absent in 2016–17 (percent)	19.0	18.6	18.3	0.6	0.2	0.4
Chronically absent from beginning of the year to random assignment (percent)	13.0	13.1	13.0	0.0	0.0	0.0

SOURCE: District administrative records and SchoolMessenger archival data.
NOTES: Sample size = 108 schools; 2,359–7,699 students in benefits-framed basic messaging; 2,296–7,629 students in consequences-framed basic messaging; 2,428–7,884 students in Control. Achievement data were available only for students in grades 3-5, so sample sizes were smaller for achievement-related characteristics.
The analyses are based on a regression model controlling for block fixed effects. Control group means are unadjusted means; messaging group means were computed by adding the estimated differences to the control group means.
* Indicates that the average student characteristic for the messaging group (benefits-framed basic messaging or consequences-framed basic messaging) is statistically significantly different from the average student characteristic for the no-messaging control group, or that the difference in average student characteristic for the two basic messaging groups (benefits-framed or consequences-framed) is statistically significant ($p < .05$).

Exhibit B.14. Differences in student background characteristics, by initial study condition

Characteristic	Estimated difference in standard deviation units		
	Benefits-framed basic vs. control	Consequences-framed basic vs. control	Benefits- basic vs. Consequences- basic
Grade	-0.010	-0.010	0.000
Female (percent)	0.023	0.023	0.001
Race/ethnicity (percent)			
White, non-Hispanic	-0.025*	-0.037*	0.012
Black, non-Hispanic	-0.026*	0.020	-0.046*
Asian, non-Hispanic	0.004	-0.005	0.009
Hispanic	0.040*	0.005	0.035*
American Indian/Alaskan Native, Native Hawaiian, non-Hispanic	-0.006	0.012	-0.018
Multi-racial, non-Hispanic	0.019	0.009	0.010
English language learner (percent)	0.037*	0.025	0.012
Special education status (percent)	-0.027	-0.012	-0.015
2016-17 Mathematics achievement (standardized)	0.003	-0.022	0.025
2016-17 Reading/English/language Arts achievement (standardized)	-0.022	-0.052	0.030
Chronically absent in 2016-17(percent)	0.016	0.006	0.010
Chronically absent from beginning of the year to random assignment (percent)	0.000	0.001	-0.001

SOURCE: District administrative records and SchoolMessenger archival data.

NOTES: Sample size = 108 schools; 2,359–7,699 students in benefits-framed basic messaging; 2,296–7,629 students in consequences-framed basic messaging; 2,428–7,884 students in Control. Achievement data were available only for students in grades 3-5, so sample sizes were smaller for achievement-related characteristics.

The analyses are based on a regression model controlling for block fixed effects.

* Indicates that the average student characteristic for the messaging group (benefits-framed basic messaging or consequences-framed basic messaging) is statistically significantly different from the average student characteristic for the control group, or that the difference in average student characteristic for the two basic messaging conditions (benefits-framed or consequences-framed) is statistically significant ($p < .05$).

Exhibit B.15. Student background characteristics, by intensified messaging group

Characteristic	School Staff Outreach mean	Goal Commitment mean	Estimated difference	
			School Staff Outreach vs. Goal Commitment	Std. dev. units Outreach vs. Commitment
Grade	2.4	2.4	0.0	0.000
Female (percent)	46.9	48.7	-1.7	-0.034
Race/ethnicity (percent)				
White, non-Hispanic	15.7	15.9	-0.2	-0.006
Black, non-Hispanic	49.1	50.1	-1.0	-0.020
Asian, non-Hispanic	1.1	1.3	-0.1	-0.012
Hispanic	29.1	27.5	1.6	0.036
Multi-racial, non-Hispanic	4.4	4.8	-0.3	-0.015
English language learner (percent)	12.5	11.7	0.8	0.024
Special education status (percent)	19.6	19.4	0.2	0.004
2016–17 Mathematics achievement (standardized)	-0.464	-0.426	-0.038	-0.039
2016–17 Reading/English/language Arts achievement (standardized)	-0.415	-0.457	0.042	0.043
Chronically absent in 2016–17 (percent)	43.2	45.1	-1.8	-0.037
Chronically absent from beginning of the year to random assignment (percent)	23.8	25.8	-2.0	-0.045

SOURCE: District administrative records and SchoolMessenger archival data.
NOTES: Sample size = 108 schools; 570–2,116 students in School Staff Outreach; 572–2,057 students in Goal Commitment messaging. Achievement data were available only for students in grades 3–5, so sample sizes were smaller for achievement-related characteristics. The analyses are based on a regression model controlling for block fixed effects. Goal Commitment group means are unadjusted means; School Staff Outreach group means were computed by adding the estimated differences to the Goal Commitment group means. No groups were statistically significantly different from each other at $p < .05$.

Data Collection and Measures Used in the Study

Exhibit B.16 displays the study's data sources. These data sources allowed the study team to construct measures of outcomes, school and student background characteristics, implementation of the texting strategy, and cost.

Exhibit B.16. Data sources

Type of data	Source	Uses in the study and analysis
Attendance data	District student information system	Calculate attendance rates from October 1 through end of fall semester to identify students above and below the 8 percent threshold for randomizing families to intensified messaging. Construct two attendance outcome measures for impact analyses: (1) a binary measure of chronic absence (absent 10 percent or more of instructional days), and (2) a continuous measure of number of days absent. Both outcome measures (the primary chronic absence and the secondary days absent) were calculated over three periods for different impact analyses: (1) October 1 to end of fall semester for the Fall 2017 outcomes; (2) January 2 to end of spring semester for the Spring 2018 outcomes; and (3) October 1 to the end of spring semester for the school year 2017–18 outcomes.
Academic achievement	District student information system	Create achievement outcomes for impact analyses (school year 2017–18): standardized (across district and grade) reading and mathematics scores.
Student rosters and background characteristics, including prior-year attendance and academic achievement; free or reduced-price lunch program eligibility or economically disadvantaged indicator, race/ethnicity, eligibility for special education services	District student information system	Describe the sample in terms of background characteristics (Fall 2017); assess generalizability; stratify for randomization; determine pre-randomization subgroups used for exploratory analyses; create covariates for impact analyses.
School characteristics data	Common Core of Data, Office for Civil Rights data, district student information system	Describe the sample.
Attendance and text messaging system data	Text messaging provider system	Monitor intervention delivery which was based on daily attendance data from districts; gauge intervention fidelity, uptake, and dosage.

Type of data	Source	Uses in the study and analysis
School Attendance Counselor Log	Study team-created protocol completed by school staff, once during school attendance counselor training and three times in Spring 2018	Describe the role of the attendance counselor and the school staff outreach activities (part of implementation analysis); describe the time spent in parent outreach (part of cost analysis); and describe business as usual attendance practices used by participating schools (service contrast).
Text messaging provider cost information	Study team accounting system	Estimate cost of delivering the text messages by the text messaging provider.
Study team labor cost information	Study team accounting system	Estimate cost of supporting the delivery of the text messages by the study team.
Information about districts' cost to implement text messaging	Cost interviews; district IT department	Estimate cost of setting up and carrying out daily data transfers to text messaging provider by district IT departments.

SOURCE: Authors' compilation.

Outcome Measures

Chronic absence was the primary outcome for the study because it is the absence measure that is most policy relevant, as most states are using it for their accountability systems under The Every Student Succeeds Act.[24] It was defined as missing 10 percent or more instructional days.[25] A secondary attendance measure was the number of days absent, used to confirm findings were similar when looking at average number of absences. Both measures have been used in previous studies testing the impact of informational interventions on student attendance.[26] The study created these measures using district attendance data for the fall (October 1 through the end of fall semester), for the spring (January to the end of spring semester), and for the full implementation period (October 1 through the end of spring semester). Multiple comparisons adjustments are not needed in this case because there is only one *primary* outcome measure (chronic absence) within the same domain (attendance).

Academic achievement outcomes were more exploratory because they were only available for part of the study sample. Test scores were available for grades 3 to 5 for English/language arts and mathematics in all districts. Because the tests used by districts differed by state, the study team standardized the student test scores by using each district's mean and standard deviation for each grade level. Due to family-level randomization within schools, the students in different messaging groups are, by design, compared only to other students in the same schools (and thus the same district and state). Therefore, students were compared to others who took the same achievement test.

[24] Bauer, Liu, Schanzenbach, & Shambaugh, 2018.

[25] Chronic absence is commonly defined as missing 10 percent or more of a school year by states and school districts and organizations working on school attendance (see, for example, https://www.attendanceworks.org/chronic-absence/the-problem/). When the U.S. Department of Education instituted reporting of chronic absenteeism in the 2013–2014 Office for Civil Rights Data Collection, however, the measure was defined as the proportion of students who were absent 15 or more days of the school year. All definitions of chronic absence include both unexcused and excused absences, due to the assumption that less time in school affects students no matter the reason.

[26] Balu, Porter, & Gunton, 2016; Rogers & Feller, 2018.

Background Characteristics, Implementation Measures, and Cost

The study team collected school and student background characteristics to describe the sample. The analyses also used the student background characteristics as covariates in the impact analyses.

The data from the text messaging provider included daily information about the text messages sent and delivered. The study team used these data to construct measures of fidelity and dosage of the automated text messaging components to help understand how well the messaging was implemented. Fidelity was defined as the rate at which intended messages were sent to the correct families on a daily basis, across the fall and spring of the study year.

Exhibit B.17 shows how the study determined whether intended messages were *sent* to at least one correct parent. Dosage was defined as the rate at which intended messages were *delivered* to at least one correct parent. Delivered messages were those recorded by the system as having been sent and successfully delivered to a local mobile phone carrier.

Exhibit B.17. Definition of how rate was calculated for intended messages sent to correct families

Message	Eligible for message	Description of the possible messaging scenarios	Correct	Incorrect
Informational messages and tips (Sundays)	Everyone assigned to benefits- or consequences-framed basic messaging at baseline In district dataset on day of message delivery At least one parent has not requested that the text messages be stopped	Message sent to at least one parent of an eligible student	✓	
		Message not sent to at least one parent (for example, because SchoolMessenger system failed or message wasn't scheduled correctly)		✓
Same-day notifications 1-3 days (daily on school days)	Same as above	Student is absent that day, the absence is not more than third consecutive absence, and same-day notification message sent to at least one parent	✓	
		Student is not absent that day, and same-day notification message not sent	✓	
		Student is absent that day, student has been absent 4 or more consecutive days, and same-day notification message not sent	✓	
		Student is absent that day, the absence is not more than third consecutive absence, and same-day notification message not sent		✓
		Student is absent that day, the student has been absent for 4 or more consecutive days, and same-day notification message sent		✓
		Student is present that day and a same-day notification message sent		✓
Welcome back (daily on school days)	Same as above [a]	Student was absent yesterday, present today, and message sent	✓	
		Student was absent yesterday, absent today, and message not sent	✓	
		Student was not absent yesterday, and message not sent	✓	
		Student was absent yesterday, absent today, and message sent		✓
		Student was absent yesterday, present today, and message not sent		✓

Message	Eligible for message	Description of the possible messaging scenarios	Correct	Incorrect
4th day notifications (daily on school days)	Same as above	Student is absent today, today's absence is the fourth consecutive, and message sent	✓	
		Student is absent today, today's absence is not the fourth consecutive, and message not sent	✓	
		Student is present today and message not sent	✓	
		Student is absent today and today's absence is the fourth consecutive, and message not sent		✓
		Student is absent today and today's absence is not the fourth consecutive, and message sent		✓
Goal Commitment message (Sundays)	Same as above, plus randomly assigned to Goal Commitment messaging	Message sent to at least one parent of an eligible student	✓	
		Message not sent to at least one parent of an eligible student (for example, because SchoolMessenger system failed, message wasn't scheduled correctly)		✓
Goal feedback (Fridays)	Same as above, plus randomly assigned to Goal Commitment messaging	Student had perfect attendance (indicator shows no absences that week), and congratulations/perfect attendance message sent	✓	
		Student had imperfect attendance (indicator shows 1+ absences that week), and "try harder" message sent	✓	
		Student had perfect attendance (indicator shows no absences that week), and "try harder" message sent		✓
		Student had imperfect attendance (indicator shows 1+ absences that week), and "congratulations" message sent		✓
		Parents indicated they did not want to commit to perfect attendance and congratulations/perfect attendance message sent		✓
		Parents indicated they did not want to commit to perfect attendance and "try harder" message sent		✓
		Message not sent to at least one parent of an eligible student (for example, because SchoolMessenger system failed)		✓
School Staff Outreach (Spring)	Same as above, plus randomly assigned to School Staff Outreach	At least one message sent by school staff	✓	
		No messages sent by school staff		✓

The school attendance counselor log provided data about the implementation of School Staff Outreach as well as measures of service contrast (that is, typical attendance outreach-related practices in study schools).

The staff who conducted School Staff Outreach completed school attendance counselor logs in early February, early March, and early April. The logs asked the attendance counselor about outreach activities to a sample of families across all study conditions during the prior month. Exhibit B.18 shows the response rate for each of the three logs, and overall.

Exhibit B.18. School staff outreach attendance counselor log response rates

	Log 1	Log 2	Log 3	Overall
Number of schools	108	108	108	108
Number of attendance counselor logs	118	118	118	354
Response rate (percent)	93.2	94.1	95.8	94.4

SOURCE: Authors' compilation.

Measures of the costs of the texting strategy were created from interview protocols developed by the study team and administered to district IT staff. The study team also captured cost data from AIR's accounting system, which included costs for study team staff for supporting implementation (such as conducting School Staff Outreach trainings) and the text messaging provider.

Minimum Detectable Effects

Minimum detectable effects are the smallest differences between one texting group and another (or the no-messaging control group) that the study has a good chance of finding to be statistically significant. The study team used actual sample sizes and data collected to estimate the minimum detectable effects for the comparisons of the four adaptive interventions (that is, the four versions of the adaptive texting strategy), as well as the comparisons between the two basic messaging approaches and the two intensified messaging approaches. The minimum detectable effects for these comparisons were calculated for the two main analysis samples for the study – the overall student sample and the subsample of students in families with a history of high absences (hereafter referred to as "students with a history of high absences").

The minimum detectable effects are shown in Exhibits B.19 to B.24. The size of the differences in attendance outcomes that this study could detect with the total analytic sample was similar to those found in prior studies that tested informational attendance-related strategies.[27] The detectable effects are relatively small by conventional standards in education (less than 0.10 standard deviations), but they are still policy relevant magnitudes, especially given that the strategy tested in this study is expected to be relatively low cost.

[27] For example, the effect on total number of days absent in Rogers, Duncan, Wolford, Ternovski, Subramanyam, & Reitano (2017) was 0.03.

Exhibit B.19. Minimum detectable effects for comparing the four versions of the adaptive texting strategy to the no-messaging control condition and to each other on attendance outcomes for the overall sample

Comparison	Minimum detectable effect	
	Chronic absence	Days absent
Benefits-framed basic with School Staff Outreach (AI-1) vs. control	0.05	0.04
Benefits-framed basic with Goal Commitment messaging (AI-2) vs. control	0.05	0.04
Consequences-framed basic with School Staff Outreach (AI-3) vs. control	0.05	0.04
Consequences-framed basic with Goal Commitment messaging (AI-4) vs. control	0.05	0.04
AI-1 vs. AI-2	0.04	0.05
AI-1 vs. AI-3	0.04	0.05
AI-1 vs. AI-4	0.04	0.05
AI-2 vs. AI-3	0.03	0.05
AI-2 vs. AI-4	0.04	0.05
AI-3 vs. AI-4	0.03	0.05

SOURCE: Authors' compilation.
NOTES: The minimum detectable effect reported for chronic absence is Cohen's h. The minimum detectable effect for number of days absent is Cohen's d.

Exhibit B.20. Minimum detectable effects for comparing the four versions of the adaptive texting strategy to the no-messaging control condition and to each other on attendance outcomes for students with a history of high absences

Comparison	Minimum detectable effect	
	Chronic absence	Days absent
Benefits-framed basic with School Staff Outreach (AI-1) vs. control	0.09	0.08
Benefits-framed basic with Goal Commitment messaging (AI-2) vs. control	0.09	0.08
Consequences-framed basic with School Staff Outreach (AI-3) vs. control	0.09	0.08
Consequences-framed basic with Goal Commitment messaging (AI-4) vs. control	0.09	0.08
AI-1 vs. AI-2	0.07	0.10
AI-1 vs. AI-3	0.05	0.10
AI-1 vs. AI-4	0.09	0.10
AI-2 vs. AI-3	0.08	0.10
AI-2 vs. AI-4	0.08	0.10
AI-3 vs. AI-4	0.09	0.10

SOURCE: Authors' compilation.
NOTES: The minimum detectable effect reported for chronic absence is Cohen's h. The minimum detectable effect for number of days absent is Cohen's d.

Exhibit B.21. Minimum detectable effects for comparing the four versions of the adaptive texting strategy to the no-messaging control condition and to each other on achievement outcomes for the overall sample

Comparison	Minimum detectable effect	
	Reading achievement	Math achievement
Benefits-framed basic with School Staff Outreach (AI-1) vs. control	0.07	0.07
Benefits-framed basic with Goal Commitment messaging (AI-2) vs. control	0.07	0.07
Consequences-framed basic with School Staff Outreach (AI-3) vs. control	0.07	0.07
Consequences-framed basic with Goal Commitment messaging (AI-4) vs. control	0.07	0.07
AI-1 vs. AI-2	0.08	0.08
AI-1 vs. AI-3	0.08	0.08
AI-1 vs. AI-4	0.08	0.08
AI-2 vs. AI-3	0.08	0.08
AI-2 vs. AI-4	0.08	0.08
AI-3 vs. AI-4	0.08	0.08

SOURCE: Authors' compilation.
NOTES: The minimum detectable effect for reading and mathematics achievement is Cohen's d.

Exhibit B.22. Minimum detectable effects for comparing the four versions of the adaptive texting strategy to the no- messaging control condition and to each other on achievement outcomes for students with a history of high absences

Comparison	Minimum detectable effect	
	Reading achievement	Math achievement
Benefits-framed basic with School Staff Outreach (AI-1) vs. control	0.15	0.15
Benefits-framed basic with Goal Commitment messaging (AI-2) vs. control	0.15	0.15
Consequences-framed basic with School Staff Outreach (AI-3) vs. control	0.14	0.14
Consequences-framed basic with Goal Commitment messaging (AI-4) vs. control	0.14	0.14
AI-1 vs. AI-2	0.17	0.17
AI-1 vs. AI-3	0.16	0.16
AI-1 vs. AI-4	0.16	0.16
AI-2 vs. AI-3	0.16	0.16
AI-2 vs. AI-4	0.16	0.16
AI-3 vs. AI-4	0.16	0.16

SOURCE: Authors' compilation.
NOTES: The minimum detectable effect for reading and mathematics achievement is Cohen's d.

Exhibit B.23. Minimum detectable effects for comparing the basic messaging approaches to the no-messaging control condition and to each other on attendance outcomes for the overall sample and for students with a history of high absences

Comparison	Minimum detectable effect			
	Overall sample		Students with a history of high absences	
	Chronic absence	Days absent	Chronic absence	Days absent
Any basic messaging (benefits- or consequences-framed) vs. control	0.04	0.04	0.07	0.07
Benefits-framed basic messaging vs. control	0.04	0.04	0.08	0.08
Consequences-framed basic messaging vs. control	0.04	0.04	0.08	0.08
Benefits-framed basic messaging vs. consequences-framed basic messaging	0.04	0.04	0.08	0.08

SOURCE: Authors' compilation.
NOTES: The minimum detectable effect reported for chronic absence is Cohen's h. The minimum detectable effect for number of days absent is Cohen's d.

Exhibit B.24. Minimum detectable effects for comparing the intensified messaging approaches to each other on attendance outcomes for the overall sample and for students with a history of high absences

Comparison	Minimum detectable effect			
	Overall sample		Students with a history of high absences	
	Chronic absence	Days absent	Chronic absence	Days absent
School Staff Outreach vs. Goal Commitment	0.02	0.02	0.06	0.06

SOURCE: Authors' compilation.
NOTES: The minimum detectable effect reported for chronic absence is Cohen's h. The minimum detectable effect for number of days absent is Cohen's d.

Impact Analysis Approaches

This study was designed to estimate the impact of the different versions of the adaptive messaging strategy on student attendance at two points in the year (mid-year and end of year) and achievement at the end of the year. Exhibit B.25 provides a high-level summary of the types of analyses reported in Appendix C and that provided the basis for the findings summarized in the main body of the report. Appendix C also includes results for the secondary attendance outcome, number of days absent. Additional exploratory and sensitivity analyses and results are described in Appendix E.

All impact analyses were conducted with the full student analytic sample defined above in "Random Assignment and Analytic Sample," and not just those for whom the sending and receipt of the messages was confirmed. This means the study estimated the impact of parents being offered the text messaging (the "intent to treat") rather than the impact of using the messages, because the former is a more realistic way in which districts would consider adding a strategy like this and more accurately reflects the cost of the strategy.

The impact models included a number of covariates to take into account the way random assignment was conducted and the possibility of differences in student characteristics across the messaging versions by chance. The student-level characteristics included free or reduced-price lunch program eligibility, student ethnicity/race, special education status, and prior year academic achievement (only for achievement outcome analysis). Other covariates represented the blocking variables used in the randomization: having a history of high absences, having at least one parent with a working mobile phone with short message service (SMS) at baseline, and school indicator variables. (Having a history of high absences was omitted as a covariate for analyses with the sub-sample of students with a history of high absences). Using the randomization block as a covariate makes the analysis a "fixed effects" model, ensuring that only students with the same observable characteristics are compared to each other (for example, from the same school, same special education status, etc.).

The analyses correct for multiple comparisons because they compared different text messaging strategies to each other.[28] The analysis corrected for four comparisons for basic messaging (any of the two basic messaging strategies compared to control, each of the two basic messaging strategies separately compared to control, and the two basic messaging strategies compared to each other). The analysis of the adaptive interventions compared to the no-messaging control condition also corrected for four comparisons (each adaptive intervention compared to control), while the analysis comparing the adaptive interventions to each other corrected for six comparisons. The analyses did not include multiple comparison corrections for the number of outcomes. The WWC Handbook specifies that such adjustments are only needed for multiple primary outcomes within the same domain. Chronic absence and number of days absent are within the same outcome domain (attendance), but only chronic absence was considered a primary outcome in this study. Reading and mathematics achievement are each considered to be in separate domains.

[28] The study's approach to correcting for multiple comparisons was guided by the What Works Clearinghouse (WWC) Procedures Handbook (version 4.1, Appendix F, pp. F-3 to F-7). However, because the WWC has not yet addressed the issue of multiple comparisons for SMART designs specifically, the study adopted a conservative approach.

Exhibit B.25. Summary of impact analyses reported in the main body of the report and Appendix C

Research question	Outcomes	Comparisons of groups	Method
1.a Do the four combinations of basic and intensified messaging (i.e., the four adaptive interventions) improve end-of-year attendance or achievement when compared to no-messaging?	Primary attendance outcome: chronic absence (missed 10 percent or more of school days) between October 1 and end of year). Secondary attendance outcome: number of days absent between October 1 and end of year).	Compare each adaptive intervention to the no-messaging control group. Results reported for the overall sample and subsample of students with a history of high absences.	Regression analysis (students within blocks, blocks as fixed effects) with inverse probability weighting to account for sequential randomization.
1.b Do the two basic messaging approaches (benefits-framed and consequences-framed messaging) improve end-of-fall attendance compared to no messaging?	Chronic absence (primary), and number of days absent (secondary) between October and end of December 2017.	Benefits-framed basic or consequences-framed basic vs. no-messaging control Benefits-framed basic vs. Control Consequences-framed basic vs. no-messaging control Results reported for the overall sample and subsample of students with a history of high absences.	Regression analysis (students within blocks, blocks as fixed effects); Wald tests to compare parameters based on the sample estimate[29]
1.c Did adding intensified messaging to basic messaging in the spring reduce absence more than basic messaging would have alone, for students with higher absences in the fall?	Chronic absence between January 2 and end of year.	Any basic messaging (benefits- or consequences-framed) vs. any intensified messaging (School Staff Outreach or Goal Commitment) Results reported for the overall sample and subsample of students with a history of high absences.	Regression discontinuity analysis comparing the chronic absence outcome for students from families just below the 8 percent threshold to qualify for intensive messaging to those just above the 8 percent threshold to qualify for intensive messaging.

[29] The Wald test is used in statistical inference and hypothesis testing. It is a statistical test of estimated parameters in a model, with the null hypothesis that a set of parameters is equal to some designated value. The Wald test can be used to test multiple hypotheses about multiple parameters simultaneously (https://www.air.org/sites/default/files/EdSurvey-WaldTest.pdf).

Research question	Outcomes	Comparisons of groups	Method
2.a Do the four combinations of basic and intensified messaging (i.e., the four adaptive interventions; AIs) have different effects on end-of-year attendance when compared to each other?	Primary: chronic absence (missed 10 percent or more of school days) between October 1 and end of year Secondary: number of days absent between October 1 and end of year	Compare adaptive interventions to each other. AI1 vs. AI2 AI1 vs. AI3 AI1 vs. AI4 AI2 vs. AI3 AI2 vs. AI4 AI3 vs. AI4 Results reported for the overall sample and subsample of students with a history of high absences.	Regression analysis (students within blocks, blocks as fixed effects) with inverse probability weighting to account for sequential randomization.
2.b Do the two basic messaging approaches (benefits-and consequences-framed messaging) have different effects on end-of-fall attendance when compared to each other?	Chronic absence (primary), and number of days absent (secondary) between October and December 2017.	Benefits-framed basic messaging vs. consequences-framed basic messaging. Results reported for the overall sample and subsample of students with a history of high absences.	Regression analysis (students within blocks, blocks as fixed effects); Wald tests to compare parameters based on the sample estimate.
2.c For children above the 8 percent absence threshold in the fall despite basic messaging, does providing school staff-initiated parent outreach and interpersonal support (School Staff Outreach) or goal commitment messaging with additional tips and resources (Goal Commitment messaging) affect attendance?	Chronic absence (10 percent or more school days missed) between January 2 and the end of spring semester 2018 (grades K-5). Number of days absent as secondary attendance outcome.	School Staff Outreach vs. Goal Commitment messaging Results reported for the overall sample, subsample of students with a history of high absences, and subsample of students whose home language was English.	Regression analysis (students within blocks, blocks as fixed effects) with inverse probability weighting to account for sequential randomization.
3. Do the four adaptive interventions have effects on academic achievement when compared to no-messaging control?	Math and reading achievement (grades 3-5) at the end of spring semester 2018	Compare each adaptive intervention to the no-messaging control group. Results reported for the overall sample and subsample of students with a history of high absences.	Regression analysis (students within blocks, blocks as fixed effects) with inverse probability weighting to account for sequential randomization.

SOURCE: Authors' compilation.

Analytical Models for Comparing Adaptive Interventions to No-Messaging Control Condition and to Each Other

The study used regression models to estimate the impact of the four adaptive interventions compared to the no-messaging control condition and to each other. A model for the number of days absent outcome is described here using a linear specification (a sensitivity analysis was also conducted using Poisson models, as described in Appendix E). The analytical model for the chronic absence outcome is similar but used a probit model.

Let Y_{ij} be the number of days absent outcome for student i in block j. Let $A_{ij}^{(1)} \in \{-1,0,1\}$ denote the basic messaging assigned in the first randomization such that $A_{ij}^{(1)} = 0$ if the student/family was assigned to the no-messaging control condition, $A_{ij}^{(1)} = -1$ if the student/family was assigned to consequences-framed basic messaging, and $A_{ij}^{(1)} = 1$ if the student/family was assigned to benefits-framed basic messaging. Let $A_{ij}^{(2)} \in \{-1,0,1\}$ denote the intensified messaging assigned at the second stage such that $A_{ij}^{(2)} = -1$ if the student/family was assigned to Goal Commitment messaging, $A_{ij}^{(2)} = 1$ if the student/family was assigned to School Staff Outreach, and $A_{ij}^{(2)} = 0$ if the student/family was assigned to the no-messaging control condition in the first randomization.

As a result, the following five messaging conditions were embedded in the sequential multiple assignment randomized trial (SMART):

1. $\pi^{Control}$ which assigned students and their families to the no-messaging control condition in the first randomization and continued to the end of the study.
2. π^{AI1} which assigned students and their families to benefits-framed basic messaging in the first randomization. Families with students above the 8 percent absence threshold were assigned to School Staff Outreach in the second randomization while families whose students were all below the absence threshold continued with the benefits-framed basic messaging.
3. π^{AI2} which assigned students and their families to benefits-framed basic messaging in the first randomization. Families with students above the 8 percent absence threshold were assigned to Goal Commitment in the second randomization while families whose students were all below the absence threshold continued with benefits-framed basic messaging.
4. π^{AI3} which assigned students and their families to consequences-framed basic messaging in the first randomization. Families with students above the 8 percent absence threshold were assigned to School Staff Outreach in the second randomization while families whose students were all below the absence threshold continued with consequences-framed basic messaging.
5. π^{AI4} which assigned students and their families to consequences-framed basic messaging in the first randomization. Families with students above the 8 percent absence threshold were assigned to Goal Commitment in the second randomization while families whose students were all below the absence threshold continued with consequences-framed basic messaging.

First, consider all the students/families who were consistent with strategy π^{AI1}. This strategy included (1) all students/families assigned to benefits-framed basic messaging in the first randomization who were below the absence threshold at the end of the fall semester and continued with benefits-framed basic messaging (with probability of 1.00) and (2) those students/families who were above the absence threshold at the end of the fall and were assigned to School Staff Outreach in the second randomization (with probability of 0.50). Since only half of the students/families who were above the absence threshold were assigned to School Staff Outreach (the other half were assigned to Goal Commitment messaging), students/families who were above the absence threshold would be under-represented when compared to those who were below the threshold. The analysis corrected for this under-representation by assigning a weight, W_{ij}, to student i in block j. The weight W_{ij} is the

inverse of the probability of being randomized to the basic and intensified messaging strategies that the student/family received. Because students/families were randomized to benefits-framed basic messaging, consequences-framed basic messaging, and the no-messaging control condition in equal proportions (with randomization probability 1/3 for each condition), a student/family who was below the absence threshold at the end of the fall semester and who therefore continued with their basic messaging strategy with probability of 1.00 received a weight $W_{ij} = 3$. A student/family who was above the absence threshold at the end of the fall semester and was then assigned to School Staff Outreach with randomization probability 0.50 received a weight of $W_{ij} = 6$. Students/families who were assigned to the no-messaging control condition and continued with the control condition received a weight of $W_{ij} = 3$.

Further adjustments were required to appropriately estimate the means of all the adaptive interventions simultaneously. If a student/family was assigned benefits-framed basic messaging in the first randomization and was below the absence threshold at the end of the fall semester, this student's/family's assignments would be consistent with both π^{AI1} and π^{AI2}. To analytically correct for this, their observation is counted twice, once for both adaptive interventions. This was done by creating a new dataset that had two identical observations for each student/family that was below the absence threshold after the fall semester (i.e., students/families who would continue with their basic messaging assignment) and the original data for each student/family who was above the absence threshold. Then for the students/families that were below the absence threshold after the fall semester, we defined the indicator of the intensified messaging strategy $A_{ij}^{(2)} = 1$ (i.e., School Staff Outreach) for one of the identical observations and $A_{ij}^{(2)} = -1$ (i.e., Goal Commitment messaging) for the other.

The model for the number of days absent outcome is then:

$$\text{B. 1.} \quad Y_{ij} = \beta_0 + \beta_1 A_{ij}^{(1)} + \beta_2 A_{ij}^{(2)} + \beta_3 A_{ij}^{(1)} A_{ij}^{(2)} + \xi^T X_{ij}^{(1)} + \gamma_j + \nu_{ij}$$

where $X_{ij}^{(1)}$ is a grand mean centered vector of baseline student covariates, γ_j is a fixed effect for block j, and ν_{ij} is the within-block error for child i in block j that is taken to be normally distributed with mean 0 and variance σ^2. Then the expected number of days absent for each of the adaptive interventions can be written as a linear combination of the β's such that

$$\mu^{AI1} = \beta_0 + \beta_1 + \beta_2 + \beta_3$$

$$\mu^{AI2} = \beta_0 + \beta_1 - \beta_2 - \beta_3$$

$$\mu^{AI3} = \beta_0 - \beta_1 + \beta_2 - \beta_3$$

$$\mu^{AI4} = \beta_0 - \beta_1 - \beta_2 + \beta_3$$

$$\mu^{Control} = \beta_0.$$

The regression coefficients were estimated using weighted least squares by minimizing

$$\text{B. 2.} \quad \sum_{j=1}^{m} \sum_{i=1}^{n_j} W_{ij} (Y_{ij} - \beta_0 - \beta_1 A_{ij}^{(1)} - \beta_2 A_{ij}^{(2)} - \beta_3 A_{ij}^{(1)} A_{ij}^{(2)} - \xi^T X_{ij}^{(1)} - \gamma_j)$$

Standard errors were estimated using the robust sandwich standard errors, which account for the replication of records for students below the absence threshold. These estimates were used to test the null hypothesis that there is no difference in the mean outcome between each adaptive intervention and the control condition or between the different adaptive interventions. For example, the estimator for $\mu^{AI1} - \mu^{AI2} = 2\beta_2 + 2\beta_3$ can be shown to have an approximately normal sampling distribution, and a *t*-test statistic based on this result can be

used to test the null hypothesis that there is no difference in mean outcome between following π^{AI1} and π^{AI2}. The study accounted for multiple comparisons with a Bonferroni correction, specifically, for four different tests to compare the adaptive intervention means to the control group mean, and six different tests when comparing the four adaptive intervention means to each other.

Analytical Models for Comparing Basic Messaging Approaches to No-Messaging Control and Each Other

The following model was used to estimate the effect on basic messaging (benefits- or consequences-framed) on chronic absence:

$$\text{B.3.} \quad \Pr(Y_{ij} = 1) = \Phi(\zeta_0 + \zeta_1 MSG_{ij} + \xi^T X_{ij}^{(1)} + \gamma_j)$$

where Y_{ij} is an indicator of whether child i in block j was chronically absent (Y_{ij} equals 1 if the student was chronically absent and 0 if the student was not chronically absent), MSG_{ij} is an indicator for whether child/family i in block j was assigned to either benefits- or consequences-framed basic messaging, $X_{ij}^{(1)}$ is a vector of student characteristics, and γ_j is a fixed effect for block j. $\Phi(\,)$ is defined as the cumulative distribution function of the standard normal distribution.

A Wald test determined whether assignment to basic messaging (benefits- or consequences-framed) had a significant effect on chronic absence in the fall semester by testing whether ζ_1 is significantly different than zero.

The model to estimate the separate effect of each of the two basic messaging approaches (versus control) on whether students were chronically absent in the fall is shown in Equation B.4:

$$\text{B.4.} \quad \Phi^{-1}\{\Pr(Y_{ij} = 1)\} = \zeta_0 + \zeta_1 Basic\_ben_{ij} + \zeta_2 Basic\_con_{ij} + \xi^T X_{ij}^{(1)} + \gamma_j$$

where Y_{ij} is the attendance outcome for child i in block j such that Y_{ij} equals 1 if the student was chronically absent and 0 if the student was not chronically absent. $Basic\_ben_{ij}$ is an indicator of whether child/family i in block j was assigned to the benefits-framed basic messaging and similarly $Basic\_con_{ij}$ is the indicator for whether a child/family was assigned to the consequences-framed basic messaging during the fall semester, $X_{ij}^{(1)}$ is a vector of student characteristics, and γ_j is a fixed effect for block j. $\Phi(\,)$ is defined as the cumulative distribution function of the standard normal distribution.

To assess the impact of the basic messaging approaches relative to control, the study team tested whether ζ_1 or ζ_2 is significantly different than zero using Wald tests. To test whether benefits- or consequences-framed basic messaging had different effects, the study team tested whether $\zeta_1 - \zeta_2$ was significantly different than zero.

Analysis for Assessing the Added Effect of Intensified Messaging Over Basic Messaging Alone

Using the SMART design, the study's main impact analyses examined whether the basic messaging approaches had an impact on attendance outcomes in the fall, whether one intensified messaging approach had a larger impact than the other on attendance outcomes in the spring, and whether the combinations of basic and intensified messaging approaches had an impact on attendance across the year. The main analyses, however, did not address the question of whether adding intensified messaging for families of students with more absences in the fall made a difference, over and above continuing with basic messaging. This question is important because adding the intensified messaging also added to the cost of the messaging strategy.

The study was not designed to answer this question using the formal SMART analytic framework. That would have required assigning an additional "control" group during the second random assignment, in addition to the two intensified messaging groups. This control group would have been composed of families who were above the fall absence threshold, and they would have continued to receive only the basic messaging from the fall. Unfortunately, the study sample was not large enough to support this third group for the second random assignment. There were also ethical concerns about withholding intensified messaging from families who were "unresponsive" to basic messaging.

To address this question, the study team instead used a regression discontinuity design (RDD) that took advantage of the fact that families were assigned to intensified messaging on the basis of a strict cutoff on fall absence rates (October to end of December 2017). Specifically, families that had at least one child who missed 8 percent or more of school days in the fall were assigned to one of the two intensified approaches for the spring: School Staff Outreach or Goal Commitment messaging. Families that had all children below this threshold (missed less than 8 percent of school days in the fall) continued with basic messaging for the rest of the school year.

A RDD provides valid causal inference when a continuous assignment variable and its cutoff score are used to assign units to intervention or comparison conditions (Shadish, Cook, & Campbell, 2002). The analysis yields an estimate of a local average treatment effect, or a measure of impact between those who fall immediately above and below the cut score. The analysis for RDD used a nonparametric model with two different bandwidths to estimate the effect of intensified messaging. The two algorithms that were used to select the bandwidths were IK (Imbens & Kalyanaraman, 2012) and CCT (Calonico, Cattaneo, & Titiunik, 2014).

Regression discontinuity is a valid design to examine whether intensified messaging added to the effect of basic messaging, because families were assigned to receive an intensified messaging approach using a numerical forcing variable with a strict cutoff (8 percent), which was uniformly applied by the study team across all schools and families in the study, with no exceptions, making this a 'sharp' RDD. That is, all families in a basic messaging condition whose children were below the 8 percent cutoff continued to receive only basic messaging in the spring, while all families in a basic messaging condition who had at least one child above the 8 percent cutoff received both intensified messaging and basic messaging in the spring.

The sections below present the steps taken to verify the validity of the design and analysis. These are aligned with the What Works Clearinghouse's RDD standards (Version 4.0), which focus on four areas for sharp RDDs: (1) integrity of the forcing variable, (2) attrition, (3) continuity of the relationship between the forcing variable and the outcome, and (4) functional form and bandwidth.

Integrity of the Forcing Variable. Because RDDs rely on a forcing variable to determine assignment to intervention and inferences about intervention effects, it is essential to evaluate whether the forcing variable could have been manipulated for certain families to affect their intervention assignment. Manipulation of the forcing variable was unlikely in this case because it would mean district or school staff changing raw, daily student attendance data in ways that would manipulate the aggregate-level forcing variable calculated by the study team—percentage of days absent between October and end of December 2017— to be above or below the 8 percent cutoff, according to the intervention assignment preferred by the district or school staff for each student/family. The study team selected both the forcing variable and the 8 percent cutoff. And, based on the study team's knowledge of participating districts' attendance policies, the 8 percent cutoff did not correspond to any existing cutoff districts used for initiating attendance-related actions or interventions (for example, a phone call or letter home). Therefore, it is unlikely to be a cutoff on which district or school staff would already have been focused. Importantly, the study team did not communicate the 8 percent threshold to district and school staff who had access to the daily attendance data. Because these individuals had no knowledge of the threshold

and how it would be used to determine intervention conditions in the study, there was no plausible incentive or opportunity for manipulation around the 8 percent cutoff.

Additionally, in establishing the integrity of the forcing variable, density plots did not reveal discontinuities at the 8 percent threshold that are obviously larger than discontinuities observed at other points along the forcing variable. (The top panel of Exhibit B.26a shows the distribution for the overall sample used in the RDD analysis and the top panel of Exhibit B.26b shows the distribution for students with a history of high absences used in the RDD.) Because the forcing variable is based on discrete counts (percentage of days absent) over a relatively short 2.5-month window, the forcing variable is unsurprisingly somewhat lumpy. This is not a concern for the validity of the RDD because as noted above, the lumpiness is not more pronounced at the 8 percent cutoff than at other parts of the distribution. This suggests that any discontinuities at the cutoff are naturally occurring and not due to manipulation. In fact, analogous density plots for the no-messaging control group (bottom panel of Exhibits B.26a and B.26b) show a very similar distribution. Since all families in the control group received no messaging for the entire school year, there was no incentive to manipulate their scores around the 8 percent cutoff. The similarity in these distributions therefore provides further evidence that there was unlikely to be manipulation.

Finally, the study team examined the statistical integrity of the forcing variable by conducting a McCrary test to see if there are discontinuities in the forcing variable distribution at the RDD cutoff (McCrary, 2008). The McCrary test indicated a discontinuity in densities at the cutoff for the overall student sample (p = .01) but not for the subsample of students with a history of high absences (p = .41). A McCrary test on the no-messaging control group found a similar pattern of results, where there was a statistically significant discontinuity in the forcing variable distribution at the RDD cutoff for the overall sample (p = .04), but not for the subsample of students with a history of high absences (p = .75). Together, these results suggest that concerns about manipulation are likely to be unwarranted because of the clear institutional integrity of the forcing variable and the compelling evidence showing that the forcing variable is naturally lumpy.

Exhibit B.26a. Density plots for the forcing variables, intervention group (top) and no-messaging control group (bottom), overall student sample

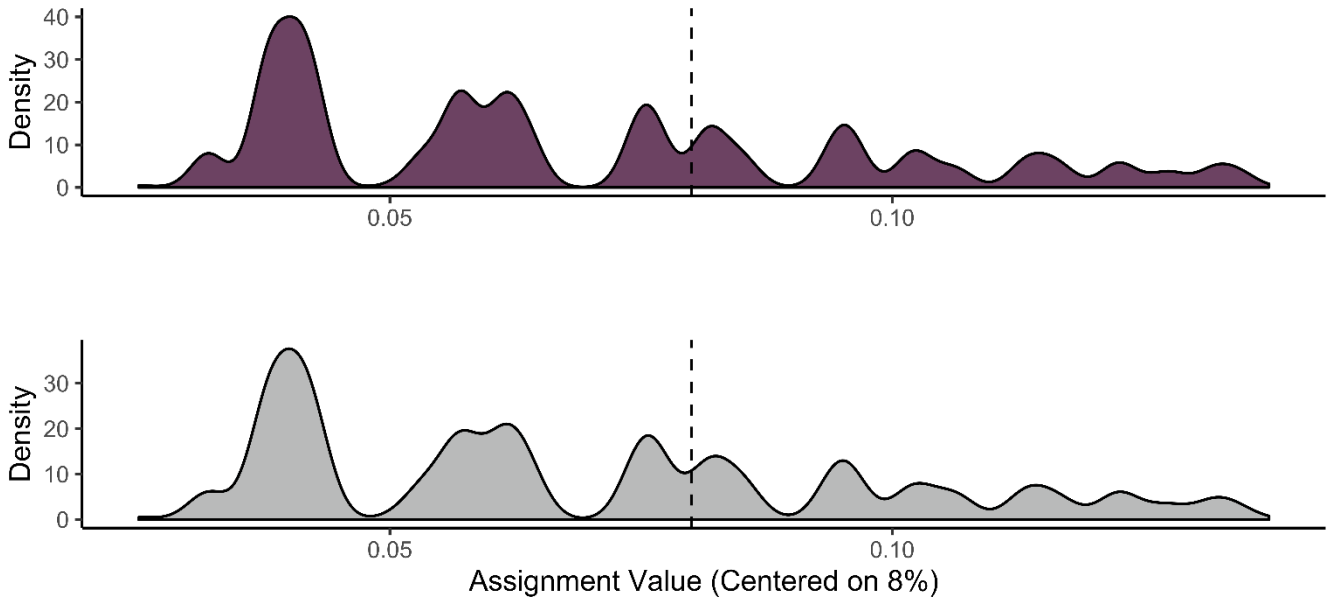
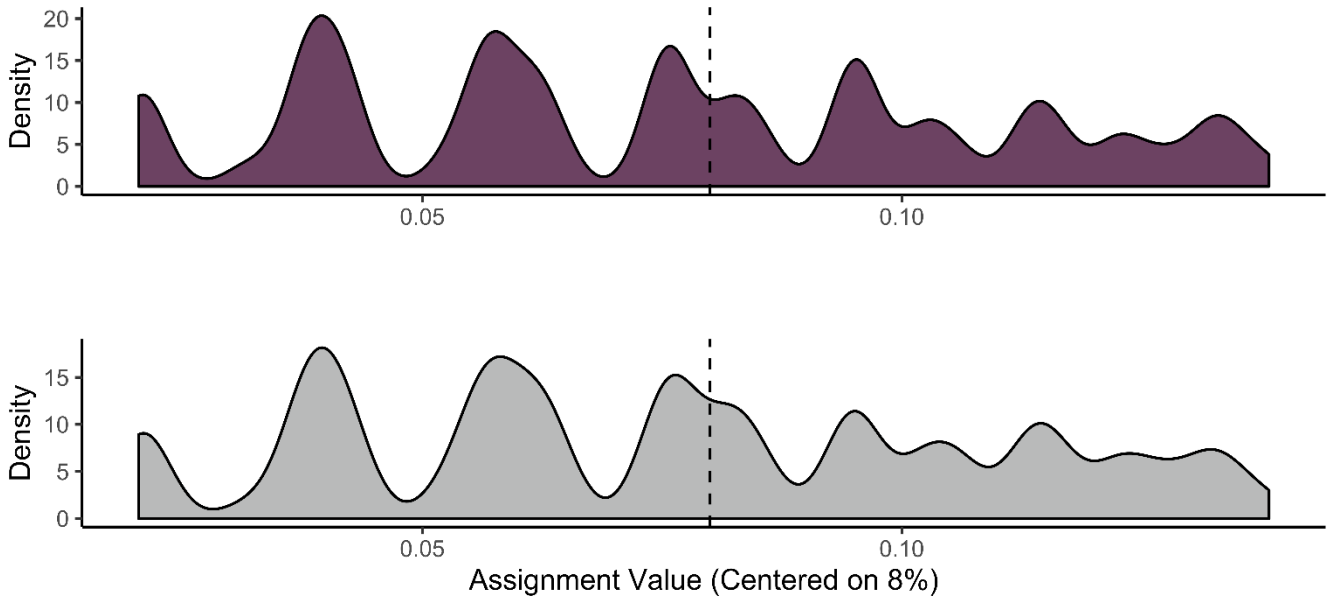


Exhibit B.26b. Density plots for the forcing variables, intervention group (top) and no-messaging control group (bottom), subsample of students with history of high absences



Attrition. As in any experimental or quasi-experimental analysis, attrition in RDDs can bias inferences about intervention effects. For example, if the families who received intensified messaging had been likely to move out of a participating district, the effect of intensified messaging could be misestimated. To be included in the regression discontinuity analysis, as with the main analyses, a student must (1) not have been opted out of the

study by a parent, (2) have been enrolled for 100 percent of the school days, and (3) have a full set of demographic variables. Exhibit B.26c shows the number of students eligible for inclusion in the RDD analysis within the optimal bandwidth identified using the IK algorithm, and the percentage of these eligible students who were excluded from the final RDD analysis on chronic absences due to attrition. Students from families below the cutoff within the optimal bandwidth correspond to the "control" group, and students from families above the cutoff within the optimal bandwidth correspond to the "intervention" group. Attrition is reported for both the overall student sample and the subgroup of students with a history of high absences. The overall and differential attrition rates for both analytic samples correspond to a low level of attrition under the WWC's "cautious" threshold.

Exhibit B.26c. Attrition results, chronic absence

Sample	Number of students eligible for inclusion in the RDD		Number of students actually included in the RDD		Overall attrition	Differential attrition
	Below cutoff	Above cutoff	Below cutoff	Above cutoff		
Overall	5,575	2,948	5,140	2,621	8.9%	3.3%
History of high absences	1,635	1,305	1,465	1,156	10.9%	1.0%

SOURCE: Authors' compilation.

Continuity of the Relationship Between the Outcome and the Forcing Variable. The study team also examined the continuity of the relationship between the forcing variable and the outcome to examine the likelihood that something other than the addition of intensified messaging could explain impacts on chronic absence. The specified RDD functional form (i.e., the relationship between the forcing variable and the outcome) and optimal IK bandwidths were applied to examine baseline equivalence of covariates at the cutoff, including race, gender, disability status, English learner status, whether or not a family had a working cell phone at baseline, and the baseline indicator for history of high absences.[30] That is, baseline equivalence tests were conducted on the same samples used in the RDD analysis of impacts on outcomes.

The results of the baseline equivalence tests are shown in Exhibits B.26d (for the overall sample) and B.26e (for the subsample of students with a history of high absences). Since the outcome of interest in the RDD analysis is chronic absence, the primary baseline covariate of interest is a baseline measure of chronic absence or more specifically, the study's indicator for whether the student has a "history of high absences" (chronically absent in the school year prior to the study or in the first month of the school year for the study, which was all prior to the start of the attendance messaging intervention).[31] For the overall student sample, the magnitude of the difference at the cutoff in the likelihood of having a history of high absences was 0.12 standard deviation, which is within WWC's 0.25 upper limit. For the subsample of students with a history of high absences, this difference is by definition zero at the cutoff since all students in the analysis have a history of high absences. Tests of baseline equivalence on the other variables, such as race, disability status, English learner status, gender, and whether the student's parent had a working cell phone at baseline, found most of these variables were within WWC's 0.25 limit for baseline differences expressed in standard deviation units. There were a few exceptions, most notably

[30] Following the WWC procedures for binary variables, results include Cox index values for each of the covariates.

[31] An alternative would be to use a baseline measure of student achievement. However, because the study sample is grades K through 5 elementary school students, only students in grades 4 and 5 would have baseline scores, because standardized testing usually does not begin until students are in grade 3.

that students below the cutoff were more likely to be Hispanic while students above the cutoff were more likely to be African American. All of these covariates were included as covariates in the RDD analyses.

Analyses examining the continuity of the relationship between the outcome and the forcing variable also included scatterplots with regression estimates to describe the relationship between the binned forcing variable (i.e., the probability of chronic absence for each unique value of the forcing variable) and the outcome. These scatterplots are presented in the results section (see Exhibits C.3b and C.3d). These graphs do not obviously show any discontinuities at forcing variable values within the bandwidth that exceed two times the standard error of the impact estimated at the cutoff, which was 2.41 percent for the overall sample and 2.72 percent for the sample of students with a history of high absences.

Exhibit B.26d. Baseline equivalence results, overall sample

Covariate	Predicted probability basic messaging	Predicted probability intensified messaging	Estimated difference in std. dev. units
History of high absences	34.3%	29.8%	-0.12
African American	40.4%	58.1%	0.43
Hispanic	38.5%	21.6%	-0.50
Student with disability	17.7%	15.8%	-0.08
English language learner	14.2%	13.7%	-0.02
White	15.5%	16.8%	0.06
Female	49.4%	49.7%	0.01
Working cell phone at baseline	83.5%	89.9%	0.34

NOTE. Standardized differences for binary variables were estimated using the Cox index. Sample size = 5,140 students within the IK bandwidth, Basic messaging (under threshold); 2,621 students within the IK bandwidth, Intensified messaging (over threshold).

Exhibit B.26e. Baseline equivalence results, sample of students with history of high absences

Covariate	Predicted probability basic messaging	Predicted probability intensified messaging	Estimated difference in std. dev. units
African American	39.6%	56.0%	0.40
Hispanic	48.0%	27.9%	-0.53
Student with disability	22.5%	22.5%	0.00
English language learner	20.4%	14.2%	-0.26
White	9.8%	11.4%	0.10
Female	47.0%	46.0%	-0.03
Working cell phone at baseline	81.8%	86.6%	0.22

NOTE: Standardized differences for binary variables were estimated using the Cox index. Sample size = 1,465 students within the IK bandwidth, Basic messaging (under threshold); 1,156 students within the IK bandwidth, Intensified messaging (over threshold).

Finally, the study team conducted falsification tests to further examine the likelihood of observing discontinuities along different values of the forcing variable. Falsification tests are used to test for other discontinuities along the forcing variable that could partially explain the estimated intervention impact. The method involves identifying multiple cutoff values other than the enacted cutoff and testing for discontinuities

along the forcing variable. These analyses used the same RDD analysis model and IK bandwidth selection algorithm as the main RDD analysis, with four values below and five values above the enacted cutoff value of 8 percent.[32] The results of these analyses are presented in Exhibit B.26f. At one cutoff value below the enacted cutoff, 3.5 percent, and at one above, 14 percent, there was a statistically significant impact on the chronic absence outcome, for the overall student sample. Additionally, at one cutoff value just below the enacted cutoff, 6.5 percent, there was a statistically significant impact on the chronic absence outcome for the students with a history of high absences.

Exhibit B.26f. Falsification test results showing whether statistically significant effects on chronic absence in the spring exist at alternative cutoffs

Cutoff value	Students overall (*p*-value)	Students with a history of high absences (*p*-value)
2.0%	0.64	0.77
3.5%	<0.001*	0.17
5.0%	0.05	0.75
6.5%	0.07	0.01*
9.5%	0.91	0.25
11.0%	0.76	0.69
12.5%	0.06	0.48
14.0%	0.01*	0.27
15.5%	0.24	0.27

NOTES: The cutoff value of 8 percent was used for the main RDD impact analysis, with results reported in Exhibits C.3a and C.3c. * *p*-value < 0.05.

Functional form and bandwidth. Adequately specifying the relationship between the forcing variable and the outcome is essential in RDDs. Fortunately, several methods are available to help with identifying a functional range (i.e., bandwidth) around the cutoff where the forcing variable-outcome relationship is sufficiently linear. Moreover, these multiple approaches can be used to evaluate the robustness of the findings to how the bandwidth is selected.

The confirmatory analysis used a nonparametric approach, a local linear regression model that accounts for differences in slopes above and below the cutoff (LLCHS). The analyses used two different bandwidth algorithms to test the robustness of the results. The local optimal bandwidth values for each contrast tested were established by using the Imbens and Kalyanaraman (2012) selection algorithm and the CCT bandwidth selection algorithm (Calonico, Cattaneo, & Titiunik, 2014). The local regression model was as follows:

$$\text{B.5.} \qquad Y_{ij} = \beta_0 + \beta_1 T_{ij} + \beta_2 AV_{ij} + \beta_3 T_{ij} AV_{ij} + \beta_4 X_{ij} + \beta_5 S_j + \varepsilon_{ij}$$

where Y_{ij} is the outcome for student i in school j; T_{ij} is an indicator variable for whether the students' family continued with basic messaging only or received additional intensified messaging, AV_{ij} is the assignment variable centered on 8 percent, X_{ij} is a vector of centered baseline student characteristics, including indicators for race (African American, Native American, Asian, Hispanic, multiple races), special education status, English learner status, gender, an indicator for the student's parent having a working mobile phone at baseline, and an indicator

[32] Minimum and maximum cutoff values were restricted so that at least 4 unique values of the forcing variable were on both sides of the enacted cutoff.

for having a history of high absences; and S_j is a vector of school indicators. In addition to controlling for school fixed-effects, the analysis used cluster-robust standard errors at the assignment variable level, as implemented in the clubSandwich package in the R statistical software program.

Analysis for Comparing the Intensified Messaging Approaches to Each Other

The following model was used to estimate the relative effect of intensified messaging approaches (School Staff Outreach or Goal Commitment messaging) on chronic absence:

$$\text{B. 6.} \quad \Pr(Y_{ij} = 1) = \Phi(\zeta_0 + \zeta_1 INT_{ij} + \xi^T X_{ij}^{(1)} + \gamma_j)$$

where Y_{ij} is an indicator of whether student i in school j was chronically absent in the spring (Y_{ij} equals 1 if the student was chronically absent and 0 if not), INT_{ij} is an indicator for whether student/family i in school j was assigned to either School Staff Outreach or Goal Commitment (INT_{ij} equals 1 for School Staff Outreach and 0 for Goal Commitment), $X_{ij}^{(1)}$ is a vector of student characteristics, and γ_j is a fixed effect for school j. $\Phi(\,)$ is defined as the cumulative distribution function of the standard normal distribution.

The analyses assessed whether one of the assigned intensified messaging approaches was more effective in the spring semester by testing whether ζ_1 is significantly different than zero using a Wald test.

APPENDIX C: DETAILED IMPACT AND IMPLEMENTATION FINDINGS

Impact Analysis Results for Student Attendance

This section provides more detail on the results presented in the main report about the impact of the text messaging approaches on chronic absence, as well as full results for analyses of the impact of the text messaging approaches on the number of days absent. Results for number of days absent are not presented in the main report because this was a secondary attendance outcome for the study. In this section we report results for both the chronic absence and the total number of days absent outcomes because readers may find it useful to view the results next to each other to facilitate interpretation.

The study team estimated simple linear models for the number of days absent outcome, but also estimated more complex Poisson models as a sensitivity analysis. Poisson models explicitly treat the outcome as a non-negative count variable. The two modeling approaches yielded substantially similar results; that is, the models identified the same comparisons as statistically significant with similar *p*-values and effect sizes. The Poisson model results are included in Appendix E.

The order of the presented results is as follows:

1. Impact of the four adaptive interventions
    a. Impact of adaptive interventions on full-year chronic absence and number of days absent, for the overall sample and the subsample of students with a history of high absences
    b. Graphical presentation of the impact of adaptive interventions on full-year number of days absent
    c. Comparison of adaptive interventions to each other on full-year chronic absence and number of days absent, for the overall sample and the subsample of students with a history of high absences
2. Impact of basic messaging approaches
    a. Impact of basic messaging approaches on chronic absence and number of days absent in fall 2017, for the overall sample and subsample of students with a history of high absences
    b. Graphical presentation of the impact of basic messaging approaches on number of days absent in fall 2017, for the overall sample and subsample of students with a history of high absences
    c. Comparison of basic messaging approaches to each other on chronic absence and number of days absent in fall 2017, for the overall sample and subsample of students with a history of high absences
3. Added benefit of intensified messaging to basic messaging
    a. Effects of any intensified messaging compared to any basic messaging on chronic absence in spring 2018 for the overall sample and subsample of students with a history of high absences
    b. Graphical presentation of the results
4. Comparison of intensified messaging approaches
    a. Impact of School Staff Outreach versus Goal Commitment Messaging on chronic absence and number of days absent in spring 2018 for the overall student sample, the subsample of students with a history of high absences, and the subsample of students whose home language was English
    b. Graphical presentation of the results

Impact of the Adaptive Interventions

Exhibits C.1a and C.1b show pairwise differences in full-year chronic absence and number of days absent, between each adaptive intervention and the no-messaging control condition, for the overall student sample and the subsample of students with a history of high absences. The results for full-year chronic absence support Exhibit 3 in the main report. Exhibit C.1c graphs pairwise differences between each adaptive intervention and

the no-messaging control condition on full-year number of days absent. Exhibits C.1d and C.1e present the pairwise differences between each adaptive intervention on full-year chronic absence and number of days absent, for the overall student sample and the subsample of students with a history of high absences. Exhibits C.1d and C.1e present the evidence to support "The Different Approaches to Basic and Intensified Messaging Were Similarly Effective in Reducing Chronic Absence" section of the main report.

Exhibit C.1a. Pairwise differences between each adaptive intervention and control on full-year attendance outcomes, for all students (results displayed in Exhibit 2 in the main report)

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)					
AI1 vs. control	16.9	20.5	-3.6*	-0.10	<0.001
AI2 vs. control	18.1	20.5	-2.4*	-0.07	0.001
AI3 vs. control	17.6	20.5	-2.9*	-0.08	<0.001
AI4 vs. control	17.6	20.5	-2.9*	-0.08	<0.001
Number of days absent (mean)					
AI1 vs. control	9.2	9.8	-0.6*	-0.07	<0.001
AI2 vs. control	9.2	9.8	-0.6*	-0.07	<0.001
AI3 vs. control	9.2	9.8	-0.6*	-0.08	<0.001
AI4 vs. control	9.2	9.8	-0.6*	-0.08	<0.001

SOURCE: District administrative records.
NOTES: AI1 assigns benefits-framed basic messaging at baseline, then School Staff Outreach if need, otherwise continue with benefits-framed messaging; AI2 assigns benefits-framed basic messaging at baseline, then Goal Commitment messaging if need, otherwise continue with benefits-framed messaging; AI3 assigns consequences-framed basic messaging at baseline, School Staff Outreach if need, otherwise continue with consequences-framed messaging; AI4 assigns consequences-framed basic messaging at baseline, Goal Commitment messaging if need, otherwise continue with consequences-framed messaging. Where "if need" is defined as missing 8 percent of days or more between the start of October and the end of December.
Sample size = 108 schools; 6,631 students in AI1; 6,591 students in AI2; 6,583 students in AI3; 6,564 students in AI4; 7,862 students in control.
Chronic absence and number of days absent are based on attendance records from October 1 through the end of the 2017–18 school year.
The analyses are based on a regression model controlling for school fixed effects, working SMS at baseline indicator, indicator for history of high absences, and a set of student covariates.
Control group means are unadjusted mean percentages (for chronic absence) or unadjusted means (for days absent); messaging group means were computed by adding the estimated differences to the control group means.
The table displays original *p*-values. * Indicates that the average outcome for the adaptive intervention is statistically significantly different from control ($p < .05$) when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.

Exhibit C.1b. Pairwise differences between each adaptive intervention and control on full-year attendance outcomes, for students with a history of high absences (results displayed in Exhibit 2 in the main report)

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)					
AI1 vs. control	39.9	47.1	-7.2*	-0.15	<0.001
AI2 vs. control	42.2	47.1	-4.9*	-0.10	0.008
AI3 vs. control	39.8	47.1	-7.3*	-0.15	<0.001
AI4 vs. control	43.6	47.1	-3.5	-0.07	0.061
Number of days absent (mean)					
AI1 vs. control	15.2	16.6	-1.4*	-0.13	<0.001
AI2 vs. control	15.4	16.6	-1.2*	-0.11	0.001
AI3 vs. control	15.3	16.6	-1.3*	-0.12	<0.001
AI4 vs. control	15.7	16.6	-0.9*	-0.09	0.010

SOURCE: District administrative records.

NOTES: AI1 assigns benefits-framed basic messaging at baseline, then School Staff Outreach if need, otherwise continue with benefits-framed messaging; AI2 assigns benefits-framed basic messaging at baseline, then Goal Commitment messaging if need, otherwise continue with benefits-framed messaging; AI3 assigns consequences-framed basic messaging at baseline, School Staff Outreach if need, otherwise continue with consequences-framed messaging; AI4 assigns consequences-framed basic messaging at baseline, Goal Commitment messaging if need, otherwise continue with consequences-framed messaging. Where "if need" is defined as missing 8 percent of days or more between the start of October and the end of December.

Sample size = 108 schools; 1,509 students in AI1; 1,502 students in AI2; 1,497 students in AI3; 1,519 students in students in AI4; 2,088 students in control.

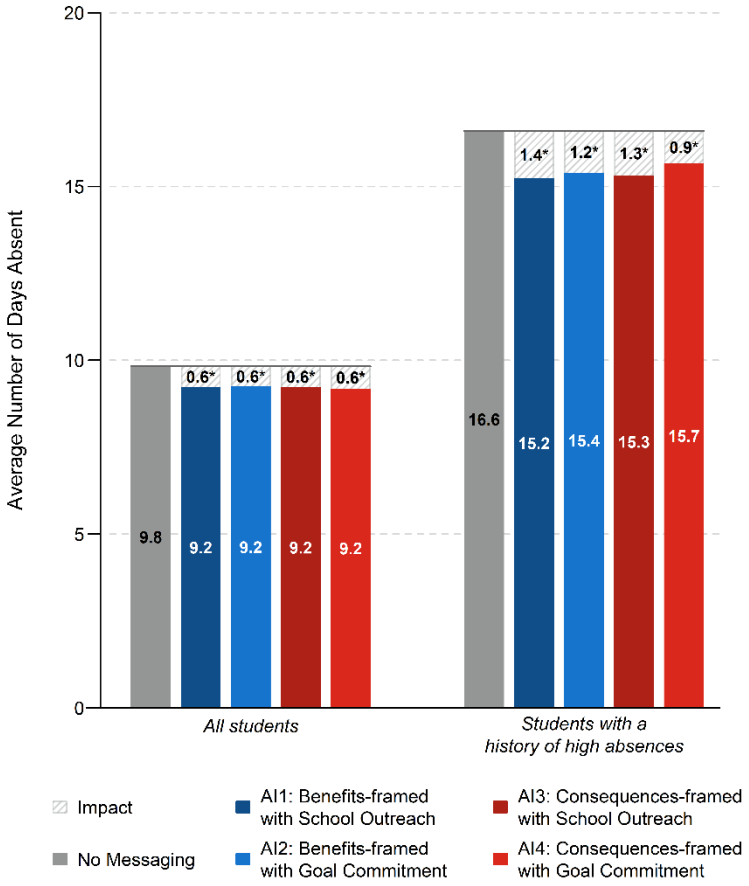
Chronic absence and number of days absent are based on attendance records from October 1 through the end of the 2017–18 school year.

The analyses are based on a regression model controlling for school fixed effects, working SMS at baseline indicator, and a set of student covariates.

Control group means are unadjusted mean percentages (for chronic absence) or unadjusted means (for days absent); messaging group means were computed by adding the estimated differences to the control group means.

* Indicates that the average outcome for the adaptive intervention is statistically significantly different from control. The table displays original *p*-values. ($p < .05$) when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.

Exhibit C.1c. Pairwise differences between each adaptive intervention and the no-messaging control condition on full-year number of days absent



NOTES: Overall sample size = 108 schools; 6,631 students in AI1; 6,591 students in AI2; 6,583 students in AI3; 6,564 students in AI4; 7,862 students in the no-messaging group. Sample size for students with a history of high absences = 108 schools; 1,509 students in AI1; 1,502 students in AI2; 1,497 students in AI3; 1,519 students in students in AI4; 2,088 students in the no-messaging group.
* Indicates that the average outcome for the adaptive intervention is statistically significantly different from the no-messaging group ($p < .05$) when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.

Exhibit C.1d. Pairwise differences between each adaptive intervention, for all students

Outcome	AI1	AI2	AI3	AI4	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)							
AI1 vs. AI2	16.9	18.1			-1.2	-0.04	0.056
AI1 vs. AI3	16.9		17.6		-0.8	-0.02	0.290
AI1 vs. AI4	16.9			17.6	-0.7	-0.02	0.329
AI2 vs. AI3		18.1	17.6		0.4	0.01	0.562
AI2 vs. AI4		18.1		17.6	0.5	0.01	0.501
AI3 vs. AI4			17.6	17.6	0.1	0.00	0.918
Number of days absent (mean)							
AI1 vs. AI2	9.2	9.2			0.0	0.00	0.886
AI1 vs. AI3	9.2		9.2		0.0	0.00	0.978
AI1 vs. AI4	9.2			9.2	0.0	0.01	0.739
AI2 vs. AI3		9.2	9.2		0.0	0.00	0.878
AI2 vs. AI4		9.2		9.2	0.1	0.01	0.640
AI3 vs. AI4			9.2	9.2	0.0	0.01	0.722

SOURCE: District administrative records.

NOTES: AI1 assigns benefits-framed basic messaging at baseline, then School Staff Outreach if need, otherwise continue with benefits-framed messaging; AI2 assigns benefits-framed basic messaging at baseline, then Goal Commitment messaging if need, otherwise continue with benefits-framed messaging; AI3 assigns consequences-framed basic messaging at baseline, School Staff Outreach if need, otherwise continue with consequences-framed messaging; AI4 assigns consequences-framed basic messaging at baseline, Goal Commitment messaging if need, otherwise continue with consequences-framed messaging. Where "if need" is defined as missing 8 percent of days or more between the start of October and the end of December.

Sample size = 108 schools; 6,631 students in AI1; 6,591 students in AI2; 6,583 students in AI3; and 6,564 students in AI4.

Chronic absence and number of days absent are based on attendance records from October 1 through the end of the 2017-18 school year.

Adaptive intervention group means were computed by adding the estimated differences between the adaptive interventions and the control condition to the control group mean (even though control group means not shown in this exhibit).

The table displays original *p*-values. * Indicates that the average outcomes for any two adaptive interventions compared to each other are statistically significantly different from each other ($p < .05$), when the significance level is adjusted for six pairwise comparisons with a Bonferroni correction.

The estimated difference does not always equal the difference between the means of compared conditions due to rounding.

Exhibit C.1e. Pairwise differences between each adaptive intervention, for students with a history of high absences

Outcome	AI1	AI2	AI3	AI4	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)							
AI1 vs. AI2	39.9	42.2			-2.3	-0.05	0.181
AI1 vs. AI3	39.9		39.8		0.0	0.00	0.997
AI1 vs. AI4	39.9			43.6	-3.7	-0.08	0.068
AI2 vs. AI3		42.2	39.8		2.3	0.05	0.249
AI2 vs. AI4		42.2		43.6	-1.4	-0.03	0.494
AI3 vs. AI4			39.8	43.6	-3.7	-0.08	0.033
Number of days absent (mean)							
AI1 vs. AI2	15.2	15.4			-0.2	-0.02	0.664
AI1 vs. AI3	15.2		15.3		-0.1	-0.01	0.834
AI1 vs. AI4	15.2			15.7	-0.4	-0.04	0.279
AI2 vs. AI3		15.4	15.3		0.1	0.01	0.852
AI2 vs. AI4		15.4		15.7	-0.3	-0.03	0.492
AI3 vs. AI4			15.3	15.7	-0.3	-0.04	0.333

SOURCE: District administrative records.

NOTES: AI1 assigns benefits-framed basic messaging at baseline, then School Staff Outreach if need, otherwise continue with benefits-framed messaging; AI2 assigns benefits-framed basic messaging at baseline, then Goal Commitment messaging if need, otherwise continue with benefits-framed messaging; AI3 assigns consequences-framed basic messaging at baseline, School Staff Outreach if need, otherwise continue with consequences-framed messaging; AI4 assigns consequences-framed basic messaging at baseline, Goal Commitment messaging if need, otherwise continue with consequences-framed messaging. Where "if need" is defined as missing 8 percent of days or more between the start of October and the end of December.

Sample size = 108 schools; 1,509 students in AI1; 1,502 students in AI2; 1,497 students in AI3; and 1,519 students in AI4.

Chronic absence and number of days absent are based on attendance records from October 1 through the end of the 2017–18 school year.

The analyses are based on a regression model controlling for school fixed effects, working SMS at baseline indicator, and a set of student covariates.

Adaptive intervention group means were computed by adding the estimated differences between the adaptive interventions and the control condition to the control group mean (even though control group means not shown in this exhibit).

The table displays original *p*-values. * Indicates that the average outcomes for any two adaptive interventions compared to each other are statistically significantly different from each other ($p < .05$), when the significance level is adjusted for six pairwise comparisons with a Bonferroni correction.

The estimated difference does not always equal the difference between the means of compared conditions due to rounding.

Impact of Basic Messaging

Exhibits C.2a and C.2b show impact estimates for the basic messaging approaches on chronic absence and number of days absent in the fall, for the overall student sample and subsample of students with a history of high absences. Exhibit C.2c graphs the results presented in Exhibits C.2a and C.2b for the number of days absent outcome. (Not displayed in the main report because number of days absent was a secondary attendance outcome measure for the study.) Finally, Exhibit C.2d shows the comparison of basic messaging approaches to each other for the overall student sample and subsample of students with a history of high absences.

Exhibit C.2a. Impact estimates for the basic messaging approaches on chronic absence and number of days absent in the fall, for all students (results displayed in Exhibit 3 in the main report)

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)					
Any basic messaging vs. control	17.2	19.4	-2.2*	-0.06	<0.001
Benefits-framed basic vs. control	17.2	19.4	-2.2*	-0.06	<0.001
Consequences-framed basic vs. control	17.3	19.4	-2.1*	-0.06	0.001
Number of days absent (mean)					
Any basic messaging vs. control	2.7	2.9	-0.2*	-0.08	<0.001
Benefits-framed basic vs. control	2.7	2.9	-0.2*	-0.08	<0.001
Consequences-framed basic vs. control	2.7	2.9	-0.2*	-0.07	<0.001

SOURCE: District administrative records.
NOTES: Sample size = 108 schools; 7,665 students in benefits-framed basic messaging; 7,606 students in consequences-framed basic messaging; 7,862 students in control.
Chronic absence and number of days absent in the fall are based on attendance records from October 1 to end of December 2017. The analyses are based on a regression model controlling for school fixed effects, indicator for history of high absences, working SMS at baseline indicator, and a set of student covariates.
Control group means are unadjusted mean percentages (for chronic absence) or unadjusted means (for the days absent outcome); messaging group means were computed by adding the estimated differences to the control group means.
The table displays original *p*-values. * Indicates that the average messaging (any basic messaging, benefits-framed basic messaging, consequences-framed basic messaging) student attendance outcome is statistically significantly different from the average control student attendance outcome ($p < .05$), when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.[33]

[33] The significance levels were adjusted for four multiple comparisons (any basic messaging vs. control, benefits-framed basic vs. control, consequences-framed basic vs. control, and benefits- vs. consequences-framed basic messaging). The results comparing benefits-framed messaging to consequences-framed basic messaging is presented separately in Exhibit C.2d.

Exhibit C.2b. Impact estimates for the basic messaging approaches on chronic absence and number of days absent in the fall, for students with history of high absences (results displayed in Exhibit 3 in the main report)

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)					
Any basic messaging vs. control	36.2	40.7	-4.5*	-0.09	0.001
Benefits-framed basic vs. control	36.3	40.7	-4.4*	-0.09	0.005
Consequences-framed basic vs. control	36.0	40.7	-4.7*	-0.10	0.003
Number of days absent (mean)					
Any basic messaging vs. control	4.6	5.0	-0.4*	-0.11	0.000
Benefits-framed basic vs. control	4.6	5.0	-0.4*	-0.12	0.000
Consequences-framed basic vs. control	4.6	5.0	-0.4*	-0.11	0.001

SOURCE: District administrative records.

NOTES: Sample size = 108 schools; 2,064 students in benefits-framed basic messaging; 2,042 students in consequences-framed basic messaging; 2,088 students in control.

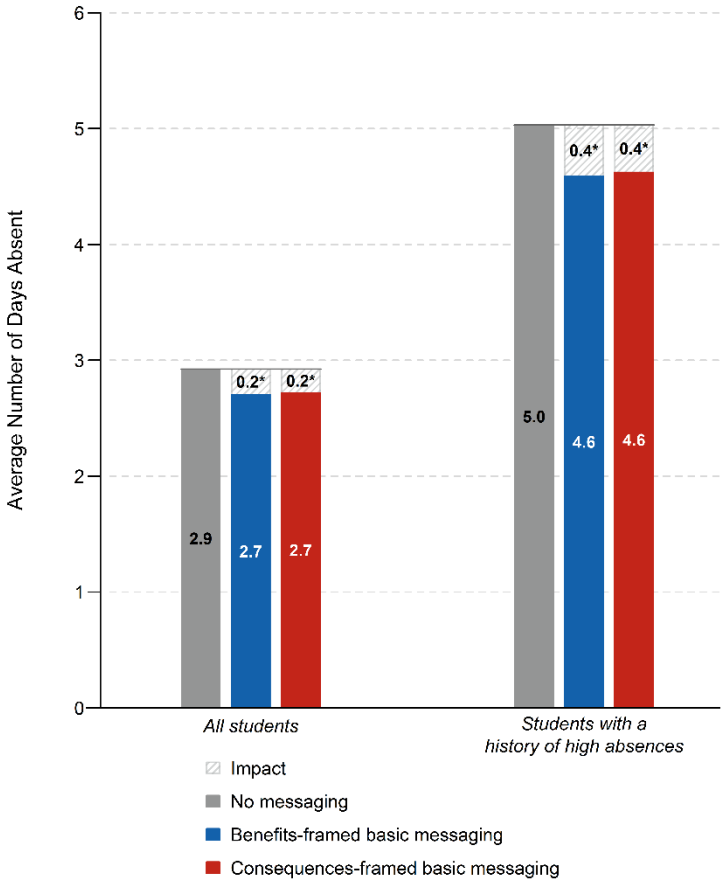
Chronic absence and number of days absent in the fall are based on attendance records from October 1 to end of December 2017.

The analyses are based on a regression model controlling for school fixed effects, working SMS at baseline indicator, and a set of student covariates.

Control group means are unadjusted mean percentages (for chronic absence) or unadjusted means (for the days absent outcome); messaging group means were computed by adding the estimated differences to the control group means.

The table displays original *p*-values. * Indicates that the average messaging (any basic messaging, benefits-framed basic messaging, consequences-framed basic messaging) student attendance outcome is statistically significantly different from the average control student attendance outcome ($p < .05$), when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.

Exhibit C.2c. Average number of days absent in fall 2017, by messaging group



NOTES: Overall sample size = 108 schools; 7,665 students in benefits-framed basic messaging; 7,606 students in consequences-framed basic messaging; 7,862 students in the no-messaging group.
Sample size for students with a history of high absences = 108 schools; 2,064 students in benefits-framed basic messaging; 2,042 students in consequences-framed basic messaging; 2,088 students in the no-messaging group.
* Indicates a statistically significantly difference between a messaging condition and the no-messaging group ($p < .05$) when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.

Exhibit C.2d. Comparison of basic messaging approaches to each other for the overall student sample and subsample of students with a history of high absences

Sample	Benefits-framed basic	Consequences-framed basic	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)					
Overall student sample	17.2	17.3	-0.2	-0.01	0.748
Students with a history of high absences	36.3	36.0	0.3	0.01	0.833
Number of days absent (mean)					
Overall student sample	2.7	2.7	0.0	0.00	0.705
Students with a history of high absences	4.6	4.6	-0.0	-0.01	0.772

NOTES: Overall student sample = 108 schools; 7,665 students in benefits-framed basic messaging; 7,606 students in consequences-framed basic messaging. Subsample of students with a history of high absences = 108 schools; 2,064 students in benefits-framed basic messaging; 2,042 students in consequences-framed basic messaging.
Chronic absence and number of days absent in the fall are based on attendance records from October 1 to end of December 2017.
The analyses are based on a regression model controlling for school fixed effects, working SMS at baseline indicator, and a set of student covariates.
Basic messaging group means were computed by adding the estimated differences between benefits-framed and consequences-framed basic messaging strategies and the control group to the unadjusted control group means. Control group means are shown in Exhibits C.2a and C.2b.
The table displays original *p*-values. * Indicates that the average outcomes for the two basic messaging conditions (benefits- or consequences-framed) are statistically significantly different from each other ($p < .05$), when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.
The estimated difference does not always equal the difference between the means of compared conditions due to rounding.

Added Benefit of Intensified Messaging to Basic Messaging

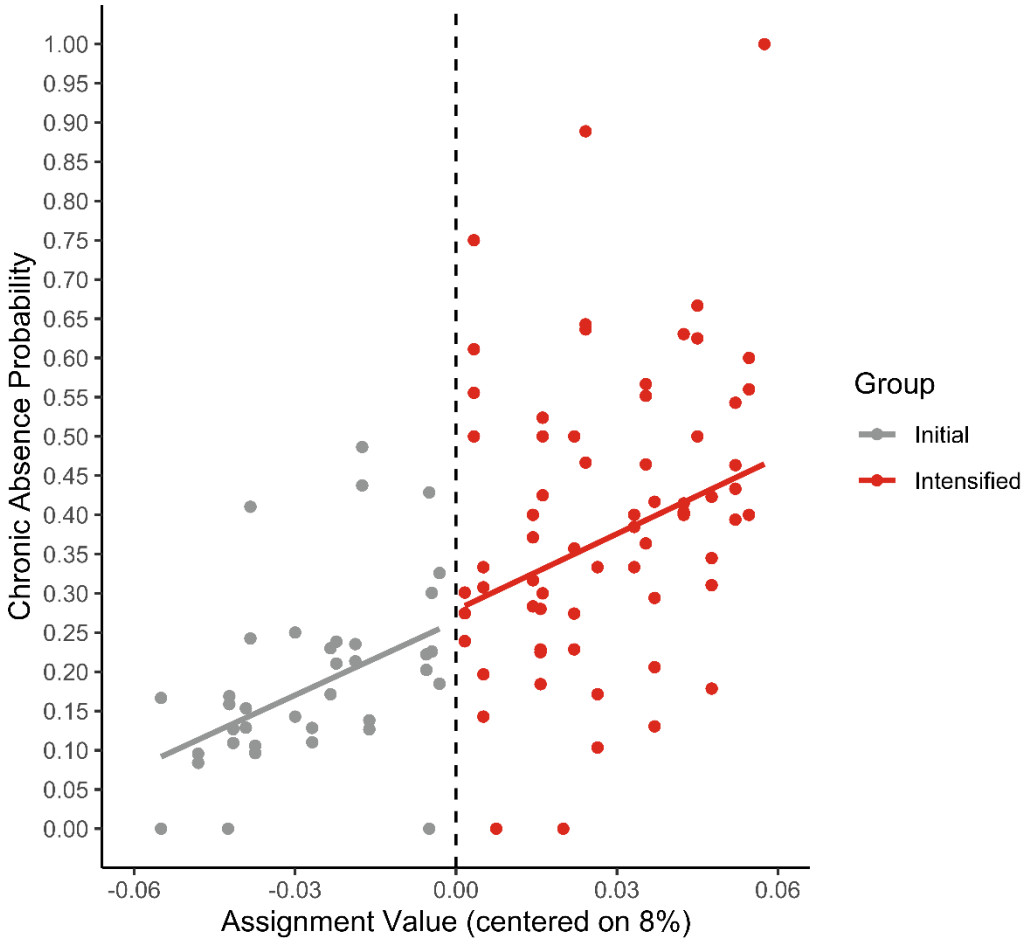
Exhibit C.3a shows results from the regression discontinuity analysis testing whether receiving any intensified messaging on top of basic messaging reduced spring chronic absence rates compared to only receiving any basic messaging, for the overall sample. Exhibit C.3b graphs the relationship between the forcing variable and probability of chronic absence for the overall sample within the IK bandwidth. Exhibits C.3c and C.3d show results for the same analysis for the subsample of students with a history of high absences.

Exhibit C.3a. Percentage of students chronically absent in the spring who were from families above and below the 8 percent fall absence threshold, among students in the overall student sample (results displayed in Exhibit 5 in the main report)

Bandwidth	Chronic absence rate for students with intensified messaging (percentage)	Chronic absence rate for students with basic messaging only (percentage)	Estimated difference (percentage points)	Effect size	*p*-value
IK	25.3	23.9	1.4	0.05	0.556
CCT	20.6	20.7	-0.01	-0.01	0.085

NOTES: Effect size is based on the Cox index for binary outcomes; IK = Imbens and Kalyanaraman; CCT = Calonico, Cattaneo, and Titiunik. The chronic absence rates reflect the predicted probabilities, at the cutoff, based on the confirmatory model using the IK algorithm. For example, predicted chronic absence rates were 23.9 percent for students from families just below the 8 percent cutoff whose parents were sent basic messaging only and 25.3 percent for students from families just above the 8 percent cutoff for students whose parents were sent basic messaging plus intensified messaging. Sample size = 5,140 students within the IK bandwidth, basic messaging; 2,621 students within the IK bandwidth, intensified messaging; 11,098 students within the CCT bandwidth, basic messaging; 3,357 within the CCT bandwidth, intensified messaging.

Exhibit C.3b. Graphical presentation of the continuity of the relationship between the forcing variable and the spring chronic absence outcome, for the overall student sample within the IK bandwidth



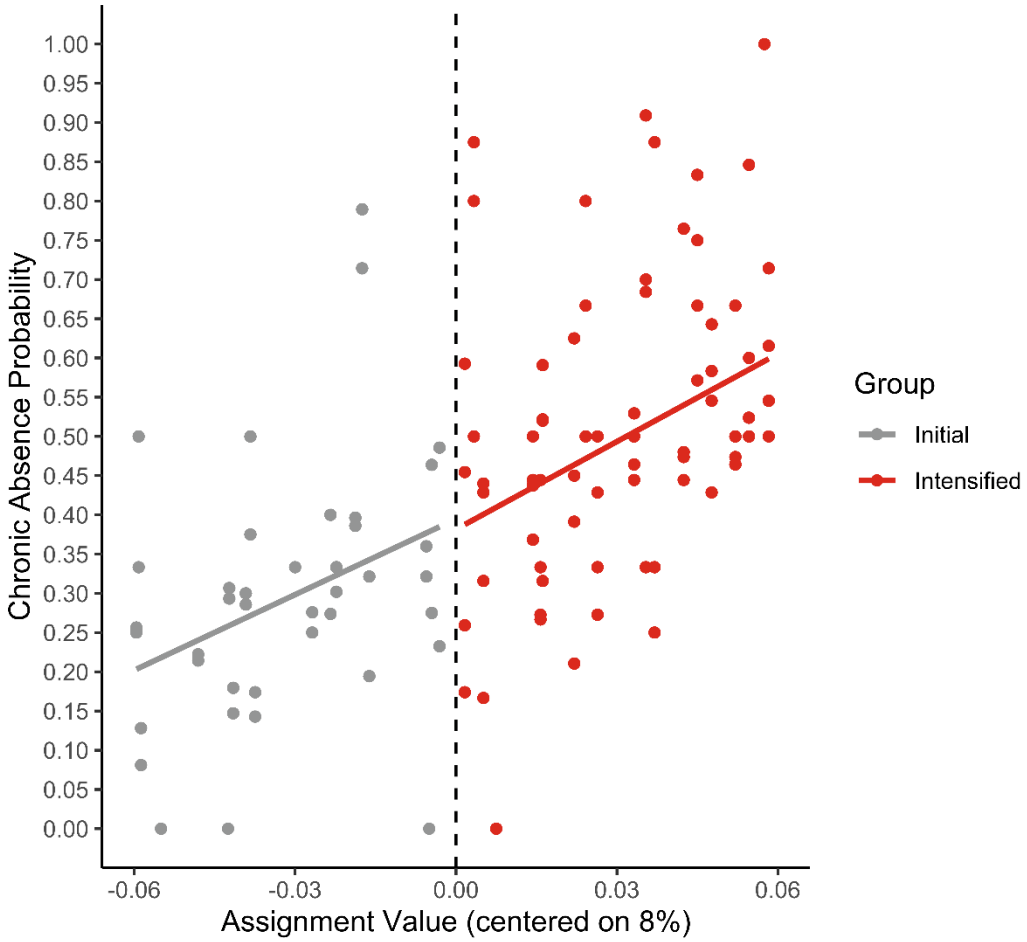
NOTES: Values reflect binned (i.e., simple average) values of the chronic absence outcome for each value of the forcing variable within the bandwidth.

Exhibit C.3c. Percentage of students chronically absent in the spring who were from families above and below the 8 percent fall absence threshold, among students in the subsample with a history of high absences (results displayed in Exhibit 4 in the main report)

Bandwidth	Chronic absence rate for students with intensified messaging (percentage)	Chronic absence rate for students with basic messaging only (percentage)	Estimated difference (percentage points)	Effect size	*p*-value
IK	34.5	40.1	-5.5	-0.14	0.042
CCT	33.9	39.6	-5.7	-0.15	0.021

NOTES: Effect size is based on the Cox index for binary outcomes; IK = Imbens and Kalyanaraman; CCT = Calonico, Cattaneo, and Titiunik. The chronic absence rates reflect the predicted probabilities, at the cutoff, based on the confirmatory model using the IK algorithm. For example, predicted chronic absence rates were 40.1 percent for students from families just below the 8 percent cutoff whose parents were sent basic messaging and 34.5 percent for students from families just above the 8 percent cutoff for students whose parents were sent basic messaging with intensified messaging. Sample size = 1,465 students within the IK bandwidth, basic messaging; 1,156 students within the IK bandwidth, intensified messaging; 1,654 students within the CCT bandwidth, basic messaging; 1,214 within the CCT bandwidth, intensified messaging.

Exhibit C.3d. Graphical presentation of the continuity of the relationship between the forcing variable and the spring chronic absence outcome, for the subsample of students with a history of high absences within the IK bandwidth



NOTES: Values reflect binned (i.e., simple average) values of the chronic absence outcome for each value of the forcing variable within the bandwidth.

Comparison of Intensified Messaging Approaches

Exhibits C.4a, C.4b, and C.4c present results comparing the intensified messaging approaches to each other in spring 2018 for the overall student sample, the subsample of students with a history of high absences, and the subsample of students whose home language was English. Exhibits C.4a and C.4b support Exhibit 5 in the main report. Exhibit C.4d displays a graphical presentation of pairwise differences between School Staff Outreach and Goal Commitment messaging on number of days absent in spring 2018 (not shown in the main report), for the overall student sample, the subsample of students with a history of high absences, and the subsample of students whose home language was English.

Exhibit C.4a. Impact estimates for the two intensified messaging approaches, compared to each other, on student attendance outcomes in the spring, for all students (results displayed in Exhibit 5 in the main report)

Outcome	School Staff Outreach	Goal Commitment	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)	43.7	46.8	-3.1	-0.06	0.061
Number of days absent (mean)	10.7	10.9	-0.2	-0.03	0.378

SOURCE: District administrative records.
NOTES: Sample size = 108 schools; 2,116 students in School Staff Outreach; 2,057 students in Goal Commitment messaging.
Chronic absence and number of days absent in the spring are based on attendance records from January 2018 through end of the 2017-18 school year.
The analyses are based on a regression model controlling for school fixed effects, indicator for history of high absences, working SMS at baseline indicator, and a set of student covariates.
School Staff Outreach means are unadjusted means; Goal Commitment means were computed by adding the estimated differences to the School Staff Outreach means.
* Indicates that the average outcomes for the two intensified messaging conditions (School Staff Outreach, Goal Commitment messaging) are statistically significantly different from each other ($p < .05$).

Exhibit C.4b. Impact estimates for the two intensified messaging approaches, compared to each other, on student attendance outcomes in the spring, for students with a history of high absences (results displayed in Exhibit 5 in the main report)

Outcome	School Staff Outreach	Goal Commitment	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)	57.5	62.3	-4.8*	-0.10	0.033
Number of days absent (mean)	13.3	13.9	-0.6	-0.07	0.111

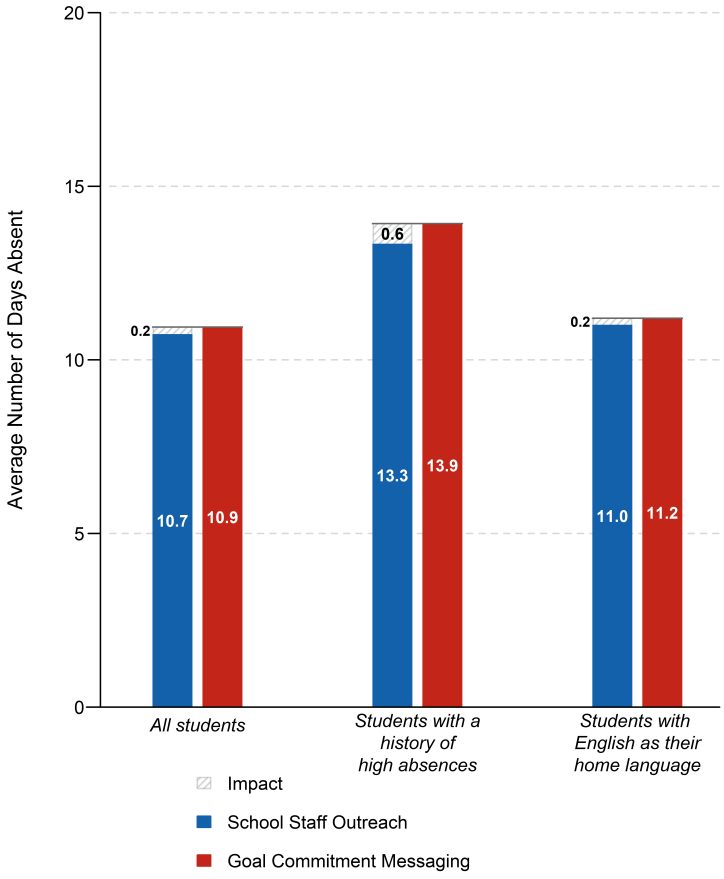
SOURCE: District administrative records.
NOTES: Sample size = 108 schools; 1,085 students in School Staff Outreach; 1,100 students in Goal Commitment messaging.
Chronic absence and number of days absent in the spring are based on attendance records from January 2018 through end of the 2017-18 school year.
The analyses are based on a regression model controlling for school fixed effects, working SMS at baseline indicator, and a set of student covariates.
School Staff Outreach means are unadjusted means; Goal Commitment means were computed by adding the estimated differences to the School Staff Outreach means.
* Indicates that the average outcomes for the two intensified messaging conditions (School Staff Outreach, Goal Commitment messaging) are statistically significantly different from each other ($p < .05$).

Exhibit C.4c. Impact estimates for the two intensified messaging approaches, compared to each other, on student attendance outcomes in the spring (English home language subgroup analysis)

Outcome	School Staff Outreach	Goal Commitment	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)	44.9	48.6	-3.7*	-0.07	0.039
Number of days absent (mean)	11.0	11.2	-0.2	-0.03	0.463

SOURCE: District administrative records.
NOTES: Sample size = 108 schools; 1,796 students in School Staff Outreach; 1,759 students in Goal Commitment messaging.
Chronic absence and number of days absent in the fall are based on attendance records from January 2018 through end of the 2017-18 school year.
The analyses are based on a regression model controlling for school fixed effects, indicator for history of high absences, working SMS at baseline indicator, and a set of student covariates.
School Staff Outreach means are unadjusted means; Goal Commitment means were computed by adding the estimated differences to the School Staff Outreach means.
* Indicates that the average outcomes for the two intensified messaging conditions (School Staff Outreach, Goal Commitment messaging) are statistically significantly different from each other ($p < .05$).

Exhibit C.4d. Pairwise differences between School Staff Outreach and Goal Commitment messaging on number of days absent in spring, for the overall student sample, the subsample of students with a history of high absences, and the subsample of students whose home language was English



Sample of students in intensified messaging condition = 108 schools; 2,116 students in School Staff Outreach; 2,057 students in Goal Commitment messaging.
Subsample of students with history of high absences = 108 schools; 1,796 students in School Staff Outreach; 1,759 students in Goal Commitment messaging.
Subsample of students whose home language was English = 108 schools; 2,116 students in School Staff Outreach; 2,057 students in Goal Commitment messaging.

Impact Analysis Results for Student Achievement

This section presents the following results for the academic achievement outcome:

Impact of adaptive interventions

a. Impact of adaptive interventions on full-year reading and mathematics outcomes, for the overall sample and the subsample of students with a history of high absences (Exhibits C.5a and C.5b)
b. Comparison of adaptive interventions to each other on full-year reading and mathematics outcomes, for the overall sample and the subsample of students with a history of high absences (Exhibits C.5c and C.5d)

Exhibit C.5a. Pairwise differences between each adaptive intervention and control on achievement outcomes, for the overall student sample (results displayed in Exhibits 6 and 7 in the main report)

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Reading achievement					
AI1 vs. control	-0.067	-0.040	-0.027	-0.04	0.195
AI2 vs. control	-0.074	-0.040	-0.034	-0.05	0.102
AI3 vs. control	-0.054	-0.040	-0.014	-0.02	0.510
AI4 vs. control	-0.071	-0.040	-0.031	-0.04	0.132
Mathematics achievement					
AI1 vs. control	-0.062	-0.055	-0.007	-0.01	0.734
AI2 vs. control	-0.067	-0.055	-0.012	-0.02	0.573
AI3 vs. control	-0.074	-0.055	-0.020	-0.03	0.348
AI4 vs. control	-0.079	-0.055	-0.025	-0.03	0.232

SOURCE: District administrative records.
NOTES: AI1 assigns benefits-framed basic messaging at baseline, then School Staff Outreach if need, otherwise continue with benefits-framed messaging; AI2 assigns benefits-framed basic messaging at baseline, then Goal Commitment messaging if need, otherwise continue with benefits-framed messaging; AI3 assigns consequences-framed basic messaging at baseline, School Staff Outreach if need, otherwise continue with consequences-framed messaging; AI4 assigns consequences-framed basic messaging at baseline, Goal Commitment messaging if need, otherwise continue with consequences-framed messaging. Where "if need" is defined as missing 8 percent of days or more between the start of October and the end of December.
Reading achievement sample size = 108 schools; 2,394 students in AI1; 2,365 students in AI2; 2,438 students in AI3; 2,439 students in AI4; 2,787 students in control. Mathematics achievement sample size = 108 schools; 2,391 students in AI1; 2,360 students in AI2; 2,434 students in AI3; 2,435 students in AI4; 2,782 students in control.
The analyses are based on a regression model controlling for school fixed effects, indicator for history of high absences, working SMS at baseline indicator, and a set of student covariates.
Messaging group means were computed by adding the estimated differences to the control group means.
The table displays original *p*-values. * Indicates that the average outcome for the adaptive intervention is statistically significantly different from control ($p < .05$) when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.

Exhibit C.5b. Pairwise differences between each adaptive intervention and control on achievement outcomes, for students with a history of high absences (results displayed in Exhibits 6 and 7 in the main report)

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Reading achievement					
AI1 vs. control	-0.307	-0.321	0.014	0.02	0.742
AI2 vs. control	-0.301	-0.321	0.020	0.03	0.636
AI3 vs. control	-0.283	-0.321	0.038	0.05	0.369
AI4 vs. control	-0.323	-0.321	-0.002	-0.00	0.951
Mathematics achievement					
AI1 vs. control	-0.349	-0.394	0.045	0.06	0.303
AI2 vs. control	-0.320	-0.394	0.074	0.10	0.094
AI3 vs. control	-0.369	-0.394	0.025	0.03	0.550
AI4 vs. control	-0.348	-0.394	0.046	0.06	0.264

SOURCE: District administrative records.

NOTES: AI1 assigns benefits-framed basic messaging at baseline, then School Staff Outreach if need, otherwise continue with benefits-framed messaging; AI2 assigns benefits-framed basic messaging at baseline, then Goal Commitment messaging if need, otherwise continue with benefits-framed messaging; AI3 assigns consequences-framed basic messaging at baseline, School Staff Outreach if need, otherwise continue with consequences-framed messaging; AI4 assigns consequences-framed basic messaging at baseline, Goal Commitment messaging if need, otherwise continue with consequences-framed messaging. Where "if need" is defined as missing 8 percent of days or more between the start of October and the end of December.

Reading achievement sample size = 108 schools; 501 students in AI1; 488 students in AI2; 569 students in AI3; 576 students in AI4; 706 students in control. Mathematics achievement sample size = 108 schools; 500 students in AI1; 486 students in AI2; 568 students in AI3; 574 students in AI4; 702 students in control.

The analyses are based on a regression model controlling for school fixed effects, working SMS at baseline indicator, and a set of student covariates.

Messaging group means were computed by adding the estimated differences to the control group means.

The table displays original *p*-values. * Indicates that the average outcome for the adaptive intervention is statistically significantly different from control ($p < .05$) when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.

Exhibit C.5c. Pairwise differences between each adaptive intervention on academic outcomes, for the overall student sample

Outcome	AI1	AI2	AI3	AI4	Estimated difference	Effect size	*p*-value
Reading achievement							
AI1 vs. AI2	-0.067	-0.074			0.007	0.02	0.600
AI1 vs. AI3	-0.067		-0.054		-0.013	-0.02	0.537
AI1 vs. AI4	-0.067			-0.071	0.004	0.01	0.855
AI2 vs. AI3		-0.074	-0.054		-0.021	-0.03	0.345
AI2 vs. AI4		-0.074		-0.071	-0.003	-0.00	0.881
AI3 vs. AI4			-0.054	-0.071	0.017	0.04	0.197
Mathematics achievement							
AI1 vs. AI2	-0.062	-0.067			0.005	0.01	0.727
AI1 vs. AI3	-0.062		-0.074		0.012	0.02	0.574
AI1 vs. AI4	-0.062			-0.079	0.017	0.02	0.426
AI2 vs. AI3		-0.067	-0.074		0.007	0.01	0.746
AI2 vs. AI4		-0.067		-0.079	0.012	0.02	0.581
AI3 vs. AI4			-0.074	-0.079	0.005	0.01	0.708

SOURCE: District administrative records.

NOTES: AI1 assigns benefits-framed basic messaging at baseline, then School Staff Outreach if need, otherwise continue with benefits-framed messaging; AI2 assigns benefits-framed basic messaging at baseline, then Goal Commitment messaging if need, otherwise continue with benefits-framed messaging; AI3 assigns consequences-framed basic messaging at baseline, School Staff Outreach if need, otherwise continue with consequences-framed messaging; AI4 assigns consequences-framed basic messaging at baseline, Goal Commitment messaging if need, otherwise continue with consequences-framed messaging. Where "if need" is defined as missing 8 percent of days or more between the start of October and the end of December.

Reading achievement sample size = 108 schools; 2,394 students in AI1; 2,365 students in AI2; 2,438 students in AI3; 2,439 students in AI4.

Mathematics achievement sample size = 108 schools; 2,391 students in AI1; 2,360 students in AI2, 2,434 students in AI3; 2,435 students in AI4.

The analyses are based on a regression model controlling for school fixed effects, indicator for history of high absences, working SMS at baseline indicator, and a set of student covariates.

Adaptive intervention group means were computed by adding the estimated differences between the adaptive interventions and the control condition to the control group mean (even though control group means not shown in this exhibit).

* Indicates that the average outcomes for any two adaptive interventions compared to each other are statistically significantly different from each other ($p < .05$), when the significance level is adjusted for six pairwise comparisons with a Bonferroni correction.

Exhibit C.5d. Pairwise differences between each adaptive intervention on academic outcomes, for students with a history of high absences

Outcome	AI1	AI2	AI3	AI4	Estimated difference	Effect size	*p*-value
Reading achievement							
AI1 vs. AI2	-0.307	-0.301			-0.006	-0.01	0.872
AI1 vs. AI3	-0.307		-0.283		-0.024	-0.03	0.607
AI1 vs. AI4	-0.307			-0.323	0.017	0.02	0.710
AI2 vs. AI3		-0.301	-0.283		-0.018	-0.02	0.705
AI2 vs. AI4		-0.301		-0.323	0.023	0.03	0.610
AI3 vs. AI4			-0.283	-0.323	0.040	0.07	0.262
Mathematics achievement							
AI1 vs. AI2	-0.349	-0.320			-0.029	-0.05	0.449
AI1 vs. AI3	-0.349		-0.369		0.020	0.03	0.660
AI1 vs. AI4	-0.349			-0.348	-0.000	-0.00	0.993
AI2 vs. AI3		-0.320	-0.369		0.049	0.07	0.287
AI2 vs. AI4		-0.320		-0.348	0.029	0.04	0.529
AI3 vs. AI4			-0.369	-0.348	-0.021	-0.04	0.549

SOURCE: District administrative records.
NOTES: AI1 assigns benefits-framed basic messaging at baseline, then School Staff Outreach if need, otherwise continue with benefits-framed messaging; AI2 assigns benefits-framed basic messaging at baseline, then Goal Commitment messaging if need, otherwise continue with benefits-framed messaging; AI3 assigns consequences-framed basic messaging at baseline, School Staff Outreach if need, otherwise continue with consequences-framed messaging; AI4 assigns consequences-framed basic messaging at baseline, Goal Commitment messaging if need, otherwise continue with consequences-framed messaging. Where "if need" is defined as missing 8 percent of days or more between the start of October and the end of December.
Reading achievement sample size = 108 schools; 501 students in AI1, 488 students in AI2; 569 students in AI3; 576 students in AI4.
Mathematics achievement sample size = 108 schools; 500 students in AI1; 486 students in AI2; 568 students in AI3; 574 students in AI4.
The analyses are based on a regression model controlling for school fixed effects, working SMS at baseline indicator, and a set of student covariates.
Adaptive intervention group means were computed by adding the estimated differences between the adaptive interventions and the control condition to the control group mean (even though control group means not shown in this exhibit).
* Indicates that the average outcomes for any two adaptive interventions compared to each other are statistically significantly different from each other ($p < .05$), when the significance level is adjusted for six pairwise comparisons with a Bonferroni correction.
The estimated difference does not always equal the difference between the means of compared conditions due to rounding.

IMPLEMENTATION OF THE TEXT MESSAGING STRATEGY

This section includes descriptive statistics about the number of messages delivered and implementation fidelity and dosage. Exhibit C.6 provides information about the number of messages sent to parents in different messaging approaches.

Exhibit C.6. Descriptive information about the number of messages sent, by message type

	Total number messages sent [a]	Average number of messages per student [a]	Standard deviation	Minimum	Maximum
Basic messaging only					
Weekly preventive message with tip	369,500	33.3	1.7	3	35
Same-day absence notification	54,803	4.9	4.2	0	49
Welcome back notification	43,036	3.9	3.3	0	26
Total messages	**467,339**	**42.1**	**7.7**	**5**	**100**
Intensified messaging: School Staff Outreach					
Weekly preventive message with tip	69,944	33.1	1.9	1	35
Same-day absence notification	26,999	12.8	8.6	0	63
Welcome back notification	20,220	9.6	6.0	0	34
School Staff Outreach	7,055	3.3	4.2	0	63
Total messages	**124,218**	**58.7**	**15.2**	**1**	**130**
Intensified messaging: Goal Commitment messaging					
Weekly preventive message with tip	68,084	33.1	1.9	2	35
Same-day absence notification	26,899	13.1	8.7	0	67
Welcome back notification	20,360	9.9	6.2	0	49
Goal Commitment Messages	42,155	20.5	1.2	1	22
Goal Commitment feedback messages	41,197	20.0	1.9	1	22
Total messages	**198,695**	**96.6**	**15.7**	**7**	**193**

SOURCE: District administrative records and SchoolMessenger archived system data.
NOTES: The analytic sample is students who were enrolled for 100 percent of the school days and had complete demographic data. Sample sizes are 11,097 students for the basic messaging only group; 2,115 students for the School Staff Outreach group; 2,057 students for the Goal Commitment messaging group.
Although students were in the sample for the full school year, for some students a working SMS number was available only for a few days. This explains the low minimum number of weekly informational messages.
[a] The total and average number of messages per student were calculated to have at most one message per student counted each time a text was sent to parents of a student (i.e., multiple contact numbers were ignored).

Implementation fidelity was defined as the percentage of daily messages that were sent as intended (i.e., the correct message type was sent to the correct parents). For example, if a student was absent on Monday, parents in the benefits-framed basic messaging group should have received a same-day notification that day informing them that their child was absent, with information about the total number of absences to date during the school year, and a positively-framed benefit of regular attendance.

Implementation dosage was defined as the percentage of correctly-sent messages that were recorded by the text messaging platform as successfully delivered to a local carrier. The fidelity measure does not capture whether the *content* of the message was correct (e.g., whether the number of absences to date was correct, as this information is based on each district's daily student information system data). In addition, although the text messaging system allowed the study to see whether the text messages were delivered, the definition of dosage does not capture whether the text messages were actually received or read by parents.

Rates of correct messaging were high across message types and intervention conditions. On average, parents in all messaging conditions were sent correct messages 94 percent of the days. Although text messages were sent with high levels of accuracy, rates of successful delivery were lower. Overall, about 70 to 75 percent of the total number of possible messages were recorded as delivered. Message delivery rates varied by message type. The dosage is lower than the accuracy rate because of non-functioning SMS numbers. (About 15 percent of families did not have functioning SMS numbers at baseline).

Exhibit C.7 shows the average rates of correctly sent text messages and delivery rates for the pre-scheduled informational messaging and absence notifications sent to all families who were assigned to receive any text messages.

Exhibit C.7. Messaging accuracy and delivery rate, by message type

	Average percent of messages sent correctly	Average percent of messages delivered
Basic messaging only		
Weekly preventive message with tip	97.0	77.7
Same-day absence notification	83.7	64.4
Welcome back notification	86.9	66.9
Total messages	**94.9**	**75.6**
Intensified Messaging: School Staff Outreach		
Weekly preventive message with tip	97.5	74.9
Same-day absence notification	86.7	63.4
Welcome back notification	86.5	63.1
School Staff Outreach	85.0	76.7
Total messages	**93.3**	**70.7**
Intensified messaging: Goal Commitment messaging		
Weekly preventive message with tip	96.3	72.5
Same-day absence notification	88.4	62.5
Welcome back notification	86.8	61.6

	Average percent of messages sent correctly	Average percent of messages delivered
Goal Commitment Messages	99.9	73.2
Goal Commitment feedback messages	98.3	68.6
Total messages	**94.2**	**70.3**

SOURCE: District administrative records and SchoolMessenger archival data.
NOTES: Sample size = 11,097 students for the basic messaging only group; 2,115 students for the School Staff Outreach group; 2,057 students for the Goal Commitment messaging group.

Uptake of Intensified Messaging

School Staff Outreach

The purpose of the School Staff Outreach was to have a trained staff person, such as an attendance counselor, conduct personalized outreach to parents. The school staff assigned to conduct the outreach were asked to use the texting platform to send personalized messages to parents of students assigned to the School Staff Outreach messaging from the beginning of February through April, until parents responded by text or other modes.

School staff conducted outreach as intended, based on two different sources of data. According to data from the text messaging system, school staff attempted to contact one or more parents of 85 percent of the students in the School Staff Outreach group. Similarly, attendance counselors reported contacting parents of 91 percent of the students who were included in their School Staff Outreach logs (Exhibit C.8). According to archived system data, 30 percent of students had a parent who responded to at least one sent School Staff Outreach text message. Of the students whose parents received School Staff Outreach, 14.8 percent had a parent who responded to more than one sent text message (Exhibit C.9). However, these rates may underestimate the actual rate of response to School Staff Outreach because parents may have responded through other means than text (e.g. phone, in-person).

Exhibit C.8. School Staff Outreach: percentage of students for whom contact was attempted, and time spent trying to contact or communicate with parents, by district and overall

District	Percentage of students in Outreach group whose parents were sent at least one school outreach text	Minutes spent texting or communicating with parents of students in the School Staff Outreach group			
		Average number of minutes	Standard deviation	Minimum	Maximum
1	92.3	14.1	19.6	0	104
2	83.4	10.3	17.2	0	150
3	94.3	15.5	21.2	0	134
4	95.4	11.8	19.3	0	147
All districts	90.5	12.6	19.2	0	150

SOURCE: Study attendance counselor logs.
NOTES: Sample size = 938 students in the School Staff Outreach group, who were also included in the Attendance Counselor Logs and in the analytic sample.

Exhibit C.9. Percentage of students whose parents responded to School Staff Outreach through text messaging, by initial messaging approach, by district and overall

District	Basic messaging approach	Percent of students whose parents were sent at least one delivered text	Percent of students with a parent who responded to at least one sent text	Percent of students with a parent who responded to more than one sent text
1	Benefits	69.5	23.3	9.0
	Consequences	69.5	26.9	13.9
2	Benefits	77.4	34.4	17.5
	Consequences	74.2	35.1	18.4
3	Benefits	78.1	26.9	14.2
	Consequences	76.8	26.6	11.6
4	Benefits	84.0	35.6	16.9
	Consequences	79.6	29.1	13.7
All districts	Benefits	78.1	31.1	15.0
	Consequences	75.3	29.8	14.7

SOURCE: SchoolMessenger archived system data.
NOTES: Sample size = 2,115 students in the analytic sample that were in the School Staff Outreach group.

Goal Commitment Messaging

Goal Commitment messaging included automated messages on Sundays asking parents to commit to a perfect attendance week and feedback on Fridays on student's attendance that week. The Goal Commitment messaging also included cascading tips as part of the weekly Sunday informational messages. The tips addressed specific topics that changed by week, and parents could request more tips by texting a keyword.

Parents of about 30 percent of students in the Goal Commitment messaging group committed to at least one perfect attendance week. Among those who committed at least once, the average number of weeks was about four (Exhibit C.10). Parents of about 10 percent of students in the Goal Commitment messaging group ever requested cascading tips. Parents who requested cascading tips requested about 2.5 tips, on average (Exhibit C.10).

Exhibit C.10. Percentage of students whose parents responded to Goal Commitment messaging, by basic messaging approach, overall and by district

District	Basic messaging approach	Percent of students whose parent committed to at least one full attendance week	Average number of full attendance weeks committed, among parents who committed to at least one week [a]	Percent of students whose parents requested cascading tips	Average number of cascading tips requested, among parents who requested at least one tip [b]
1	Benefits	24.7	4.2	6.4	1.9
	Consequences	24.4	4.2	5.1	2.7
2	Benefits	29.4	4.5	11.9	3.1
	Consequences	29.9	5.1	12.6	2.4
3	Benefits	28.2	4.3	8.9	3.8
	Consequences	23.1	3.5	7.2	2.3
4	Benefits	39.0	3.3	12.7	2.3
	Consequences	41.4	3.6	10.7	2.5
All districts	Benefits	31.0	4.0	10.3	2.8
	Consequences	30.9	4.1	9.3	2.5

SOURCE: SchoolMessenger data archived system data.
NOTES: Sample size = 2,057 families in the analytic sample and assigned to Goal Commitment messaging. [a] total of 642 parents committed to at least one week. [b] A total of 202 parents requested at least one tip.

Description of Typical (Business-as Usual) Attendance-Related Outreach and Contrast in What Students in the Messaging vs. No-Messaging Groups Received

Description of Business-as-Usual

For districts and schools to be eligible to participate in the study, they could not already be systematically using text messaging to inform parents about attendance. However, it was known at the outset that multiple practices were already in place to improve attendance in study schools. The districts and schools were not expected to change their typical practices with the introduction of the text messaging strategy. Thus, the study's text messaging approaches were layered over existing attendance policies, procedures, and practices - the "business-as-usual" services that the no-messaging group of families received. The business-as-usual condition provides context for understanding the impacts of the messaging strategy, since those effects are measured as the added benefit of the messaging on top of those existing, business-as-usual practices. This section summarizes information collected during the study about these existing practices in participating schools.

According to the logs completed by school staff, most study schools (74 percent) had a formal attendance team. Most formal attendance teams had an attendance counselor/specialist (79 percent of the teams), the principal (61 percent of the teams), and a school secretary (57 percent of the teams) as members (Exhibit C.11). Fewer teams (31 percent) had teachers as members of the formal attendance team. The most common attendance-related practices reported as in use by study schools were (Exhibit C.12):

- Contacting parents by phone or mail when students were absent (85 percent)
- Providing information to parents or guardians about the importance of attendance (85 percent)
- Developing intervention plans with families and monitor for progress (73 percent)

Exhibit C.11. Business-as-usual attendance communication practices: Percentage of schools with a formal attendance team and composition of the team, overall and by district

District	Percentage of schools with formal attendance team	Percentage of teams with...					
		Principal	Assistant principal	Attendance specialist/ counselor(s)	Teacher(s)	School secretary	Other
1	79.2	73.7	47.4	89.5	47.4	73.7	42.1
2	68.0	76.5	41.2	100.0	17.6	35.3	47.1
3	87.0	35.0	20.0	65.0	40.0	45.0	70.0
4	65.5	63.2	26.3	63.2	15.8	73.7	26.3
All districts	74.3	61.3	33.3	78.7	30.7	57.3	46.7

SOURCE: Study attendance counselor log.
NOTES: Formal attendance team was defined as a team delegated by principals to lead the school's efforts related to improving student attendance. Sample size = 100 schools completed the initial log including questions about business-as-usual practices.

Exhibit C.12. Business-as-usual attendance communication practices: Percentage of schools indicating use of different attendance strategies

Attendance strategy	Percentage of schools formally using attendance strategies
Tier I-type supports (for all students):	
Contact parents by phone or mail when students are absent	85.1
Create a welcoming school climate	71.7
Recognize good or improved attendance for classrooms, students, or parents	70.0
Invite parents and community members to help address the barriers that keep children from attending school (e.g., health related issues, unsafe neighborhood)	48.5
Tier II-type supports (for students in need of more support):	
Provide information to parents or guardians about the importance of attendance	85.1
Assess individual student or family needs that affect attendance and contact parents or guardians as appropriate	84.2
Establish specific attendance goals for students	67.3
Involve public agencies and community partners and resources as needed to address barriers to attendance	66.0
Have school staff identify barriers to attendance, such as health, transportation, or housing	65.7
Involve the school nurse with follow-up on medical-related absences	62.6
Tier III-type supports (for students in need of most intensive intervention)	
Develop intervention plans with families and monitor for progress	72.7
Connect students with chronic physical and mental health issues to medical providers	66.7
Make home visits and refer families to appropriate services (e.g., social services, human resources, housing, and health services)	66.0
Use legal means (e.g., courts) to involve families and students in needed services when appropriate	63.9

Attendance strategy	Percentage of schools formally using attendance strategies
Arrange transportation to and from school with other families or staff	32.0

SOURCE: Study attendance counselor logs.
NOTES: Sample size = 100 schools that completed the initial log asking questions of business-as-usual practices.

Service Contrast

The attendance counselor logs asked the school staff to record whether they contacted parents, the amount of time spent contacting or trying to contact parents, the means of communication, and whether they referred parents to additional services or resources. The study collected this information for students whose parents received basic messaging only, basic messaging with School Staff Outreach or Goal Commitment, and for students whose parents did not receive any messaging (i.e., in the no-messaging control group).[34]

Data from the logs showed that parents of students with more absences received more frequent contact from school staff in all messaging groups. However, among parents of students with more absences, those in School Staff Outreach were contacted most often, as expected. The following patterns emerged, suggesting a link between frequency of contact and students' absence level and the messaging approach (Exhibit C.13):

- Parents of students with low absences (that is, missed less than 8 percent of school days in the fall) were contacted the least (52 to 53 percent of parents), regardless of basic messaging approach (benefits-framed, consequences-framed, or no-messaging).
- Parents of students with higher absences (that is, missed more than 8 percent of school days in the fall) and who were in the Goal Commitment or no-messaging groups were contacted more often than parents of students with low absences (62 to 64 percent of parents).
- Parents of students with higher absences and who were in the School Staff Outreach group were contacted most often (91 percent of parents).

This pattern of school staff contacting parents of students with more absences most often when they were in the School Staff Outreach group is also reflected in the reported duration of time spent contacting parents and in the reported rates of parent referrals to services or other supports (a key purpose of School Staff Outreach):

- On average, school staff reported spending about 13 minutes per student communicating with parents in School Staff Outreach. They reported spending about 8 minutes per student communicating with parents in the no-messaging group, who would have been eligible for an intensified intervention based on their child(ren)'s high fall absence rate (Exhibit C.13).
- School staff were more than twice as likely to report using text messaging to contact parents of children in School Staff Outreach than parents of children in the no-messaging group, who would have been eligible for an intensified intervention based on their child(ren)'s high fall absence rate (about 66 percent versus 25 percent) (Exhibit C.14).

[34] The main analyses of the amount of time spent contacting or trying to contact parents were conducted using linear regression models for simplicity. Poisson models were additionally used for sensitivity analyses because the number of minutes is a count variable. The results do not substantively differ (i.e., the models identify the same comparisons as statistically significant with similar *p*-values).

- School staff reported referring 41 percent of parents in School Staff Outreach to supports or services. They also reported referring 32 percent of parents in the no-messaging group, who would have been eligible for an intensified intervention based on their child(ren)'s high fall absence rate (Exhibit C.15).

Together, these results suggest that School Staff Outreach was implemented as intended, and in particular, that there was a meaningful difference (as intended) in what those assigned to School Staff Outreach received and what those assigned to other groups received (including those who were in the no-messaging control group but were otherwise similar to those in School Staff Outreach in terms of fall absence rates). Thus, the impact findings presented earlier in Appendix C represent a meaningful test of the texting strategy.

Exhibit C.13. Amount of time school staff reported spending trying to contact or communicate with parents, overall and by messaging condition

Eligibility for intensified messaging and messaging condition	Percentage of students whose parents were contacted	Minutes spent contacting or communicating with parents of the sampled students			
		Average number of minutes	Standard deviation	Min	Max
Below absence threshold (< 8 percent missed)					
Continuing basic messaging	51.7*	4.0*	8.8	0	99
No-messaging control group	52.7*	4.1*	8.0	0	78
Above absence threshold (≥ 8 percent missed)					
Basic messaging with School Staff Outreach	90.5	12.6	19.2	0	150
Basic messaging with Goal Commitment	62.4*	8.2*	16.9	0	135
No-messaging control group	64.0*	8.1*	16.9	0	135

SOURCE: Study attendance counselor logs.
NOTES: Sample size = 106 schools participating in the study that completed at least one of the three follow up attendance counselor logs; 3,947 students included in the attendance counselor logs and in the analytic sample.
* Indicates that the school staff reported, on average, levels of contact with parents of students in each messaging or control condition that were statistically significantly different from the average levels of contact with parents of students in School Staff Outreach ($p < .05$).

Exhibit C.14. Percentage of attendance counselors communicating with students or their parents about attendance via different modes, overall and by messaging condition

Eligibility for intensified messaging and messaging condition	Percentage of attendance counselors				
	One-on-one discussion with student	Emails or writing letters	Text messaging	In-person or phone meeting with parents	Other
Below absence threshold (< 8 percent missed)					
Continuing basic messaging	15.7*	21.3*	24.7*	30.3*	4.9*
No-messaging control group	17.1*	22.7*	24.4*	33.6*	4.1*
Above absence threshold (≥ 8 percent missed)					
Basic messaging with School Staff Outreach	29.5	32.6	65.6	51.3	7.4
Basic messaging with Goal Commitment	22.2*	30.3*	28.3*	41.7*	8.5
No-messaging control group	21.9*	28.8*	25.0*	42.5*	8.7

SOURCE: Study attendance counselor logs.

NOTES: 106 schools participating in the study that completed at least one of the three follow up attendance counselor logs; 3,947 students included in the attendance counselor logs and in the analytic sample.

* Indicates that the likelihood of school staff reporting that they contacted parents of students in each messaging or control condition that were statistically significantly different from the likelihood of school staff reporting that they contacted parents of students in School Staff Outreach ($p < .05$), in different modes.

Exhibit C.15. Parent referrals to supports or services, according to school staff

Eligibility for intensified messaging and messaging condition	Percentage of students whose parents were referred to supports or services	Percentage of sample of students whose parents were referred to the following supports and services					
		Transportation	District student services	Social services	Breakfast/ lunch programs	Family court/ truancy programs	Other
Below absence threshold (< 8 percent missed)							
Continuing basic messaging	23.7*	5.4*	11.0	1.9*	6.7*	2.8*	6.0*
No-messaging control group	23.8*	5.1*	10.7	2.3*	6.9*	2.8*	6.8*
Above absence threshold (≥ 8 percent missed)							
Basic messaging with School Staff Outreach	40.8	9.6	17.0	5.9	9.0	7.2	13.6
Basic messaging with Goal Commitment	33.7*	8.0*	12.6	4.3*	8.2	4.8*	9.6*
No-messaging control group	32.2*	7.8*	12.5	5.2	8.2	5.2*	8.9*

SOURCE: Study attendance counselor logs.

NOTES: Sample size = 106 schools participating in the study that completed follow-up attendance counselor logs; 3,947 students included in the attendance counselor logs and in the analytic sample.

* Indicates that the likelihood school staff reporting that they referred parents of students to supports or services in each messaging or control condition was statistically significantly different from the likelihood of reporting that they referred parents of students in School Staff Outreach ($p < .05$) to supports or services.

APPENDIX D: COST AND COST EFFECTIVENESS ANALYSES

The study intended to test a relatively low-cost text messaging strategy that intensified for parents of students with more absences. A critical aspect of the study was to document the start-up and maintenance costs, to help prospective users consider what the costs might be in their own district or school. In addition, the study translated cost information for delivering the adaptive interventions into estimates of *cost-effectiveness*, taking into account the impact of the adaptive interventions on attendance outcomes. The following section describes the steps taken to assess the costs of the adaptive intervention.

The study used the Resource Cost Model, an approach to cost analysis that involves organizing the data collection around the specific activities related to provision of a service, strategy, or an intervention. The method has its roots in the "ingredients" approach to cost analysis (Levin, 1983; Levin & McEwan, 2001); it models structure and "ingredients" of services as they are delivered. Spending variations can then be analyzed by the types, quantities, and prices of the different resources. This allows identification of the expected costs associated with replication and scaling up the intervention, as well as detail about the specific costs of different intervention components.

The study constructed a Resource Cost Model for each participating district using the *CostOut* tool developed by the Center for Benefit-Cost Studies in Education at Teachers College, Columbia University (https://www.cbcse.org/costout). Data came from three sources:

- Extant administrative data on expenditures for contracted services by SchoolMessenger and labor hours for the study team staff.
- Interviews with the district IT and student information system departments about the time spent and any new software or hardware purchased for implementing the intervention.
- Attendance counselor logs that asked school staff conducting the School Staff Outreach to document time spent contacting parents of students in School Staff Outreach condition, and the school or district resources to which they referred parents (results reported in Appendix C).

In addition to these three sources, the study calculated the time school staff spent in trainings on the School Staff Outreach component to be included in the cost estimates. Exhibit D.1 lists the estimated costs for developing the text messaging content and platform. Exhibit D.2 shows the estimated implementation cost for the different text messaging components (i.e., basic messaging, School Staff Outreach, and Goal Commitment messaging). Exhibit D.3 shows the cost of delivering the text messaging approaches overall, as well as average cost per district, school, and student.

After data were entered into the Resource Cost Model, the study team calculated the costs associated with the adaptive interventions. The study team then divided the total cost of each adaptive intervention by the total change in attendance that the adaptive intervention produced in order to provide the cost-effectiveness ratio for each adaptive intervention. For example, for each adaptive intervention, the "cost per additional student day of attendance" was calculated as (Total cost of the adaptive intervention)/(Number of students in the adaptive intervention*Days absent effect).[35] Exhibit D.4 provides the estimated cost per unit of improvement.

[35] For AI1: Benefits-framed basic messaging with School Staff Outreach, the calculation would be $56,165/(6,631*0.60)= $56,165/3,972=$14.14 (see the first row of Exhibit D.4).

Exhibit D.1. Estimated text messaging development costs

Cost ingredients	Total cost
Development	
Study team costs of message content development	$92,037
Texting provider costs for refining their main platform	$58,540
Texting provider costs for creating the outreach platform and additional tip functionality	$44,200
Total	**$194,777**

SOURCE: District administrative records and district interviews.

Exhibit D.2. Estimated implementation costs per messaging component

Components of the adaptive text messaging strategy	Total cost
Basic messaging	$151,915
Intensified messaging: School Staff Outreach	$36,372
Intensified messaging: Goal Commitment	$15,045
Total	**$202,612**

SOURCE: District administrative records and district interviews.

Exhibit D.3. Estimated text messaging implementation costs overall and average cost per district, school, and student

Aspects of the adaptive text messaging strategy delivery	All	Per district	Per school	Per student
Basic messaging (benefits- and consequences-framed)				
Study team costs				
Labor for programming messages	$12,938	$12,938	$120	$0.13
Labor for scheduling and monitoring	$77,491	$19,373	$718	$3.00
District costs				
Labor for setup and monitoring	$22,338	$5,584	$207	$0.86
Computers and software	$7,448	$1,862	$69	$0.29
Provider costs				
Labor for setup	$23,900	$5,975	$221	$0.93
Text message programming	$7,800	$1,950	$72	$0.30
Basic messaging total	**$151,915**	**$47,682**	**$1,407**	**$5.88**
School Staff Outreach				
Study team costs				
Labor for training	$8,527	$2,132	$79	$3.51
District Costs				
Labor for training	$9,844	$2,461	$91	$4.05
Labor for outreach	$9,800	$2,450	$91	$4.03
Provider Costs				
Labor for training	$5,000	$1,250	$46	$2.06
Text messages	$3,200	$800	$30	$1.32
School Staff Outreach total	**$36,372**	**$9,093**	**$337**	**$14.97**
Goal Commitment messaging				
Study team costs				
Labor for programming messages	$3,234	$3,234	$30	$1.34
Labor for scheduling and monitoring	$8,610	$2,153	$80	$3.56
Provider costs				
Text messages	$3,200	$800	$30	$1.32
Goal Commitment total	**$15,045**	**$6,187**	**$139**	**$6.27**

SOURCE: District administrative records and district interviews.

Exhibit D.4. Estimated adaptive intervention costs and cost per unit of improvement

Adaptive intervention	Total cost	Cost per student	Cost per additional student day of attendance	Cost of preventing a student from becoming chronically absent
AI1: Benefits-framed basic with School Staff Outreach	$56,165	$8.47	$14.14	$235.28
AI2: Benefits-framed basic with Goal Commitment	$45,500	$6.90	$11.88	$287.65
AI3: Consequences-framed basic with School Staff Outreach	$56,165	$8.53	$14.15	$294.20
AI4: Consequences-framed basic with Goal Commitment	$45,500	$6.93	$10.70	$239.03

SOURCE: District administrative records and district interviews.

APPENDIX E: SENSITIVITY, SUBGROUP, AND EXPLORATORY ANALYSES

Sensitivity Analyses

This section provides results of analyses conducted to check whether the main findings reported were sensitive to decisions about which students were included in analyses and different model specifications.

As described in Appendix B, to be in the main analytic sample, students had to have:

1. not been "opted out" of the study by their parents, meaning that when parents were informed about the study taking place in their school, they did not text or submit a paper form indicating that they did not want their child(ren) to participate[36]
2. been part of the original sample randomly assigned to basic messaging or the no-messaging control group in fall 2017
3. been enrolled for 100 percent of the school days in the 2017–18 school year, which allowed the study team to create clear and consistent attendance outcome measures
4. been included in district records with information available about their demographic characteristics

This section reports results from analyses conducted on two alternative definitions of the analytic sample:

1. students who were enrolled for at least 70 percent of school days
2. all students in the basic messaging or no-messaging control groups at the beginning of the year regardless of missing data

The model specifications for the sensitivity analyses testing different sample definitions are the same as for the main impact analyses described in Appendix C. For the purpose of brevity, this section presents results for analyses comparing basic messaging approaches and adaptive interventions to the no-messaging control condition, and the two intensified messaging approaches to each other. This section does not present results for analyses comparing adaptive interventions or basic messaging approaches to each other, but all the sensitivity analyses for these other SMART design comparisons were consistent with the main analyses. (That is, there were no statistically significant differences among the four adaptive interventions or between the two basic messaging approaches.)

In addition to the sensitivity analyses with different sample definitions, this section includes results for the number of days absent outcome using Poisson and quasi-Poisson models. These analyses compared the four adaptive interventions to the control condition and each other, the basic messaging strategies to the control condition and each other, and the two intensified messaging approaches to each other. The results are substantially the same as the results from the linear models (i.e., the models identify the same comparisons as statistically significant, with similar p-values and effect sizes).

Students Enrolled for at Least 70 Percent of School Days

The reason the main analyses restricted the analytic sample to students who were enrolled for 100 percent of the school days was to avoid the problem of missing attendance data. Missing attendance data complicates the

[36] Most students who were opted out of the study by their parents were removed from the potential study sample prior to random assignment. Requests for opt out received after random assignment were still honored. Opt-out rates overall and by study condition are shown in Appendix B (Exhibits B.11 and B.12). Parents in the messaging groups were also able to "unsubscribe" so that a specific phone number would no longer receive the study's text messages, but this did not remove a student from the study sample.

definition of the attendance outcome measures, including chronic absence (missing 10 percent or more of school days between October 1 and the end of the year) and number of days absent across that period. However, it is possible that this restriction of 100 percent enrollment was too stringent and excluded students who may have been more or less prone to respond to the messaging strategies than students enrolled for the full year. Including a wider range of students in the analysis might also make the estimated impacts more applicable to high-need districts, which typically have high rates of transfer out of the district during the year.

To see whether the impact results were similar, one set of sensitivity analyses included a broader group of students - those who were enrolled in the study schools for at least 70 percent of school days. To calculate the attendance measures for this sample of students, the study team used the actual number of days enrolled. For example, if a student was enrolled for 120 days and was absent 12 days, the student would have missed 10 percent of school days and considered to be chronically absent. This approach assumes that the rate of absences that students had during their enrollment would have remained constant if they had stayed enrolled for 100 percent of school days. As a result, using the actual number of days enrolled as the denominator introduces some degree of error to the attendance measures. Nevertheless, the study analyses examined this alternative sample definition to check the sensitivity of the main results.

Exhibits E.1a to E.1f present results for the overall sample and for the subsample of students with a history of high absences who were enrolled for at least 70 percent of the school days. These analyses compared (1) each adaptive intervention to no-messaging, (2) each basic messaging approach to no-messaging, and (3) the intensified messaging approaches to each other.

The results from the analyses including students who were enrolled for at least 70 percent of the school days are consistent with the main results in all cases with one exception:

- ***Analyses comparing the intensified messaging approaches to each other.*** The main impact analysis did not find a statistically significant difference between School Staff Outreach and Goal Commitment messaging for the overall student sample (though did for students with a history of high absences, in favor of School Staff Outreach). The sensitivity analyses with students who were enrolled for at least 70 percent of school days did reveal a statistically significant difference, in favor of School Staff Outreach, for both the overall sample and the subsample of students with a history of high absences. The larger difference between the two intensified approaches may have emerged because this sensitivity sample includes more mobile students, who tend to be more at-risk.[37] Direct one-on-one outreach may therefore be a better strategy than Goal Commitment messaging for this broader, more vulnerable group.

[37] Green, DeFossett, & Kuo, 2019.

Exhibit E.1a. Pairwise differences between each adaptive intervention and control on full-year attendance outcomes, for students overall

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)					
AI1 vs. control	17.4	21.2	-3.8*	-0.10	<0.001
AI2 vs. control	18.8	21.2	-2.4*	-0.06	0.001
AI3 vs. control	18.3	21.2	-2.9*	-0.08	<0.001
AI4 vs. control	18.2	21.2	-3.0*	-0.08	<0.001
Number of days absent (mean)					
AI1 vs. control	9.4	10.0	-0.6*	-0.07	<0.001
AI2 vs. control	9.4	10.0	-0.6*	-0.07	<0.001
AI3 vs. control	9.4	10.0	-0.5*	-0.07	<0.001
AI4 vs. control	9.3	10.0	-0.6*	-0.08	<0.001

SOURCE: District administrative records.

NOTES: AI1 assigns benefits-framed basic messaging at baseline, then School Staff Outreach if need, otherwise continue with benefits-framed messaging; AI2 assigns benefits-framed basic messaging at baseline, then Goal Commitment messaging if need, otherwise continue with benefits-framed messaging; AI3 assigns consequences-framed basic messaging at baseline, School Staff Outreach if need, otherwise continue with consequences-framed messaging; AI4 assigns consequences-framed basic messaging at baseline, Goal Commitment messaging if need, otherwise continue with consequences-framed basic messaging; where "if need" is defined as missing 8 percent of days or more between the start of October and the end of December 2017.

Sample size = 108 schools; 6,788 students in AI1; 6,759 students in AI2; 6,763 students in AI3; 6,740 students in AI4; 8,088 students in control.

Chronic absence and number of days absent are based on attendance records from October 1 through the end of the 2017–18 school year.

The analyses are based on a regression model controlling for school fixed effects, working SMS at baseline indicator, indicator for history of high absences, and a set of student covariates.

Control group means are unadjusted mean percentages (for chronic absence) or unadjusted means (for days absent); messaging group means were computed by adding the estimated differences to the control group means.

The table displays original *p*-values. * Indicates that the average outcome for the adaptive intervention is statistically significantly different from control ($p < .05$) when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.

The estimated difference does not always equal the difference between the means of compared conditions due to rounding.

Exhibit E.1b. Pairwise differences between each adaptive intervention and control on full-year attendance outcomes, for students with a history of high absences

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)					
AI1 vs. control	40.8	47.9	-7.2*	-0.14	<0.001
AI2 vs. control	43.2	47.9	-4.8*	-0.10	0.009
AI3 vs. control	41.1	47.9	-6.9*	-0.14	<0.001
AI4 vs. control	44.6	47.9	-3.3	-0.07	0.067
Number of days absent (mean)					
AI1 vs. control	15.4	16.7	-1.3*	-0.12	<0.001
AI2 vs. control	15.5	16.7	-1.2*	-0.11	0.001
AI3 vs. control	15.5	16.7	-1.2*	-0.11	0.001
AI4 vs. control	15.9	16.7	-0.8	-0.08	0.023

SOURCE: District administrative records.

NOTES: AI1 assigns benefits-framed basic messaging at baseline, then School Staff Outreach if need, otherwise continue with benefits-framed messaging; AI2 assigns benefits-framed basic messaging at baseline, then Goal Commitment messaging if need, otherwise continue with benefits-framed messaging; AI3 assigns consequences-framed basic messaging at baseline, School Staff Outreach if need, otherwise continue with consequences-framed messaging; AI4 assigns consequences-framed basic messaging at baseline, Goal Commitment messaging if need, otherwise continue with consequences-framed basic messaging; where "if need" is defined as missing 8 percent of days or more between the start of October and the end of December 2017.

Sample size = 108 schools; 1,575 students in AI1; 1,573 students in AI2; 1,576 students in AI3; 1,596 students in AI4; 2,188 students in control.

Chronic absence and number of days absent are based on attendance records from October 1 through the end of the 2017–18 school year.

The analyses are based on a regression model controlling for school fixed effects, working SMS at baseline indicator, and a set of student covariates.

Control group means are unadjusted mean percentages (for chronic absence) or unadjusted means (for days absent); messaging group means were computed by adding the estimated differences to the control group means.

The table displays original *p*-values. * Indicates that the average outcome for the adaptive intervention is statistically significantly different from control ($p < .05$) when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.

The estimated difference does not always equal the difference between the means of compared conditions due to rounding.

Exhibit E.1c. Impact estimates for the basic messaging approaches on chronic absence and number of days absent in the fall, for students overall

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)					
Any basic messaging vs. control	17.7	19.9	2.2*	0.06	<0.001
Benefits-framed basic vs. control	17.6	19.9	2.3*	0.06	<0.001
Consequences-framed basic vs. control	17.8	19.9	2.1*	0.06	<0.001
Number of days absent (mean)					
Any basic messaging vs. control	2.8	3.0	0.2*	0.07	<0.001
Benefits-framed basic vs. control	2.8	3.0	0.2*	0.08	<0.001
Consequences-framed basic vs. control	2.8	3.0	0.2*	0.07	<0.001

SOURCE: District administrative records.
NOTES: Sample size = 108 schools; 7,876 students in benefits-framed basic messaging 7,839 students in consequences-framed basic messaging; 8,088 students in control.
Chronic absence and number of days absent in the fall are based on attendance records from October 1 to end of December 2017.
The analyses are based on a regression model controlling for school fixed effects, indicator for history of high absences, working SMS at baseline indicator, and a set of student covariates.
Control group means are unadjusted mean percentages (for chronic absence) or unadjusted means (for the days absent outcome); messaging group means were computed by adding the estimated differences to the control group means.
The table displays original *p*-values. * Indicates that the average messaging (any basic messaging, benefits-framed basic messaging, consequences-framed basic messaging) student attendance outcome is statistically significantly different from the average control student attendance ($p < .05$), when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.[38]

[38] The statistical significance levels were adjusted for four multiple comparisons (any basic messaging vs. control, benefits-framed basic vs. control, consequences-framed basic vs. control, and benefits- vs. consequences-framed basic messaging). The results comparing benefits-framed basic messaging to consequences-framed basic messaging for the impact analyses were presented in Appendix C. The differences between benefits- and consequences-framed basic messaging were not statistically significant for any of the main impact analysis, nor for any of the sensitivity analyses conducted. Thus, these results are not presented here in Appendix E.

Exhibit E.1d. Impact estimates for the basic messaging approaches on chronic absence and number of days absent in the fall, for students with a history of high absences

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)					
Any basic messaging vs. control	36.8	41.3	-4.5*	-0.09	0.001
Benefits-framed basic vs. control	36.9	41.3	-4.4*	-0.09	0.005
Consequences-framed basic vs. control	36.6	41.3	-4.7*	-0.10	0.003
Number of days absent (mean)					
Any basic messaging vs. control	4.7	5.1	-0.4*	-0.11	<0.001
Benefits-framed basic vs. control	4.7	5.1	-0.4*	-0.12	<0.001
Consequences-framed basic vs. control	4.7	5.1	-0.4*	-0.11	0.001

SOURCE: District administrative records.
NOTES: Sample size = 108 schools; 2,166 students in benefits-framed basic messaging; 2,161 students in consequences-framed basic messaging; 2,194 students in control.
Chronic absence and number of days absent in the fall are based on attendance records from October 1 to end of December 2017.
The analyses are based on a regression model controlling for school fixed effects, working SMS at baseline indicator, and a set of student covariates.
Control group means are unadjusted mean percentages (for chronic absence) or unadjusted means (for the days absent outcome); messaging group means were computed by adding the estimated differences to the control group means.
The table displays original *p*-values. * Indicates that the average messaging (any basic messaging, benefits-framed basic messaging, consequences-framed basic messaging) student attendance outcome is statistically significantly different from the average control student attendance outcome ($p < .05$), when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.

Exhibit E.1e. Impact estimates for the intensified messaging approaches, compared to each other, on student attendance outcomes in the spring, for students overall

Outcome	School Staff Outreach	Goal Commitment	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)	44.7	48.0	-3.3*	-0.07	0.037
Number of days absent (mean)	10.9	11.1	-0.2	-0.03	0.327

SOURCE: District administrative records.
NOTES: Sample size = 108 schools; 2,216 students in School Staff Outreach; 2,164 students in Goal Commitment messaging.
Chronic absence and number of days absent are based on attendance records from January 2018 through the end of the 2017-18 school year.
The analyses are based on a regression model controlling for school fixed effects, working SMS at baseline indicator, indicator for history of high absences, and a set of student covariates.
School Staff Outreach means are unadjusted means; Goal Commitment means were computed by adding the estimated differences to the School Staff Outreach means.
* Indicates that the average outcomes for the two intensified messaging conditions (School Staff Outreach, Goal Commitment messaging) are statistically significantly different from each other ($p < .05$).

Exhibit E.1f. Impact estimates for the intensified messaging approaches, compared to each other, on student attendance outcomes in the spring, for students with a history of high absences

Outcome	School Staff Outreach	Goal Commitment	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)	58.6	63.4	-4.8*	-0.10	0.033
Number of days absent (mean)	13.5	14.1	-0.6	-0.07	0.111

SOURCE: District administrative records.
NOTES: Sample size = 108 schools; 1,149 students in School Staff Outreach; 1,1168 students in Goal Commitment messaging.
Chronic absence and number of days absent are based on attendance records from January 2018 through the end of the 2017-18 school year.
The analyses are based on a regression model controlling for school fixed effects, working SMS at baseline indicator, and a set of student covariates.
School Staff Outreach means are unadjusted means; Goal Commitment means were computed by adding the estimated differences to the School Staff Outreach means.
* Indicates that the average outcomes for the two intensified messaging conditions (School Staff Outreach, Goal Commitment messaging) are statistically significantly different from each other ($p < .05$).

All Students at the Start of the Study in a Basic Messaging or No-Messaging Control Condition, with Multiple Imputation to Account for Missing Data

The main analyses included students who were enrolled for 100 percent of the days and not missing baseline demographic data. Although the level of missing data in the study was low (see Exhibit E.2), it is possible that the results could be different if students who did not meet these criteria were included in the analytic sample. For example, students who transferred out of the district may have been more at-risk than students who remained for the full year, and more at-risk students may have been affected by the texting strategy differently than less at-risk students. To examine this possibility, the study conducted sensitivity analyses using the entire sample of students initially in the basic text messaging or no-messaging conditions who were not opted out by parents. Because this sample included students who were missing data for one or more variables, multiple imputation was used to fill in the missing information.

Exhibit E.2. Rates of missing data

Variables	Percent of total sample
Missing at least one demographic baseline variable	1.33
Missing attendance data for at least one day in first quarter	2.15
Missing attendance data for at least one day in second quarter	3.53
Missing attendance data for at least one day in third quarter	4.76
Missing attendance data for at least one day in fourth quarter	6.97

SOURCE. Authors calculations.
NOTES. Sample size = 26,843 originally in the initial messaging conditions or no-messaging control group.

Multiple imputation is a Monte Carlo technique in which missing values are replaced by m>1 simulated versions. In this study, m was set to 10 (Little & Rubin, 1987; Rubin 1987; Schafer 1997; Schafer & Graham, 2002). Multiple imputation is a valid method for handling missing data when the missing data mechanism is 'missing at random,' or MAR. In the case of MAR, missing patterns can be predicted by observed covariates (Rubin, 1987). This assumption implies that missing data does not depend on unobserved covariates, after controlling for observed

ones.[39] Missing data analyses conducted with the study data showed that multiple baseline characteristics predicted whether students in the study had missing data, including indicators for being White, Hispanic, having a history of high absences, being an English language learner, and having a parent with a working cell phone number at baseline. These results suggest that the use of multiple imputation is a reasonable approach for handling missing data in this study.

The study team used the R-mice package to conduct the multiple imputation. This study applied a time-ordered nested conditional imputation model to impute missing data, as it is the only approach used for SMART designs thus far (Shortreed et al., 2014). This approach is cascading in the sense that the imputed and observed values from the baseline are used as predictors in an imputation model for missing information in the fall, and the observed and imputed values from the baseline and the fall are then used as predictors in the imputation model for missing information in the spring. Missing baseline data were imputed first using only baseline data. This was done using a fully conditional specification of each of the baseline variables. First, the missing baseline data were imputed by filling in the missing values for a variable by sampling at random from the data that were observed for that variable. The first variable to be imputed was denoted as X_1, while $X_2, \dots, X_k$ denoted the additional baseline variables. For the baseline variables that were binary (such as gender), a logistic regression model of the form:

$$\text{E. 1.} \qquad \text{logit}\{\Pr(X_1 = 1 \mid X_2, \dots, X_k)\} = \alpha_1 + \alpha_2 X_2 + \cdots + \alpha_k X_k$$

was fit to the data for which X_1 was observed. The missing values of X_1 were then imputed by sampling from the posterior predictive distribution of X_1. Then the missing values for variable X_2 were imputed using the same model conditioned on $X_1, X_3, \dots, X_k$ such that the imputed values from the previous step were used for the missing values in X_1. This process was repeated for all of the variables to complete one cycle. The same process was used to cycle through the rest of the variables repeatedly until the results stabilized and one imputed data set of the baseline variables was constructed.

Next, the missing data for the percentage of days absent in the fall were imputed. The fall semester was split in half so that the first half of the semester ran from October 1 to November 12. Those who were not enrolled for the entire period were considered to be missing. Let $X = (X_1, \dots, X_k)$ be a vector of baseline covariates and Y_1 be the percentage of days absent during the first half of the fall. The imputation model for the percentage of days absent was a regression model that included (1) the imputed baseline variables, (2) the intervention indicators, and (3) interactions between the intervention indicators and baseline covariates:

$$\text{E. 2.} \qquad Y_1 = \alpha_1 + \alpha_2 X + \alpha_3 A_1 + \alpha_4 A_1 X$$

As before, the model was fit to the data for which Y_1 is observed, and the missing values were imputed by sampling from the posterior predictive distribution. The model was fitted repeatedly with the sample drawn from the posterior distribution until the results stabilized. The percentage of days absent during the second half of the fall was imputed next, where those students who were not enrolled for the entire second half were considered to have missing data. Let Y_2 denote the percentage of days absent during the second half of the fall. The same procedure was used to impute the missing data using a model that included both the baseline imputed data and the imputed data for the first half of the fall semester, including the (1) imputed baseline variables, (2) intervention indicators, (3) the interactions between intervention indicators and baseline variables, (4) the imputed percentage of days absent for the first part of the fall semester, and (5) the interactions between the intervention indicators and the percentage of days absent in the first part of the fall semester:

[39] The MAR assumption, however, cannot be formally tested, nor is it possible to test whether missingness depends on the values that are missing (the 'not missing at random' or NMAR assumption).

$$\text{E. 3.} \quad Y_2 = \alpha_1 + \alpha_2 X + \alpha_3 A_1 + \alpha_4 A_1 X + \alpha_5 Y_1 + \alpha_6 A_1 Y_1.$$

After the imputation was completed for the fall semester, the missing data for the spring semester that also included the additional intensified messaging strategies were imputed. The first step was to impute the intervention status for students who were missing an intervention assignment for the spring based on their imputed absences in the fall. Those students from families who were below the 8 percent threshold continued to have the same intervention status as during the fall and those students from families who were above the 8 percent threshold were randomized to School Staff Outreach or Goal Commitment messaging with equal probability. Otherwise the percentage of days missed was imputed similarly to the fall semester. The spring semester was split into two, from January 2 to April 1 and from April 2 to the end of the Spring semester. Let Y_3 and Y_4 denote the percentage of days absent during the first and second half of the spring, respectively. A regression approach similar to the one used for imputing missing fall data was used to impute the missing spring data, with a model that included (1) the baseline observed and imputed data, (2) fall intervention indicators, (3) the interactions between fall intervention indicators and baseline variables, (4) the interactions between spring intervention indicators and baseline variables, (5) the interaction between fall and spring intervention indicators, (6) the imputed percentage of days absent for the first and second parts of the fall semester, and (7) the interactions between fall and spring intervention indicators and the percentage of days absent in the first and second parts of the fall semester:

$$\text{E. 4.} \quad Y_3 = \alpha_1 + \alpha_2 X + \alpha_3 A_1 + \alpha_4 A_1 X + \alpha_5 A_2 X + \alpha_6 A_2 A_1 + \alpha_7 Y + \alpha_8 A_1 Y + \alpha_9 A_2 Y$$

$$\text{where } Y = (Y_1, Y_2)$$

The same approach was used for the second half of the spring. The imputation model is the same, other than the addition of the percentage of days absent in the first part of the spring semester, and the interactions between fall and spring intervention indicators and the percentage of days absent in the first part of the spring semester:

$$\text{E. 5.} \quad Y_4 = \alpha_1 + \alpha_2 X + \alpha_3 A_1 + \alpha_4 A_1 X + \alpha_5 A_2 X + \alpha_6 A_2 A_1 + \alpha_7 Y + \alpha_8 A_1 Y + \alpha_9 A_2 Y$$

$$\text{where } Y = (Y_1, Y_2, Y_3)$$

All of these procedures were repeated 10 times to create 10 multiple imputed data sets. The percentage of days absent in the fall and the indicator for whether a student was chronically absent in the fall was then calculated from each of the resulting data sets. The overall estimate is the average of individual estimates from each imputed data set. The standard errors were adjusted for within- and between-imputation variance.

The results of these analyses conducted on the entire student sample that were in families randomly assigned at the start of the study (and that did not subsequently opt out) are shown in the exhibits that follow. Exhibits E.3a and E.3b present attendance outcomes for the overall student sample and the subsample of students with a history of high absences, comparing each adaptive intervention to the no-messaging control condition. Exhibits E.3c and E.3d present attendance outcomes for the overall sample and students with a history of high absences, comparing each basic messaging condition to the no-messaging control condition. Exhibit E.3e and E.3f present the attendance outcomes for the overall sample and students with a history of high absences, comparing the two intensified messaging approaches to each other.

The results from the analysis using the full sample with multiple imputation to account for missing data are consistent with the main results in almost all cases. The few exceptions noted below largely come from analyses examining the study's secondary measure of attendance, which was number of days absent.[40]

- ***Analyses comparing adaptive interventions to the control condition.*** The main impact analysis found significant differences between each adaptive intervention and the no-messaging control for both chronic absence and number of days absent outcomes for the overall sample and for students with a history of high absences. The analysis using multiple imputation indicated similar significant results for the chronic absence outcome for the overall sample and the subsample of students with a history of high absences. However, unlike the main impact analysis, for the number of days absent outcome only one of the adaptive interventions had a statistically significant impact (the one that assigned consequences-framed basic messaging at baseline and intensified with Goal Commitment messaging) for the overall sample, and none of the adaptive interventions had significant effects on the number of days absent outcome for students with a history of high absences.
- ***Analysis comparing basic messaging approaches to the control condition.*** The main impact analyses found both benefits- and consequences-framed basic messaging reduced both chronic absence and the number of days absent, compared to the no-messaging control for the overall sample and students with a history of high absences. The analysis using multiple imputation did not find statistically significant differences between the individual comparisons of benefits- or consequences-framed basic messaging to the control group for the chronic absence outcome for the overall sample. (However, like the main impact analysis, the analysis using multiple imputation found a significant impact for *any basic messaging* on the chronic absence outcome when compared to the no-messaging control condition.) For students with a history of high absences, the analysis using multiple imputation was consistent with the main analyses – both benefits- and consequences-framed messages reduced chronic absence and the number of days absent, compared to the no-messaging control condition.
- ***Analysis comparing intensified messaging approaches.*** In the main impact analyses, chronic absence rates and number of days absent for the overall sample appeared lower for students in School Staff Outreach than Goal Commitment messaging, but the difference was not statistically significant. This difference was statistically significant for students with a history of high absences. With the entire sample with multiple imputation, number of days absent (but not chronic absence rates) were statistically significantly lower for students overall in School Staff Outreach than those in Goal Commitment messaging; and among students with a history of high absences, School Staff Outreach was a statistically significantly better intensified strategy than Goal Commitment messaging, in terms of reducing both chronic absence and the number of days absent.

[40] Multiple imputation is the only recommended missing data approach for SMART designs but has been only recently applied in SMART analyses. The study team used the one approach that has been best-documented in the research literature: a time-ordered nested conditional imputation model. As the application of multiple imputation to SMART designs is relatively new and research comparing different missing data approaches for SMART designs is lacking, it is unclear why the results for the number of days absent outcome differ for the multiple-imputed sample and the main analysis sample.

Exhibit E.3a. Pairwise differences between each adaptive intervention and control on full-year attendance outcomes, full student sample with multiple imputation to address missing data

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)					
AI1 vs. control	14.9	18.0	-3.1*	-0.08	<0.001
AI2 vs. control	15.7	18.0	-2.3*	-0.06	0.001
AI3 vs. control	16.0	18.0	-2.0*	-0.05	0.005
AI4 vs. control	15.6	18.0	-2.4*	-0.07	<0.001
Number of days absent (mean)					
AI1 vs. control	9.7	10.1	-0.4	-0.02	0.145
AI2 vs. control	9.6	10.1	-0.5	-0.03	0.050
AI3 vs. control	9.8	10.1	-0.3	-0.02	0.281
AI4 vs. control	9.5	10.1	-0.6*	-0.05	0.002

SOURCE: District administrative records.

NOTES: AI1 assigns benefits-framed basic messaging at baseline, then School Staff Outreach if need, otherwise continue with benefits-framed messaging; AI2 assigns benefits-framed basic messaging at baseline, then Goal Commitment messaging if need, otherwise continue with benefits-framed messaging; AI3 assigns consequences-framed basic messaging at baseline, School Staff Outreach if need, otherwise continue with consequences-framed messaging; AI4 assigns consequences-framed basic messaging at baseline, Goal Commitment messaging if need, otherwise continue with consequences-framed messaging; where "if need" is defined as missing 8 percent of days or more between the start of October and the end of December 2017.

Sample size = 108 schools; 7,346 students in AI1; 7,338 students in AI2; 7,306 students in AI3; 7,284 students in AI4; 8,782 students in control.

Chronic absence and number of days absent are based on attendance records from October 1 through the end of the 2017–18 school year.

The analyses are based on a regression model controlling for school fixed effects, working SMS at baseline indicator, indicator for history of high absences, and a set of student covariates.

Control group means are unadjusted mean percentages (for chronic absence) or unadjusted means (for the days absent outcome); messaging group means were computed by adding the estimated differences to the control group means.

The table displays original *p*-values. * Indicates that the average outcome for the adaptive interventions is statistically significantly different from control ($p < .05$) when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.

Exhibit E.3b. Pairwise differences between each adaptive intervention and control on full-year attendance outcomes, for students with history of high absences with multiple imputation to address missing data

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)					
AI1 vs. control	41.7	47.8	-6.1*	-0.12	<0.001
AI2 vs. control	42.8	47.8	-5.0*	-0.10	0.008
AI3 vs. control	42.0	47.8	-5.8*	-0.12	0.001
AI4 vs. control	44.2	47.8	-3.6	-0.07	0.040
Number of days absent (mean)					
AI1 vs. control	16.0	16.8	-0.8	-0.04	0.244
AI2 vs. control	15.7	16.8	-1.1	-0.05	0.136
AI3 vs. control	16.1	16.8	-0.7	-0.03	0.304
AI4 vs. control	16.0	16.8	-0.8	-0.05	0.133

SOURCE: District administrative records.

NOTES: AI1 assigns benefits-framed basic messaging at baseline, then School Staff Outreach if need, otherwise continue with benefits-framed messaging; AI2 assigns benefits-framed basic messaging at baseline, then Goal Commitment messaging if need, otherwise continue with benefits-framed messaging; AI3 assigns consequences-framed basic messaging at baseline, School Staff Outreach if need, otherwise continue with consequences-framed messaging; AI4 assigns consequences-framed basic messaging at baseline, Goal Commitment messaging if need, otherwise continue with consequences-framed messaging; where "if need" is defined as missing 8 percent of days or more between the start of October and the end of December 2017.

Sample size = 108 schools; 1,764 students in AI1; 1,766 students in AI2; 1,758 students in AI3; 1,772 students in AI4; 2,442 students in control. Chronic absence and number of days absent are based on attendance records from October 1 through the end of the 2017-18 school year. The analyses are based on a regression model controlling for school fixed effects, working SMS at baseline indicator, and a set of student covariates.

Control group means are unadjusted mean percentages (for chronic absence) or unadjusted means (for days absent); messaging group means were computed by adding the estimated differences to the control group means.

The table displays original *p*-values. * Indicates that the average outcome for the adaptive intervention is statistically significantly different from control ($p < .05$) when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.

Exhibit E.3c. Impact estimates for the comparison of basic messaging approaches on chronic absence and number of days absent in the fall, for the full student sample with multiple imputation to address missing data

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)					
Any basic messaging vs. control	15.9	18.2	-2.3*	-0.06	<0.001
Benefits-framed basic vs. control	15.9	18.2	-2.3	-0.06	0.055
Consequences-framed basic vs. control	15.8	18.2	-2.4	-0.06	0.050
Number of days absent (mean)					
Any basic messaging vs. control	2.9	3.1	-0.2*	-0.11	<0.001
Benefits-framed basic vs. control	2.9	3.1	-0.2*	-0.07	<0.001
Consequences-framed basic vs. control	2.9	3.1	-0.2*	-0.06	<0.001

SOURCE: District administrative records.

NOTES: Sample size = 108 schools; 8,566 students in benefits-framed basic messaging; 8,486 students in consequences-framed basic messaging; 8,782 students in control.

Chronic absence and number of days absent in the fall are based on attendance records from October 1 to the end of December 2017. The analyses are based on a regression model controlling for school fixed effects, indicator for history of high absences, working SMS at baseline indicator, and a set of student covariates.

Control group means are unadjusted mean percentages (for chronic absence) or unadjusted means (for the days absent outcome); messaging group means were computed by adding the estimated differences to the control group means.

The table displays original *p*-values. * Indicates that the average messaging (any basic messaging, benefits-framed basic messaging, consequences-framed basic messaging) student attendance outcome is statistically significantly different from the average control student attendance outcome ($p < .05$), when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.

Exhibit E.3d. Impact estimates for the comparison of basic initial messaging approaches on chronic absence and number of days absent in the fall, for students with history of high absences with multiple imputation to address missing data

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)					
Any basic messaging vs. control	36.5	41.3	-4.8*	-0.10	<0.001
Benefits-framed basic vs. control	36.4	41.3	-4.9*	-0.10	0.001
Consequences-framed basic vs. control	36.5	41.3	-4.8*	-0.10	0.001
Number of days absent (mean)					
Any basic messaging vs. control	4.8	5.2	-0.4*	-0.12	<0.001
Benefits-framed basic vs. control	4.8	5.2	-0.5*	-0.10	<0.001
Consequences-framed basic vs. control	4.9	5.2	-0.4*	-0.09	0.002

SOURCE: District administrative records.
NOTES: Sample size = 108 schools; 2,408 students in benefits-framed basic messaging; 2,376 students in consequences-framed basic messaging; 2,436 students in control.
Chronic absence and number of days absent in the fall are based on attendance records from October 1 to the end of December 2017. The analyses are based on a regression model controlling for school fixed effects, working SMS at baseline indicator, and a set of student covariates.
Control group means are unadjusted mean percentages (for chronic absence) or unadjusted means (for the days absent outcome); messaging group means were computed by adding the estimated differences to the control group means.
The table displays original *p*-values. * Indicates that the average messaging (any basic messaging, benefits-framed basic messaging, consequences-framed basic messaging) student attendance outcome is statistically significantly different from the average control student attendance outcome ($p < .05$), when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.
The estimated difference does not always equal the difference between the means of compared conditions due to rounding.

Exhibit E.3e. Impact estimates for the intensified messaging approaches, compared to each other, on student attendance outcomes in the spring, for the full student sample with multiple imputation to address missing data

Outcome	School Staff Outreach	Goal Commitment	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)	48.9	51.8	-3.0	0.06	0.069
Number of days absent (mean)	16.9	17.1	-0.3*	0.06	0.036

SOURCE: District administrative records.
NOTES: Sample size = 108 schools; 2,594 students in School Staff Outreach; 2,580 students in Goal Commitment messaging.
Chronic absence and number of days absent are based on attendance records from January 2018 through the end of the 2017-18 school year. The analyses are based on a regression model controlling for school fixed effects, indicator for history of high absences, working SMS at baseline indicator, and a set of student covariates.
School Staff Outreach means are unadjusted means; Goal Commitment means were computed by adding the estimated differences to the School Staff Outreach means.
* Indicates that the average outcomes for the two intensified messaging conditions (School Staff Outreach, Goal Commitment messaging) are statistically significantly different from each other ($p < .05$).
The estimated difference does not always equal the difference between the means of compared conditions due to rounding.

Exhibit E.3f. Impact estimates for the intensified messaging approaches, compared to each other, on student attendance outcomes in the spring, for students with a history of high absences with multiple imputation to address missing data

Outcome	School Staff Outreach	Goal Commitment	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)	64.5	69.0	-4.5*	0.10	0.030
Number of days absent (mean)	20.2	20.7	-0.5*	0.09	0.015

SOURCE: District administrative records.

NOTES: Sample size = 108 schools; 1,139 students in School Staff Outreach; 1,348 students in Goal Commitment messaging.

Chronic absence and number of days absent are based on attendance records from January 2018 through the end of the 2017-18 school year. The analyses are based on a regression model controlling for school fixed effects, working SMS at baseline indicator, and a set of student covariates.

School Staff Outreach means are unadjusted means; Goal Commitment means were computed by adding the estimated differences to the School Staff Outreach means.

* Indicates that the average outcomes for the two intensified messaging conditions (School Staff Outreach, Goal Commitment messaging) are statistically significantly different from each other ($p < .05$).

Alternative Model Specification for the Number of Days Absent Outcome

For simplicity, the main impact analyses for the number of days absent outcome were conducted using linear models. However, because the number of days absent is a count variable, we also conducted sensitivity analyses using a Poisson model for comparing the adaptive interventions to the no-messaging control and to each other, a quasi-Poisson model for comparing the basic messaging approaches to the no-messaging control and to each other, and a quasi-Poisson model comparing the two intensified messaging strategies to each other.[41] These alternative models explicitly account for the fact that number of days absent is a non-negative count outcome. Exhibits E.4a, E.4b, E.4c, and E.4d present the results from these analyses for students overall. The results are similar to those for the main analyses (that is, the same comparisons are statistically significant, with similar *p*-values and effect sizes.)

Exhibit E.4a. Pairwise differences between each adaptive intervention and control on number of days absent over the full year, for students overall

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Number of days absent (mean)					
AI1 vs. control	8.4	8.9	-0.6*	-0.08	<0.001
AI2 vs. control	8.4	8.9	-0.5*	-0.08	<0.001
AI3 vs. control	8.4	8.9	-0.5*	-0.07	<0.001
AI4 vs. control	8.4	8.9	-0.6*	-0.08	<0.001

SOURCE: District administrative records.
NOTES: AI1 assigns benefits-framed basic messaging at baseline, then School Staff Outreach if need, otherwise continue with benefits-framed messaging; AI2 assigns benefits-framed basic messaging at baseline, then Goal Commitment messaging if need, otherwise continue with benefits-framed messaging; AI3 assigns consequences-framed basic messaging at baseline, School Staff Outreach if need, otherwise continue with consequences-framed messaging; AI4 assigns consequences-framed basic messaging at baseline, Goal Commitment messaging if need, otherwise continue with consequences-framed basic messaging; where "if need" is defined as missing 8 percent of days or more between the start of October and the end of December 2017.
Sample size = 108 schools; 6,788 students in AI1; 6,759 students in AI2; 6,763 students in AI3; 6,740 students in AI4; 8,088 students in control.
Chronic absence and number of days absent are based on attendance records from October 1 through the end of the 2017–18 school year.
The analyses are based on a Poisson regression model controlling for school fixed effects, working SMS at baseline indicator, indicator for history of high absences, and a set of student covariates.
Control group means are unadjusted means; messaging group means were computed by adding the estimated differences to the control group means.
The table displays original *p*-values. * Indicates that the average outcome for the adaptive intervention is statistically significantly different from control ($p < .05$) when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.
The estimated difference does not always equal the difference between the means of compared conditions due to rounding.

[41] In general, the quasi-Poisson model was preferred to the Poisson model because the absence data are over-dispersed due to a large number of 0s. However, the more complex analyses involving the full-year absence data and various adaptive interventions (Exhibits E.4a and E.4b) were run using a Poisson model because of convergence problems with the quasi-Poisson model. Since those analyses were estimated in the Generalized Estimating Equation framework, standard errors were corrected for distributional violations.

Exhibit E.4b. Pairwise differences between each adaptive intervention on number of days absent over the full year, for students overall

Outcome	AI1	AI2	AI3	AI4	Estimated difference	Effect size	*p*-value
Number of days absent (mean)							
AI1 vs. AI2	8.4	8.4			-0.0	-0.01	0.760
AI1 vs. AI3	8.4		8.4		-0.0	-0.01	0.771
AI1 vs. AI4	8.4			8.4	-0.0	-0.00	0.938
AI2 vs. AI3		8.4	8.4		0.0	0.00	0.975
AI2 vs. AI4		8.4		8.4	0.0	0.00	0.851
AI3 vs. AI4			8.4	8.4	0.0	0.00	0.807

SOURCE: District administrative records.
NOTES: AI1 assigns benefits-framed basic messaging at baseline, then School Staff Outreach if need, otherwise continue with benefits-framed messaging; AI2 assigns benefits-framed basic messaging at baseline, then Goal Commitment messaging if need, otherwise continue with benefits-framed messaging; AI3 assigns consequences-framed basic messaging at baseline, School Staff Outreach if need, otherwise continue with consequences-framed messaging; AI4 assigns consequences-framed basic messaging at baseline, Goal Commitment messaging if need, otherwise continue with consequences-framed messaging. Where "if need" is defined as missing 8 percent of days or more between the start of October and the end of December 2017.
Sample size = 108 schools; 6,631 students in AI1; 6,591 students in AI2; 6,583 students in AI3; 6,564 students in AI4.
Number of days absent are based on attendance records from October 1 through the end of the 2017–18 school year.
The analyses are based on a Poisson regression model controlling for school fixed effects, working SMS at baseline indicator, indicator for history of high absences, and a set of student covariates.
The table displays original *p*-values. * Indicates that the average outcomes for any two adaptive interventions compared to each other are statistically significantly different from each other ($p < .05$), when the significance level is adjusted for six pairwise comparisons with a Bonferroni correction.
The estimated difference does not always equal the difference between the means of compared conditions due to rounding.

Exhibit E.4c. Impact estimates for the basic messaging approaches on number of days absent in the fall, for students overall

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Number of days absent (mean)					
Any basic messaging vs. control	2.7	2.9	-0.2*	-0.08	<0.001
Benefits-framed basic vs. control	2.7	2.9	-0.2*	-0.08	<0.001
Consequences-framed basic vs. control	2.7	2.9	-0.2*	-0.07	<0.001

SOURCE: District administrative records.
NOTES: Sample size = 108 schools; 7,876 students in benefits-framed basic messaging; 7,839 students in consequences-framed basic messaging; 8,088 students in control.
Number of days absent in the fall are based on attendance records from October 1 to the end of December 2017. The analyses are based on a quasi-Poisson regression model controlling for school fixed effects, working SMS at baseline indicator, indicator for history of high absences, and a set of student covariates.
Control group means are unadjusted means; messaging group means were computed by adding the estimated differences to the control group means.
The table displays original *p*-values. * Indicates that the average messaging (any basic messaging, benefits-framed basic messaging, consequences-framed basic messaging) student attendance outcome is statistically significantly different from the average control student attendance ($p < .05$), when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.

Exhibit E.4d. Impact estimates for the two intensified messaging approaches, compared to each other, on number of days absent outcome in the spring, for students overall

Outcome	School Staff Outreach	Goal Commitment	Estimated difference	Effect size	*p*-value
Number of days absent (mean)	10.8	11.0	-0.2	-0.03	0.378

SOURCE: District administrative records.
NOTES: Sample size = 108 schools; 2,116 students in School Staff Outreach; 2,057 students in Goal Commitment messaging.
Number of days absent is based on attendance records from January 2018 through the end of the 2017-18 school year.
The analyses are based on a quasi-Poisson regression model controlling for school fixed effects, indicator for history of high absences, working SMS at baseline indicator, and a set of student covariates.
School Staff Outreach means are unadjusted means; Goal Commitment means were computed by adding the estimated differences to the School Staff Outreach means.* Indicates that the average outcomes for the two intensified messaging conditions (School Staff Outreach, Goal Commitment messaging) are statistically significantly different from each other (p <.05).

Subgroup Analyses

The study hypothesized that the text messaging might be more effective for students with a prior history of high absences and prioritized examining findings for that subsample of students alongside the overall sample. The study also conducted exploratory analyses for three other subgroups of students. (The student samples used in these analyses were subsets of the overall student sample used for the main impact analyses - that is, students who were not opted out of the study and were enrolled for 100 percent of school days, with complete demographic data.)

1. District subgroup: these analyses excluded one district (out of four participating districts total) that experienced the greatest degree of messaging delivery challenges. These analyses included a total of 79 schools and 16,569 students in the three other districts.
   - The study team hypothesized that the attendance messaging may have been more effective when excluding the one district where messages were more often not sent as planned.
2. Home language subgroup: these analyses included only students for whom the home language indicated in the district student information system was English, a total of 18,691 students.
   - The study team hypothesized that the attendance messaging may have been more effective when students whose parents received messages in languages other than English are excluded. The reason for this hypothesis was that although the messages were carefully and professionally translated into many languages, they were developed in English.
3. Subgroup of students with both a history of high absences and a working mobile phone at baseline: These analyses included only students who had both a history of high absences (missed 10 percent or more of school days in the prior year or in the first month of the 2017-18 school year) and had at least one parent with a working cell phone number in the first month of the 2017-18 school year. As reported in Appendix B, 27 percent of students in the study sample had a history of high absences, and 85 percent had a parent with a working phone at baseline; 22 percent had both, or a total of 5,193 students in this subgroup.
   - This subgroup of students was arguably the group that might be expected to experience the greatest impact of the adaptive text messaging strategy; that is, students who were at risk for chronic absence due to previous attendance patterns and whose parents were more likely to be reachable via text messaging.

For brevity, this section does not present subgroup results for analyses comparing adaptive interventions or basic messaging approaches to each other, but all the subgroup analyses for these comparisons were consistent

with the main analyses. (That is, there were no statistically significant differences among the adaptive interventions or between the two basic messaging approaches.)

The subgroup analyses did not reveal any new patterns of results. The effects of the adaptive interventions and basic messaging approaches, and the comparison of intensified messaging approaches were similar to those found in the main impact analyses.

District Subgroup Analysis

Exhibit E.5a shows results for analyses comparing each adaptive intervention to the no-messaging control condition from the three districts without message delivery problems. Exhibit 5.b shows results for analyses comparing each basic text messaging approach to no-messaging, and Exhibit 5.c shows results for analyses comparing the two intensified text messaging approaches to each other, for the overall sample in the district subgroup.

These results are similar to those from the main impact analyses reported in Appendix C with the following exception, which appears to possibly be due to reduced statistical power with the smaller sample size, because the point estimate is about the same or larger in magnitude, but the difference is not statistically significant:

- ***Analysis comparing basic messaging approaches to the no-messaging control condition.*** The comparison between consequences-framed basic messaging and the control condition is not statistically significant for the chronic absence outcome.

Exhibit E.5a. Pairwise differences between each adaptive intervention and control on full-year attendance outcomes, for the overall student sample in the three districts included in the district subgroup analysis

Outcome	Messaging condition	Control	Estimated difference	Effect size	p-value
Chronic absence (percentage)					
AI1 vs. control	17.6	20.8	-3.2*	-0.09	0.000
AI2 vs. control	18.8	20.8	-2.2*	-0.06	0.009
AI3 vs. control	17.4	20.8	-3.4*	-0.09	0.000
AI4 vs. control	17.4	20.8	-3.4*	-0.10	0.000
Number of days absent (mean)					
AI1 vs. control	9.7	10.3	-0.6*	-0.07	0.000
AI2 vs. control	9.8	10.3	-0.6*	-0.07	0.000
AI3 vs. control	9.6	10.3	-0.7*	-0.09	0.000
AI4 vs. control	9.7	10.3	-0.7*	-0.08	0.000

SOURCE: District administrative records.

NOTES: AI1 assigns benefits-framed basic messaging at baseline, then School Staff Outreach if need, otherwise continue with benefits-framed messaging; AI2 assigns benefits-framed basic messaging at baseline, then Goal Commitment messaging if need, otherwise continue with benefits-framed messaging; AI3 assigns consequences-framed basic messaging at baseline, School Staff Outreach if need, otherwise continue with consequences-framed messaging; AI4 assigns consequences-framed basic messaging at baseline, Goal Commitment messaging if need, otherwise continue with consequences-framed messaging; where "if need" is defined as missing 8 percent of days or more between the start of October and the end of December 2017.

Sample size = 79 schools; 4,748 students in AI1; 4,743 students in AI2; 4,735 students in AI3; 4,710 students in AI4; 5,656 students in control.

Chronic absence and number of days absent are based on attendance records from October 1 through the end of the 2017-18 school year.

The analyses are based on a regression model controlling for school fixed effects, indicator for history of high absences, working SMS at baseline indicator, and a set of student covariates.

Control group means are unadjusted mean percentages (for chronic absence) or unadjusted means (for days absent); messaging group means were computed by adding the estimated differences to the control group means.

The table displays original *p*-values. * Indicates that the average outcomes for the adaptive intervention is statistically significantly different from control ($p < .05$) when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.

Exhibit E.5b. Impact estimates for the basic messaging approaches on chronic absence and number of days absent in the fall, for the overall student sample in the three districts included in the district subgroup analysis

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)					
Any basic messaging vs. control	16.7	18.5	-1.8*	-0.05	0.003
Benefits-framed basic vs. control	16.6	18.5	-1.9*	-0.06	0.005
Consequences-framed basic vs. control	16.9	18.5	-1.6	-0.05	0.021
Number of days absent (mean)					
Any basic messaging vs. control	2.8	3.0	-0.2*	-0.07	0.000
Benefits-framed basic vs. control	2.8	3.0	-0.2*	-0.08	0.000
Consequences-framed basic vs. control	2.8	3.0	-0.2*	-0.07	0.001

SOURCE: District administrative records.

NOTES: Sample size = 79 schools; 5,474 students in benefits-framed basic messaging; 5,439 students in consequences-framed basic messaging; 5,656 students in control.

Chronic absence and number of days absent in the fall are based on attendance records from October 1 to the end of December 2017. The analyses are based on a regression model controlling for school fixed effects, indicator for history of high absences, working SMS at baseline indicator, and a set of student covariates.

Control group means are unadjusted mean percentages (for chronic absence) or unadjusted means (for the days absent outcome); messaging group means were computed by adding the estimated differences to the control group means.

The table displays original *p*-values. * Indicates that the average messaging (any basic messaging, benefits-framed basic messaging, consequences-framed basic messaging) student attendance outcome is statistically significantly different from the average control student attendance outcome ($p < .05$), when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.

Exhibit E.5c. Impact estimates for the intensified messaging approaches, compared to each other, on student attendance outcomes in the spring, for the overall student sample in the three districts included in the district subgroup analysis

Outcome	School Staff Outreach	Goal Commitment	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)	45.1	48.5	-3.4	-0.07	0.090
Number of days absent (mean)	11.5	11.9	-0.4	-0.05	0.213

SOURCE: District administrative records.

NOTES: Sample size = 79 schools; 1,460 students in School Staff Outreach; 1,430 students in Goal Commitment messaging.

Chronic absence and number of days absent in the spring are based on attendance records from January 2018 through end of the 2017-18 school year. The analyses are based on a regression model controlling for school fixed effects, indicator for history of high absences, working SMS at baseline indicator, and a set of student covariates.

School Staff Outreach means are unadjusted means; Goal Commitment means were computed by adding the estimated differences to the School Staff Outreach means.

* Indicates that the average outcomes for the two intensified messaging conditions (School Staff Outreach, Goal Commitment messaging) are statistically significantly different from each other ($p < .05$).

Home Language Subgroup Analysis

Exhibit E.6a shows results for analyses comparing each adaptive intervention to the no-messaging control condition among students whose home language was English. Exhibit E.6b shows results for analyses comparing each basic text messaging approach to no messaging, and Exhibit E.6c shows results for analyses comparing the two intensified text messaging approaches to each other, for the overall sample in the English home language subgroup.

These results are similar to those of the main impact analyses reported in Appendix C with the following exception, which again, seems possibly due to reduced statistical power with the smaller sample size:

- ***Analysis comparing basic messaging approaches to the control condition.*** The comparison between consequences-framed basic messaging and the control condition is not statistically significant for the chronic absence outcome.

Exhibit E.6a. Pairwise differences between each adaptive intervention and control on full-year attendance outcomes, for students in the overall sample whose home language was English

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)					
AI1 vs. control	17.8	21.9	-4.1*	0.11	0.000
AI2 vs. control	19.4	21.9	-2.5*	0.07	0.002
AI3 vs. control	19.2	21.9	-2.7*	0.07	0.001
AI4 vs. control	19.0	21.9	-2.9*	0.08	0.000
Number of days absent (mean)					
AI1 vs. control	9.7	10.2	-0.6*	0.07	0.000
AI2 vs. control	9.7	10.2	-0.5*	0.07	0.000
AI3 vs. control	9.7	10.2	-0.5*	0.06	0.001
AI4 vs. control	9.7	10.2	-0.6*	0.07	0.000

SOURCE: District administrative records.
NOTES: AI1 assigns benefits-framed basic messaging at baseline, then School Staff Outreach if need, otherwise continue with benefits-framed messaging; AI2 assigns benefits-framed basic messaging at baseline, then Goal Commitment messaging if need, otherwise continue with benefits-framed messaging; AI3 assigns consequences-framed basic messaging at baseline, School Staff Outreach if need, otherwise continue with consequences-framed messaging; AI4 assigns consequences-framed basic messaging at baseline, Goal Commitment messaging if need, otherwise continue with consequences-framed messaging; where "if need" is defined as missing 8 percent of days or more between the start of October and the end of December 2017.
Sample size = 108 schools; 5,267 students in AI1; 5,235 students in AI2; 5,267 students in AI3; 5,262 students in AI4; 6,398 students in control.
Chronic absence and number of days absent are based on attendance records from October 1 through the end of the 2017–18 school year.
The analyses are based on a regression model controlling for school fixed effects, indicator for history of high absences, working SMS at baseline indicator, and a set of student covariates.
Control group means are unadjusted mean percentages (for chronic absence) or unadjusted means (for days absent); messaging group means were computed by adding the estimated differences to the control group means.
The table displays original *p*-values. * Indicates that the average outcome for the adaptive intervention is statistically significantly different from control ($p < .05$) when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.
The estimated difference does not always equal the difference between the means of compared conditions due to rounding.

Exhibit E.6b. Impact estimates for the basic messaging approaches on chronic absence and number of days absent in the fall, for students in the overall sample whose home language was English

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)					
Any basic messaging vs. control	18.4	20.3	-1.9*	-0.05	0.001
Benefits-framed basic vs. control	18.1	20.3	-2.2*	-0.06	0.002
Consequences-framed basic vs. control	18.6	20.3	-1.7	-0.05	0.015
Number of days absent (mean)					
Any basic messaging vs. control	2.8	3.0	0.2*	0.06	0.000
Benefits-framed basic vs. control	2.8	3.0	0.2*	0.07	0.000
Consequences-framed basic vs. control	2.9	3.0	0.2*	0.06	0.001

SOURCE: District administrative records.
NOTES: Sample size = 108 schools; 6,143 students in benefits-framed basic messaging; 6,150 students in consequences-framed basic messaging; 6,398 students in control.
Chronic absence and number of days absent in the fall are based on attendance records from October 1 to the end of December 2017. The analyses are based on a regression model controlling for school fixed effects, indicator for history of high absences, working SMS at baseline indicator, and a set of student covariates.
Control group means are unadjusted mean percentages (for chronic absence) or unadjusted means (for the days absent outcome); messaging group means were computed by adding the estimated differences to the control group means.
The table displays original *p*-values. * Indicates that the average messaging (any basic messaging, benefits-framed basic messaging, consequences-framed basic messaging) student attendance outcome is statistically significantly different from the average control student attendance outcome ($p < .05$), when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.
The estimated difference does not always equal the difference between the means of compared conditions due to rounding.

Exhibit E.6c. Impact estimates for the intensified messaging approaches, compared to each other, on student attendance outcomes in the spring, for students in the overall sample whose home language was English

Outcome	School Staff Outreach	Goal Commitment	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)	44.9	48.6	-3.7*	-0.07	0.039
Number of days absent (mean)	11.0	11.2	-0.2	-0.03	0.463

SOURCE: District administrative records.
NOTES: Sample size = 108 schools; 1,796 students in School Staff Outreach; 1,759 students in Goal Commitment messaging.
Chronic absence and number of days absent in the spring are based on attendance records from January 2018 through end of the 2017–18 school year. The analyses are based on a regression model controlling for school fixed effects, indicator for history of high absences, working SMS at baseline indicator, and a set of student covariates.
School Staff Outreach means are unadjusted means; Goal Commitment means were computed by adding the estimated differences to the School Staff Outreach means.* Indicates that the average outcomes for the two intensified messaging conditions (School Staff Outreach, Goal Commitment messaging) are statistically significantly different from each other ($p < .05$).

Subgroup of Students with A History of High Absences and Working Mobile Phone at Baseline

These analyses by definition focused on the students with a history of high absences, further subset by those who had at least one parent with a working mobile phone number prior to the start of the study. Exhibit E.7a presents results from analyses comparing each adaptive intervention to no messaging; Exhibit E.7b presents

results from analyses comparing the basic text messaging approaches to no messaging; and Exhibit E.7c presents results from analyses comparing the intensified text messaging approaches to each other.

These results are similar to the main impact analysis results with the sample of students with a history of high absences, except for the following which again, seem possibly due to reduced statistical power with a smaller sample size:

- ***Analysis comparing intensified messaging strategies.*** In the main impact analyses, chronic absence rates and number of days absent for the subsample of students with a history of high absences were statistically significantly lower for students in School Staff Outreach than Goal Commitment messaging. For the subgroup of students with a history of high absences and working mobile phone at baseline, the results show a similar pattern but are not statistically significant.

Exhibit E.7a. Pairwise differences between each adaptive intervention and control on full-year attendance outcomes, for students with a history of high absences and a working phone at baseline

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)					
AI1 vs. control	37.8	46.6	-8.8*	-0.18	0.000
AI2 vs. control	39.7	46.6	-6.9*	-0.14	0.001
AI3 vs. control	37.8	46.6	-8.8*	-0.18	0.000
AI4 vs. control	41.9	46.6	-4.7	-0.10	0.020
Number of days absent (mean)					
AI1 vs. control	14.7	16.5	-1.9*	-0.17	0.000
AI2 vs. control	15.0	16.5	-1.5*	-0.14	0.000
AI3 vs. control	14.9	16.5	-1.7*	-0.16	0.000
AI4 vs. control	15.2	16.5	-1.4*	-0.13	0.000

SOURCE: District administrative records.
NOTES: AI1 assigns benefits-framed basic messaging at baseline, then School Staff Outreach if need, otherwise continue with benefits-framed messaging; AI2 assigns benefits-framed basic messaging at baseline, then Goal Commitment messaging if need, otherwise continue with benefits-framed messaging; AI3 assigns consequences-framed basic messaging at baseline, School Staff Outreach if need, otherwise continue with consequences-framed messaging; AI4 assigns consequences-framed basic messaging at baseline, Goal Commitment messaging if need, otherwise continue with consequences-framed messaging; where "if need" is defined as missing 8 percent of days or more between the start of October and the end of December.
Sample size = 108 schools; 1,274 students in AI1; 1,270 students in AI2; 1,251 students in AI3; 1,289 students in AI4; 1,756 students in control.
Chronic absence and number of days absent are based on attendance records from October 1 through the end of the 2017–18 school year.
The analyses are based on a regression model controlling for school fixed effects and a set of student covariates.
Control group means are unadjusted mean percentages (for chronic absence) or unadjusted means (for days absent); messaging group means were computed by adding the estimated differences to the control group means.
The table displays original *p*-values. * Indicates that the average outcome for the adaptive intervention is statistically significantly different from control ($p < .05$) when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.
The estimated difference does not always equal the difference between the means of compared conditions due to rounding.

Exhibit E.7b. Impact estimates for the basic messaging approaches on chronic absence and number of days absent in the fall, for students with a history of high absences and a working phone at baseline

Outcome	Messaging condition	Control	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)					
Any basic messaging vs. control	34.4	40.7	-6.3*	-0.13	0.000
Benefits-framed basic vs. control	34.9	40.7	-5.8*	-0.12	0.001
Consequences-framed basic vs. Control	34.0	40.7	-6.7*	-0.14	0.000
Number of days absent (mean)					
Any basic messaging vs. control	4.5	5.0	-0.6*	-0.15	0.000
Benefits-framed basic vs. control	4.5	5.0	-0.5*	-0.14	0.000
Consequences-framed basic vs. control	4.4	5.0	-0.6*	-0.15	0.000

SOURCE: District administrative records.
NOTES: Sample size = 108 schools; 1,732 students in in benefits-framed basic messaging; 1,705 students in students in consequences-framed basic messaging; 1,756 students in control.
Chronic absence and number of days absent in the fall are based on attendance records from October 1 to the end of December 2017. The analyses are based on a regression model controlling for school fixed effects and a set of student covariates.
Control group means are unadjusted mean percentages (for chronic absence) or unadjusted means (for the days absent outcome); messaging group means were computed by adding the estimated differences to the control group means.
The table displays original *p*-values. * Indicates that the average messaging (any basic messaging, benefits-framed basic messaging, consequences-framed basic messaging) student attendance outcome is statistically significantly different from the average control student attendance outcome ($p < .05$), when the significance level is adjusted for four pairwise comparisons with a Bonferroni correction.
The estimated difference does not always equal the difference between the means of compared conditions due to rounding.

Exhibit E.7c. Impact estimates for the intensified messaging approaches, compared to each other, on student attendance outcomes in the spring, for students with a history of high absences and a working phone at baseline

Outcome	School Staff Outreach	Goal Commitment	Estimated difference	Effect size	*p*-value
Chronic absence (percentage)	55.8	60.2	-4.4	-0.09	0.079
Number of days absent (mean)	12.9	13.5	-0.6	-0.07	0.116

SOURCE: District administrative records.
NOTES: Sample size = 108 schools; 878 students in School Staff Outreach; 912 students in Goal Commitment messaging.
Chronic absence and number of days absent in the spring are based on attendance records from January 2018 through end of the 2017-18 school year. The analyses are based on a regression model controlling for school fixed effects and a set of student covariates.
School Staff Outreach means are unadjusted means; Goal Commitment means were computed by adding the estimated differences to the School Staff Outreach means.
* Indicates that the average outcomes for the two intensified messaging conditions (School Staff Outreach, Goal Commitment messaging) are statistically significantly different from each other ($p < .05$).

Quantile Regression Analyses

Exploratory analyses examined whether the basic messaging approaches - which on average reduced chronic absence both overall and for students with a history of high absences - had different effects for students with relatively low or relatively high absences in the fall. This information sheds light on whether the basic messaging approaches worked because they affected attendance only for students with a large number of absences, only for students with relatively few absences, or because they affected attendance for students more universally. These results are only suggestive, as they only focus on the effect of the basic messaging in the fall, the time between the first and second round of random assignment. The basic messaging effect in the fall is the focus because a quantile regression approach has not yet been developed for SMART designs that covers the intervention and outcomes over the entire school year. The quantile regression approach also focuses on the number of days absent outcome rather than the chronic absence outcome because quantile regression methods are substantially more developed for continuous outcomes than for binary outcomes. Exhibit E.8a shows the number of students, mean, standard deviation, minimum, and maximum for the days absent outcome for each quantile (defined as deciles for this analysis), for the overall student sample.

Exhibit E.8a. Descriptive statistics for deciles

All students					
Decile	***N***	**Mean number of days absent**	**Standard deviation**	**Minimum**	**Maximum**
0-10.0%	2,313	0.0	0.0	0	0
10.1-20.0%	2,313	0.0	0.0	0	0
20.1-30.0%	2,313	0.7	0.4	0	1
30.1-40.0%	2,314	1.0	0.0	1	1
40.1-50.0%	2,313	1.7	0.4	1	2
50.1-60.0%	2,313	2.1	0.3	2	3
60.1-70.0%	2,314	3.0	0.1	3	3.5
70.1-80.0%	2,313	4.1	0.3	3.5	5
80.1-90.0%	2,313	5.6	0.6	5	7
90.1-100.0%	2,314	9.8	3.3	7	36
All Students	**23,133**	**2.8**	**3.1**	**0**	**36**

SOURCE: District administrative records.

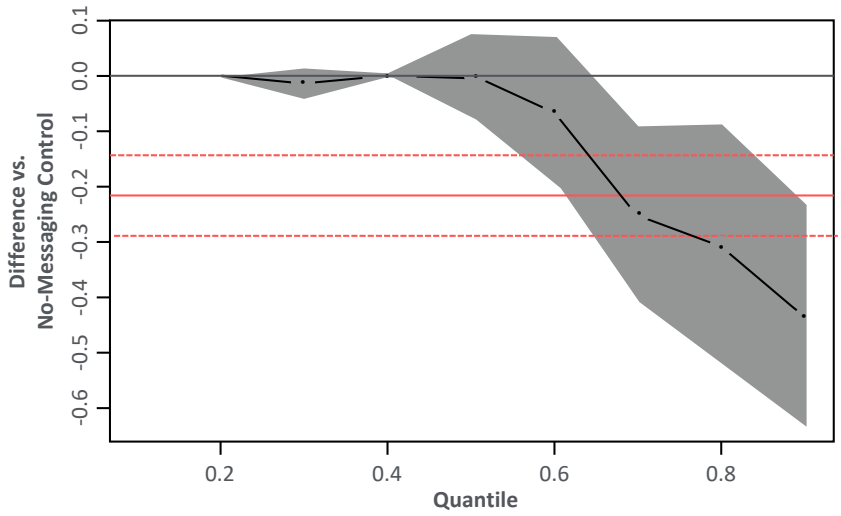
The quantile regression analyses estimated whether the effect of basic messaging varied for students located in different parts of the distribution of number of days absent in the fall. A quantile regression models the relationship between a set of predictor variables and specific quantiles (or deciles in this case) of the response variable. The quantile regression parameter estimates the change in a specified quantile of the response variable produced by a one-unit change in the predictor variable (Koenker, 2005). This allows an examination of whether students in some quantiles based on number of days absent were more affected by basic messaging than students in other quantiles. The magnitude of the effect for different quantiles is reflected in the change in size of the regression coefficient for each quantile. This analysis defined the quantiles in terms of deciles in the distribution of days absent, and the analytical model included the same covariates as the main impact analyses. The following model was used for the quantile regression:

$$\text{E. 6.} \qquad y_i = \beta_0^p + \beta_1^p Basic\_ben_i + \beta_2^p Basic\_con_i + \beta_3^p X_i + \beta_4^p S_i + \varepsilon_i^p$$

Where $0 < p < 1$ indicates the proportion of the population having scores below the quantile at p; y_i is the response variable (number of days absent); $Basic\_ben_i$ and $Basic\_con_i$ are indicators for the two basic messaging approaches; X_i is a vector of baseline student characteristics variables, including race (African American, Native American, Asian, Hispanic, multiple races), gender, disability status, English learner status, whether or not a family had a working cell phone at baseline, and the baseline indicator for a history of high absences; and S_i is a vector of school indicators. The quantile regression was estimated using the R package quantreg.

Exhibits E.8b and E.8c provide a graphical presentation of the quantile regression results. Exhibit E.8b shows the estimated effect of benefits-framed basic messaging, and Exhibit E.8c shows the same plot for consequences-framed basic messaging. Each plot shows the 95 percent confidence intervals in the shaded area, estimated from bootstrapped standard errors. For reference, the solid red line shows the overall estimated impact for the full distribution (as shown in Appendix C), with the dotted lines representing the 95 percent confidence interval for the estimate.[42] Each of these plots shows that there is no effect of assigning one of the basic text messaging approaches for those that were absent for a small number of days, but there is a significant effect for those with more fall absences.

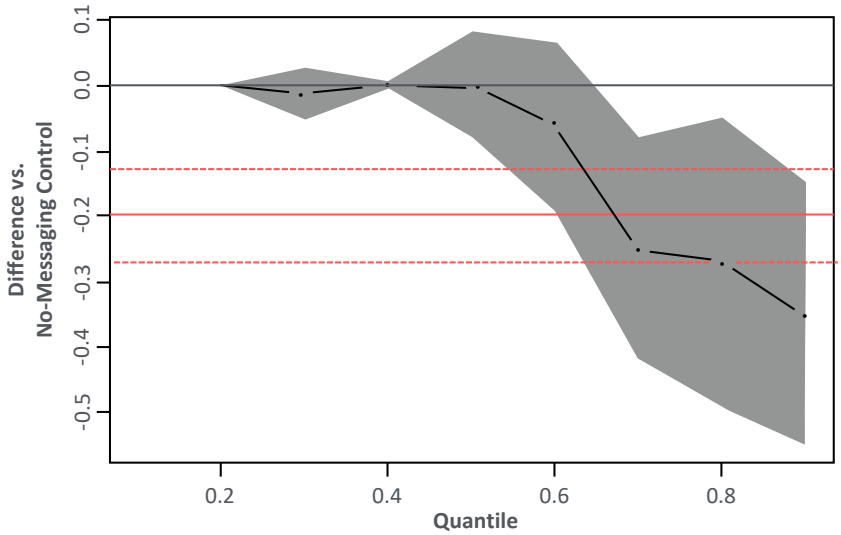
Exhibit E.8b. Estimated effects of benefits-framed basic messaging on number of days absent compared to no-messaging control, by decile



SOURCE: District administrative records
NOTES: Sample size = 23,133 students in the analytic sample.

[42] The difference in the overall estimated impact of benefits-framed messaging in Exhibit E.8b (-0.22) compared to Exhibits C.2a and E.8d is due to rounding.

Exhibit E.8c. Estimated effects of consequences-framed basic messaging on number of days absent compared to no-messaging control, by decile



SOURCE: District administrative records.
NOTES: Sample size = 23,133 students in the analytic sample.

The exact point estimates of the effects of the basic messaging approaches compared to no-messaging are shown in Exhibit E.8d for each decile. Like the graphical presentations, the results in Exhibit E.8d show that the effect begins to appear for deciles in the middle of the distribution, where the number of days absent started to rise.[43] This means that the average impact of the text messaging was driven by an effect on attendance for students who had more absences, but not only on the students who had the *most* absences or who were closest to the 8 percent absence threshold used in this study to assign intensified messaging. This makes sense, as mechanically, basic messaging would have at most a limited effect for students in the lowest three deciles, for whom the number of days absent was already zero or close to zero.

[43] The results for the last decile (90.1-100.0%) are excluded from Exhibits E.8b and E.8c because the bootstrapped standard errors indicate that the point estimate is very imprecise. Including these results would require major changes to the scale, which would make the graphs much more difficult to read.

Exhibit E.8d. Estimated effects of basic messaging on number of days absent compared to no-messaging, by decile

Deciles	Benefits- or consequences-framed basic vs. control	Benefits-framed basic vs. control	Consequences-framed basic vs. control
0-10.0%	0	0	0
10.1-20.0%	0	0	0
20.1-30.0%	-0.01	-0.01	-0.01
30.1-40.0%	0	0	0
40.1-50.0%	0	0	0
50.1-60.0%	-0.06	-0.06	-0.06
60.1-70.0%	-0.25	-0.25	-0.25
70.1-80.0%	-0.33	-0.31	-0.27
80.1-90.0%	-0.36	-0.44	-0.35
90.1-100.0%	-1.0	-1.0	-1.0
All Students	**-0.20**	**-0.20**	**-0.20**

SOURCE: District administrative records.
NOTES: Sample size = 23,133 students in the analytic sample.

REFERENCES

Abroms, L. C., Whittaker, R., Free, C., Van Alstyne, J. M., & Schinderler-Ruwisch, J.M. (2015). Developing and pretesting a text messaging program for health behavior change: Recommended steps. *JMIR mHealth and uHealth, 3*(4): e107. Retrieved from https://mhealth.jmir.org/2015/4/e107/.

Allcott, H. (2011). Social norms and energy conservation. *Journal of Public Economics, 95*, 1082–1095.

Almirall, D., Nahum-Shani, I., Sherwood, N. E., & Murphy, S. A. (2014). Introduction to SMART designs for the development of adaptive interventions: With application to weight loss research. *Translational Behavioral Medicine, 4*(3), 260–274. Retrieved from http://link.springer.com/article/10.1007/s13142-014-0265-0.

Applied Survey Research. (2011). *Attendance in early elementary grades: Associations with student characteristics, school readiness, and third grade outcomes*. San Francisco, CA: Attendance Works. Retrieved from http://www.attendanceworks.org/wordpress/wp-content/uploads/2010/04/ASR-mini-report-attendance-readiness-and-third-grade-outcomes-7-8-11.pdf.

Balu, R., Porter, K., & Gunton, B. (2016). Can informing parents help high school students show up for school? *Results from a partnership between New Visions for Public Schools and MDRC*. New York, NY: MDRC. Retrieved from https://www.mdrc.org/publication/can-informing-parents-help-high-school-students-show-school.

Bauer, L., Liu, P., Schanzenbach, W. D., Shambaugh, J. (2018). *Reducing chronic absenteeism under the Every Student Succeeds Act*. The Hamilton Project Strategy Paper. Washington, DC: Brookings Institution.

Bergman, P. (2015). Parent-Child Information Frictions and Human Capital Investment: Evidence from a Field Experiment. *CESifo Working Paper Series No. 5391*. Retrieved from https://ssrn.com/abstract=2622034.

Calonico, S., Cattaneo, M., & Titiunik, R. (2014). Robust nonparametric confidence intervals for regression-discontinuity designs. *Econometrica*, *82*(6), 2295-2326.

Castleman, B. L. (2015). *The 160-character solution*. Baltimore, MD: Johns Hopkins University Press.

Castleman, B. L., & Page, L. C. (2014). A tickle or a torrent? Understanding the extent of summer "melt" among college-intending high school graduates. *Social Science Quarterly*, *95*(1), 202-220.

Castleman, B. L., & Page, L. C. (2016). Freshman year financial aid nudges: An experiment to increase FAFSA renewal and college persistence. *Journal of Human Resources*, *51*(2), 389-415.

Ehrlich, S. B., Gwynne, J. A., Pareja, A. S., Allensworth, E. M., Moore, P., Jagesic, S., & Sorice, E. (2014). *Preschool attendance in Chicago public schools: Relationship with learning outcomes and reasons for absences: Research summary*. University of Chicago, Consortium on Chicago School Research. Retrieved from https://consortium.uchicago.edu/publications/preschool-attendance-chicago-public-schools-relationships-learning-outcomes-and-reasons.

Fisher, J. D., & Fisher, W. A. (1992). Changing AIDS-risk behavior. *Psychological Bulletin*, *111*(3), 455–474.

Green, G., DeFossett, A., & Kuo, T. (2019). Residential mobility among elementary school students in Los Angeles County and early school experiences: Opportunities for early intervention to prevent absenteeism and academic failure. *Frontiers in Psychology, 10*, 2176.

Head, K. J., Noar, S. M., Iannarino, N. T., & Harrington, N. G. (2013). Efficacy of text messaging-based interventions for health promotion: A meta-analysis. *Social Science & Medicine, 97*, 41–48.

Imbens, G., & Kalyanaraman, K. (2012). Optimal bandwidth choice for regression discontinuity estimator. *The Review of Economic Studies*, *79*(3), 933-959.

Klasnja, P., & Pratt, W. (2012). Healthcare in the pocket: Mapping the space of mobile-phone health interventions. *Journal of Biomedical Informatics*, *45*, 184–198.

Koenker, R. (2005). *Quantile regression* (Econometric Society Monographs). Cambridge, UK: Cambridge University Press.

Kraft, M. A., & Dougherty, S. M. (2013). The effect of teacher-family communication on student engagement: Evidence from a randomized field experiment. *Journal of Research on Educational Effectiveness*, *6*(3), 199–222.

Kraft, M. A., & Rogers, T. (2015). The underutilized potential of teacher-to-parent communication: Evidence from a field experiment. *Economics of Education Review*, *47*, 49–63.

Levin, H. (1983). *Cost-effectiveness: A primer*. Newbury Park, CA: Sage.

Levin, H., & McEwan, P. (2001). *Cost effectiveness analysis: Methods and applications*. Thousand Oaks, CA: Sage.

Little, R. J. A., & Rubin, D. B. (1987). *Statistical analysis with missing data*. New York: John Wiley & Sons.

Mayer, S. E., Kalil, A., Oreopoulos, P., & Gallegos, S. (2015). *Using behavioral insights to increase parental engagement: The parents and children together (PACT) intervention* (Working Paper 21602). Cambridge, MA: National Bureau of Economic Research.

McCrary, J. (2008). Manipulation of the running variable in the regression discontinuity design: A density test. *Journal of Econometrics*, *142*(2), 698–714.

Militello, L. K., Kelly, S. A., & Melnyk, B. M. (2012). Systematic review of text messaging interventions to promote healthy behaviors in pediatric and adolescent populations: Implications for clinical practice and research. *Worldviews on Evidence Based Nursing*, *9*, 66–77.

Murphy, S. A., & Almirall, D. (2009). Dynamic treatment regimens. *Encyclopedia of Medical Decision Making*. Thousand Oaks, CA: Sage.

Nahum-Shani, I., & Almirall, D. (2019). *An introduction to adaptive interventions and SMART designs in education* (NCSER 2020-001). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Special Education Research. Retrieved from https://ies.ed.gov/ncser/pubs/2020001/.

Nahum-Shani, I., Qian, M., Almirall, D., Pelham, W. E., Gnagy, B., Fabiano, G. A., . . .Murphy, S. A. (2012). Experimental design and primary data analysis methods for comparing adaptive interventions. *Psychological Methods*, *17*(4), 457–477.

Perry, C., Chhatralia, K., Damesick, D., Hobden, S., & Volpe, L. (2015). *Behavioral insights in health care*. London, UK: The Health Foundation. Retrieved from https://www.health.org.uk/sites/default/files/BehaviouralInsightsInHealthCare.pdf.

Ready, D. D. (2010). Socioeconomic disadvantage, school attendance, and early cognitive development: The differential effects of school exposure. *Sociology of Education, 83*(4), 271-286.

Rogers, T., Duncan, T., Wolford, T., Ternovski, J., Subramanyam, S., & Reitano, A. (2017). *A randomized experiment using absenteeism information to "nudge" attendance* (REL 2017-252). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Mid-Atlantic. Retrieved from https://ies.ed.gov/ncee/edlabs/projects/project.asp?projectID=440.

Rogers, T. & Feller, A. (2018). Reducing student absences at scale by targeting parents' misbeliefs. *Nature Human Behaviour, 2*, 335-342.

Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys*. New York: John Wiley & Sons.

Schafer, J. L. (1997). *Analysis of incomplete multivariate data*. Boca Raton, FL: Chapman & Hall/CRC.

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods*, *7*(2), 147–177.

Shadish, W. R., Cook, T. E., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs*. Boston, MA: Houghton Mifflin Company.

Shortreed, S. M., Laber, E., Scott Stroup, T., Pineau, J., & Murphy, S. A. (2014). A multiple imputation strategy for sequential multiple assignment randomized trials. *Statistics in Medicine, 33*(24), 4202–4214.

Smythe-Leistico, K. & Page, L. C. (2018). Connect-text: Leveraging text-message communication to mitigate chronic absenteeism and improve parental engagement in the earliest years of schooling. *Journal of Education for Students Placed at Risk, 23*(1), 139-152.

What Works Clearinghouse, Standards Handbook, Version 4.1. (2020). U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, What Works Clearinghouse. Retrieved from https://ies.ed.gov/ncee/wwc/Docs/referenceresources/WWC-Standards-Handbook-v4-1-508.pdf.

York, B. N., & Loeb, S. (2014). *One step at a time: The effects of an early literacy text messaging program for parents of preschoolers* (Working Paper No. 20659). Cambridge, MA: National Bureau Economic Research.