TEXT MESSAGING IS A USEFUL REMINDER TOOL

Ben W.R. Balzer[1,2,*], BMedSc; Patrick J. Kelly[3], PhD; Philip Hazell[4] BMedSc MBChB PhD FRANZCP; Karen Paxton[5], BHSc; Catherine Hawke[5], MBBS FFPH; Katharine S. Steinbeck[1,2], MBBS PhD FRACP

Affiliations: [1]Academic Department of Adolescent Medicine, The Children's Hospital at Westmead, Sydney, Australia; [2]Discipline of Paediatrics and Child Health, Sydney Medical School, The University of Sydney, Sydney, Australia; [3]Sydney School of Public Health, The University of Sydney, Sydney, Australia; [4]Discipline of Psychiatry, Sydney Medical School, The University of Sydney, Sydney, Australia; [5]School of Rural Health, The University of Sydney, Orange, Australia

Address Correspondence to: Ben Balzer, Room W415, Blackburn Building D06, The University of Sydney, NSW 2006, Australia, ben.balzer@sydney.edu.au, Tel +61424161300, Fax +61296423796

Short Title: Text messaging for engaging with an adolescent cohort

Abbreviations: SMS – Short Message Service; ARCHER Study – Adolescent Rural Cohort, Hormones and Health, Education, Environments and Relationships Study

Key Words: adolescence; text messaging; cellular phone; data collection; longitudinal study

Word Count: 1114

Tables: 1

Figures: 1

ABSTRACT

Introduction

Longitudinal studies of adolescents must be ‘adolescent-friendly’, both to collect data and encourage maintenance in the study cohort. Text messaging may offer a feasible means to do both.

Methods

Adolescents in the Adolescent Rural Cohort, Hormones and Health, Education, Environments and Relationships (ARCHER) study (n=342) are sent automated text messages every three months, prompting biological specimen collection.

Results

A total of 99.2% of participants (or their parents) owned a mobile phone, of which 89.1% of participants responded to text messages and 97.3% of intended urine samples were collected. The average time to provide a urine sample after prompting correlated with time to reply to SMS.

Conclusions

This study shows SMS can be used effectively in longitudinal research involving adolescents, and is both feasible and useful as a reminder tool for regular biological specimen collection.

INTRODUCTION

Longitudinal studies in adolescents have their own particular challenges, especially when the collection of biological samples is included. [1] In this context, 'adolescent-friendly' research tools are required both for the collection of longitudinal data and to encourage retention in the study cohort. One potential tool is text messaging via Short Message Service (SMS), [2] a ubiquitous communication means among adolescents. SMS has been shown to be effective in a variety of healthcare contexts, [3] though its usefulness in research involving adolescents is unclear. The aim of this study was to determine the usefulness of SMS as a reminder tool in a longitudinal study of adolescents.

METHODS

The Adolescent Rural Cohort, Hormones and Health, Education, Environments and Relationships (ARCHER) study [2] is a three-year longitudinal cohort study of adolescents, which requires the regular collection of urine samples for puberty hormone assay. The principal aim of the ARCHER study is to explore how the onset and tempo of changes in gonadal hormones during puberty affect adolescent behavior, health and wellbeing.

Participants are sent urine collection kits every three months. SMS messages are sent the morning of the scheduled urine collection day. Depending on family cellular phone ownership, participants (or parents) are instructed to reply when the urine collection is completed. Participants without cellular phones were provided with a sticker on which they wrote their mood score number (part of the broader study and data not presented here). The standard text was: "Hi ≪First Name≫≪Last Name≫. On a scale from 0 to 9 (with 9 = best ever). What is your mood now? Thanks ≪Investigator Name≫." This reply is in a form of a linear analog self-assessment scale of mood (focusing on the adolescent). Prior research has

shown that any request for action increased the chances of a response to a text message [4] and we hypothesized our request would increase the likelihood of specimen collection. If participants did not provide an SMS response or urine specimen within two weeks, they were followed up by telephone call.

The ARCHER Study has full ethical approval from the Human Research Ethics Committee, University of Sydney (HREC 13094) within the Australian National Health and Medical Research Council Guidelines for Human Experimentation, which are consistent with the Declaration of Helsinki. All participants and their parents provided written informed consent prior to commencing the study.

RESULTS

The total study recruitment was 342 adolescents (153 female). Three hundred and thirty-nine participants (151 female) in the ARCHER study had provided at least one SMS mood indicator response by June 30, 2013. The average age (SD) for adolescent participants at enrollment was 11.8 (0.99) years for males and 11.7 (0.98) years for females. Three hundred and thirty-seven (99.4%) of these participants or their parents owned a cellular phone and were able to provide responses by SMS. The two participants without a mobile phone provided their responses written on stickers provided with the urine collection kit. A total of 1555 SMS were sent to the 339 participants between 1 June 2011 and 30 June 2013, with 1386 replies (89.1% response rate).

Table 1. Time to SMS reply and urine collection scheduled date by gender

	Overall N (%)	Male N (%)	Female N (%)
SMS Reply*			
Time to reply (days) (Median/IQR)	3 (0-10)	2 (0-8)	4 (0-12)
Reply within 24 hours	599 (39)	333 (40)	266 (36)
Reply between 2 to 7 days	365 (23)	208 (25)	157 (21)
Reply between 8 to 28 days	332 (21)	159 (19)	173 (24)
Reply between 29 to 90 days	90 (6)	38 (5)	52 (7)
Did not reply (no reply after 90 days)	169 (11)	83 (10)	86 (12)
Urine Collection*			
Time to collection (days) (Median/IQR)	3 (0-10)	3 (0-8)	4 (0-12)
Collection within 24 hours	643 (41)	354 (43)	289 (39)
Collection between 2 to 7 days	409 (26)	239 (29)	170 (23)
Collection between 8 to 28 days	373 (24)	177 (21)	196 (27)
Collection between 29 to 90 days	88 (6)	42 (5)	56 (8)
Did not collect (no specimen after 90 days)	42 (3)	20 (2)	22 (3)

* Time in days to SMS reply or urine collection from scheduled date

From 1555 intended urine collections, 42 were not provided (2.7%). Of these, 36 (85.7%) did not provide an SMS response. Over two-thirds of SMS replies and urine samples were obtained within seven days of the scheduled date (see Table 1). Males and females did not differ in time to reply to SMS (mean difference = 1.75 days; 95% CI = -0.431 – 3.933 days; p=0.116), though females took longer than males to provide a urine specimen (mean difference = 2.01 days; 95% CI 0.526 – 3.50 days; p=0.008).

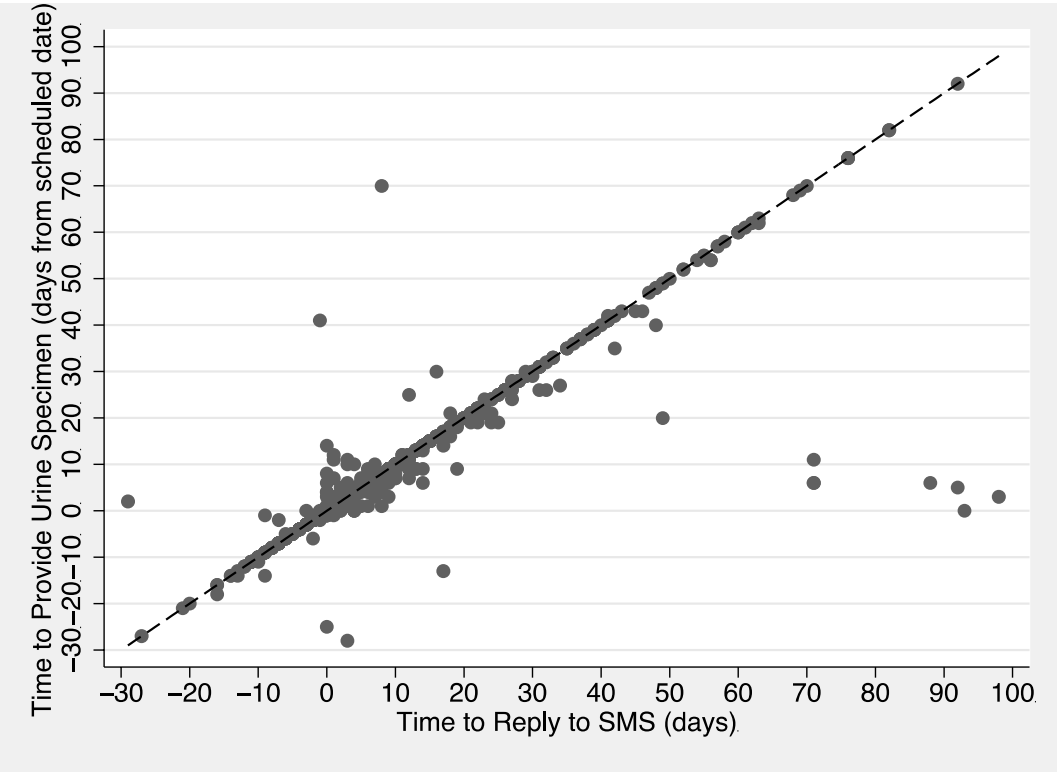

Figure 1. Plot of urine specimen collection time and SMS reply time. Line shows y=x. Dots on the line indicate SMS reply and urine sample conducted on same day, dots above line indicate urine sample conducted before SMS reply and dots below line indicates urine sample conducted post SMS reply.

Time of urine specimen collection was correlated with the time of SMS reply, as shown in Figure 1 (r = 0.606, p<0.001). Some SMS replies and urine collections occurred

before scheduled dates if participants were unavailable then, giving negative times relative to scheduling (Figure 1).

DISCUSSION

In this study, SMS reminders were used to increase compliance and retention. The high cellular phone ownership and high response rates to the text messages in this cohort indicate that contact via SMS is both feasible and acceptable in a longitudinal cohort study of adolescents.

The time to reply to the SMS strongly correlated with the time to supply a urine sample, and less than 10% of collections were missed. While this does not imply SMS was the sole reason for remembering to collect a sample, the timing of the message with scheduled collection is likely to have an influence. The mean time from scheduled date to reply SMS receipt and the provision of a urine sample were both approximately one week. This is primarily due to scheduling and logistics between research staff and participants: dates had to be organized for specimen kit delivery, timing for follicular phase of menstrual cycle and participant preference. Menstrual cycle adjustments may explain the difference in urine specimen collection between sexes. The negative times seen in Figure 1 did not affect the correlation between SMS reply and collection time.

There are several limitations to our study. There was no control group so we cannot be certain the SMS prompt contributed to compliance and may limit the conclusions which we can draw. Likewise, the SMS component was used once every three months so results could differ if contact occurred at different frequencies, though weekly SMS contact with children and adolescents has been shown to have similar response rates [5]. We could not tell whether the parent or the adolescent was replying to the text message. As the SMS was one

aspect of the reminder system (along with the delivery of the specimen collection kit), it may not be the sole reason for collection reminder, though the strong correlation between reply time and collection rate shows participants were compliant in replying to the SMS as requested. The use of smartphone applications, such as “SnapChat” or “What’s App” may appeal more to adolescents and possibly increase reply rate, however SMS is a feature common to all cellular phones so avoids limitations imposed by operating systems, data access and application costs.

In conclusion, SMS has been shown to be an acceptable and feasible tool for use as part of a reminder system in longitudinal research involving adolescents. The current analysis suggests that SMS may be used in research studies involving multiple home-based data collection points and replies are in line with instructions (regarding timing and content). Young people readily reply to a simple and short SMS. Our findings suggest that SMS may be a potential data collection tool for other information, provided the question does not require a complex response. Clinically, SMS may be useful in monitoring and compliance with adolescent patients who require multiple specimen collections over a period of time.

ACKNOWLEDGEMENTS, FUNDING, CONFLICTS OF INTEREST

Funding Source:

The ARCHER study is supported by the Australian National Health and Medical Research Council (NHMRC) Project Grant #1003312. The funding source was not involved in the conduct of the study or the planning, writing or submission of this manuscript. No honoraria, grants, or other forms of payment were given to anyone to produce the manuscript.

Conflict of Interest:

Nothing to disclose

Prior Publication:

An abstract using some of this study's data was presented as a poster at the Australian and New Zealand National Youth Health Conference, November 2013. There was no formal publication of Conference proceedings.

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