

# A cross-sectional study to assess the feasibility of a short message service to improve adherence of outpatients undergoing sedation gastrointestinal endoscopy in the People's Republic of China

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**Background:** Adherence to the prescribed preparation regimen for patients scheduled for sedation gastrointestinal endoscopy (SGIE) often fails to meet health care providers' expectations. Therefore, the feasibility of using mobile phones to improve the adherence of outpatients was assessed among outpatients scheduled for SGIE.

**Methods:** The study was designed as a cross-sectional study using survey questionnaires. Outpatients who would be undergoing SGIE were enrolled. The main outcomes included proportions of outpatients who have access to mobile phones, and the use of text-messaging among outpatients. Willingness to receive text messages and personal opinions about short message service (SMS) were also investigated. Characteristics of outpatients, including socio-demographic factors, with a mobile phone (or those who could receive and read messages) compared with those without a mobile phone (or those who could not receive and read messages) were compared using the chi-square test. Logistic regression was used to analyze significant contributing factors associated with mobile phone ownership and the use of text messages.

**Results:** A large majority of outpatients owned personal mobile phones (94.9%) and could receive and read the messages (78.9%). Most of the outpatients were willing to receive a pre-procedure education via text message (81.9%). Outpatients aged 16–39 years old and those with a college education or higher were more likely to use mobile phones and read SMS than outpatients aged 60–80 years old and those with only a primary education level ( $P < 0.0001$ ). Outpatients who lived in an urban setting were more likely to own a mobile phone than outpatients who lived in a rural setting ( $P = 0.002$ ).

**Conclusion:** The accessibility of mobile phones and the frequent use of message functions on mobile phones provide support for the initiation of an SMS reminder system for outpatients who will undergo SGIE in the People's Republic of China. In addition, the characteristics of the target study population should be considered when carrying out an SMS intervention.

**Keywords:** feasibility, short message service, adherence, sedation gastrointestinal endoscopy

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## Introduction

The lack of outpatient adherence to pre-procedural instructions of medical staff has caused significant concerns regarding the safety and efficient completion of clinical procedures.<sup>1</sup> Although all of the best interventions and efforts are provided by health care professionals, it is challenging for medical staff to provide in-depth pre-procedural

instructions due to time constraints. Therefore, it is difficult for outpatients to reach a level of adherence that reaches the health care professionals' expectations.<sup>2,3</sup> Adherence to pre-procedural instructions by outpatients plays a crucial role in clinical procedures, especially because the number of outpatients has dramatically increased in the People's Republic of China. For example, the number of outpatients undergoing sedation gastrointestinal endoscopy (SGIE) in the West China Hospital of Sichuan University (Chengdu, People's Republic of China) has increased from 24,781 in 2009 to 37,485 in 2012. Approximately 8% of outpatients canceled on the day of the procedure for various reasons, such as severe respiratory tract infections, inadequate bowel preparation, insufficient fasting time and arriving without an escort. These issues upset patients because they need to delay their procedure and upset medical personnel because such delays waste medical resources and disturb the clinic schedule.

The potential of mobile phones to support health care is increasingly recognized;<sup>4</sup> some Asian countries have reported that short message service (SMS) was acceptable to patients and helped improve health outcomes.<sup>5,6</sup> In 2011, the number of mobile phone subscribers in the People's Republic of China was more than 940 million. During the same period, more than 575 billion text messages were sent.<sup>7</sup> The Ministry of Health of the People's Republic of China is encouraging a greater role of mobile technology in assisting with health education in rural and community public health clinics.<sup>7</sup> However, there are few studies that focus on the pre-conditions of mobile phone ownership, text messaging usage, and patients' attitudes about receiving text messages when implementing an SMS intervention in Chinese hospitals. Therefore, we used a pre-designed questionnaire to estimate the accessibility of outpatients to SMS and analyzed patients' features and attitudes to show that further SMS interventions for improving adherence in SGIE outpatients is feasible.

## Methods

### Study design

This investigation was conducted in the West China Hospital of Sichuan University (the largest hospital in Sichuan Province, located in West China where more than ten thousand outpatients are cared for daily). Compared to East China, which is developed, Sichuan Province is a developing area. The investigation was approved by the ethics committee of Sichuan University and registered on the Chinese Clinical Trial Registry ([www.chictr.org/cn](http://www.chictr.org/cn), registration number: ChiCTR-TRC-12002224). Written informed consent was obtained from all outpatients in the anesthesia clinic.

Outpatients were recruited from the anesthesia clinic for pre-procedure assessment if they met the following criteria: were younger than 80 years old and had a primary school education level or higher. Demographic characteristics, ownership of a mobile phone, usage of text messaging, willingness to receive SMS, and patients' opinions about SMS reminders were collected using pre-designed questionnaires.

The statistical program SPSS 18.0 for Windows (SPSS Inc., Chicago, IL, USA) was used for all data analyses. Categorical data were summarized as frequencies (percentages). The characteristics of patients with a mobile phone (or those who could receive and read messages) and without a mobile phone (or those who could not receive and read messages) were collected, including sex, age, occupation, education level, per capita income, and long-term residence; the characteristics were compared using the chi-square test. Logistic regression was used to analyze significant contributing factors associated with mobile phone ownership and the usage of text messages ( $\alpha=0.05, \beta=0.1$ ). Findings were considered statistically significant if  $P<0.05$ .

## Results

One thousand outpatients were enrolled from April to June 2012, and 908 patients completed the questionnaire. Characteristics of the 908 participants are shown in Table 1.

Among the 908 outpatients, 862 (94.9%) outpatients owned mobile phones. Among the outpatients with mobile phone access, 680 (78.9%) outpatients were able to receive and read the SMS messages, and 706 (81.9%) outpatients had a positive attitude toward propaganda and education by SMS. Most outpatients preferred to receive the messages in the morning; in addition, outpatients were comfortable with a frequency of 1–2 messages per day. The investigation showed that information regarding the surgery or procedure was a key concern for most of the outpatients, while information about anesthesia was least concerning for the outpatients (Table 2).

The results of the chi-square statistic showed that age, occupation, education level, per capita income, and long-term residence were independent predictors of ownership of a mobile phone and usage of messaging ( $P<0.0001$ ).

Next, logistic regression was performed, including factors that were significant independent predictors of mobile phone ownership or usage of messaging and sex. Logistic regression analysis demonstrated that age and education level not only contributed to the ownership of a mobile phone but also impacted whether the outpatient could receive and read short messages ( $P<0.0001$ ). In addition, the place of

**Table 1** The socio-demographic characteristics of patients

Characteristics	Population n (%)
Age	
16–39	334 (36.8)
40–59	430 (47.3)
60–80	144 (15.9)
Sex	
Male	421 (46.4)
Female	487 (53.6)
Occupation	
Farmer	274 (30.2)
Worker	80 (8.8)
Student	19 (2.1)
Laid-off or unemployed	88 (9.7)
Retired	123 (13.5)
Other	324 (35.7)
Education level	
Primary school	213 (23.5)
Junior high school	418 (46.0)
College degree or above	277 (30.5)
Income (CNY)	
≤10,000	432 (47.6)
10,000–30,000	290 (31.9)
≥30,000	186 (20.5)
Residence	
Urban	612 (67.4)
Rural area	296 (32.6)

**Abbreviation:** CNY, Chinese Yuan Renminbi.

residence was also a contributing factor to the ownership of a mobile phone ( $P=0.002$ ). Outpatients aged 60–80 years old were 12% and 7% likely to own a mobile phone and use the message function, respectively, compared with patients aged 16–39 years old. Outpatients with a college education or higher were 15 times and 22 times more likely to use mobile phones and read short messages, respectively, than outpatients with a primary school education level. Outpatients who lived in rural areas had a 20% probability of owning a mobile phone compared to outpatients who lived in urban settings (Table 3).

## Discussion

Accessibility to mobile phones and SMS are fundamental pre-conditions for an SMS intervention. In this study, 94.9% of outpatients owned a mobile phone; among outpatients with mobile phone access, 78.9% used the phone to receive text messages and more than 81% had a favorable opinion about SMS reminder, suggesting that pre-procedure education using SMS is a potential intervention for outpatients from developing areas of the People's Republic of China. Outpatients in the 16–59 age group with a college education level or above had a higher probability of mobile phone and text message usage. This is most likely because this age group was more willing to accept the technological tool and could

**Table 2** Patients' attitude and opinion of short message service (SMS)

Item	N%
Can receive and read the message	78.9
Cannot receive and read the message	21.1
Unable to use the message function	10.4
Illiteracy	3.6
Presbyopia	7.1
Opinion on pre-procedure education through SMS	
Agree with	81.9
Disagree with	3.7
Not care	14.4
Preferred time for receiving message	
9–10 am	61.2
3–5 pm	20.6
6–9 pm	18.2
Preferred number of messages to be received per day	
1–2	72.9
3–5	20.7
>5	6.4
Preferred kind of information to be received by SMS	
Surgery or examination procedure	96.2
Anesthesia	62.1
Preparation	79.3
Appointment time	76

afford it.<sup>8</sup> People over 60 years of age were more likely to not have a mobile phone and may have been unable to read the text messages by themselves due to visual impairment or unfamiliarity with the function of messages.<sup>9</sup> Therefore, an intervention utilizing text messages may not be suitable for elderly patients. However, for our future research, the messages might be sent to an elder's younger family members or caregivers to expand the clinical application of SMS.

Additionally, the place of residence was a contributing factor for mobile phone ownership. We found that compared to the outpatients living in urban areas, patients living in rural areas were only 20% likely to own a mobile phone (Table 3). This result concurred with previous findings from the China Internet Network Information Center, which found that People's Republic of China's rural population accounts for only 29.1% of mobile phone users despite being 50.32% of the total national population.<sup>10</sup> According to synthesized data from a telecommunications industry report and the 2010 National Census, mobile phone usage in the People's Republic of China, despite nearing 1 billion users and a national subscriber rate of 70.5%, is approximately only 48%–60% in 12 predominantly rural provinces.<sup>11</sup> Although subscriber rates are expected to rise in all socioeconomic groups, these disparities should be taken into consideration for our next step in mobile phone-based intervention research.

**Table 3** Multivariate logistic regression analysis: association of mobile phone ownership/short message receiving with socio-demographic factors

Indicators	Mobile phone ownership <sup>a</sup>			Short message receiving <sup>b</sup>		
	P	OR	95% CI	P	OR	95% CI
Sex (compared with "male")						
Female	0.56	0.81	(0.39, 1.66)	0.61	0.90	(0.58, 1.38)
Age (compared with "16–39" group)	<0.0001			<0.0001		
40–59	0.5	0.68	(0.23, 2.04)	0.001	0.39	(0.22, 0.68)
60–80	<0.0001	0.12	(0.04, 0.37)	<0.0001	0.07	(0.04, 0.15)
Occupation (compared with "farmer")	0.10			0.61		
Worker	0.42	0.46	(0.09, 2.70)	0.98	0.99	(0.40, 2.47)
Student	0.04	0.08	(0.007, 0.92)	0.99	0.68	(0.08, 5.86)
Laid-off or unemployed	0.02	0.24	(0.07, 0.78)	0.70	0.86	(0.39, 1.87)
Other	0.93	1.07	(0.24, 4.79)	0.16	0.58	(0.28, 1.23)
Educational level (compared with "Primary school")	<0.0001			<0.0001		
Junior high school	<0.0001	5.92	(2.28, 15.40)	<0.0001	4.96	(3.11, 7.90)
College degree or above	0.02	15.42	(1.62, 146.73)	<0.0001	22.34	(9.59, 52.04)
Per capita income (CNY) (compared with #10,000)	0.44			0.23		
10,000–30,000	0.44	1.50	(0.54, 4.14)	0.11	1.54	(0.91, 2.62)
≥30,000	0.40	1.82	(0.15, 2.13)	0.10	0.10	(0.49, 2.02)
Long-term residence (compared with "urban")						
Rural	0.002	0.20	(0.07, 0.57)	0.19	0.69	(0.40, 1.20)

**Notes:** <sup>a</sup>The number of participants was 908; <sup>b</sup>the number of participants was 862.

**Abbreviations:** OR, odds ratio; CI, confidence interval; CNY, Chinese Yuan Renminbi.

Our results also showed the majority of outpatients considered 1–2 messages per day as an acceptable frequency, suggesting too frequent reminders may be viewed as intrusive rather than helpful and may lead to message fatigue.<sup>12,13</sup> In addition, most of the outpatients focused on information about the surgery or procedure itself, while a minority of outpatients cared about knowledge regarding the anesthesia. The results indicated that most of the outpatients did not recognize the risk or importance of anesthesia, which might lead to insufficient preparation for anesthesia and put the patients themselves at risk. Therefore, for our pre-procedure education, knowledge regarding the procedure and anesthesia should be presented with equal importance to outpatients.

There are some limitations in this investigation. This study only recruited outpatients who were scheduled for SGIE, which might not represent a heterogeneous population. Generally speaking, patients scheduled for SGIE were comparatively young and had mild cases and short disease courses. Second, the Chinese are reluctant to talk about their income in public; therefore, the provided information about their income might not represent true income levels and subsequently impact the analysis of the contributing factors to the usage of mobile phones.

## Conclusion

In conclusion, greater access to mobile phones and usage of the text message function, as well as favorable opinions,

indicate that SMS is a potentially efficient intervention to enhance the adherence of SGIE outpatients in the People's Republic of China. Age, education level, and place of residence should also be considered in SMS implementation and future investigations.

## Disclosure

The authors report no conflicts of interest in this work.

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