

# Survey Response Rates to a Self-Initiated Longitudinal Survey Accessed by QR Code in Six Different Regions of the United States

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## Research Article

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# Abstract

## OBJECTIVE

A quick response (QR) code allows rapid access to an online survey via a smart phone and may improve response rates for web-based surveys. We report the response rates for a QR code based, self-initiated longitudinal survey of opioid use and pain scores following hospital discharge in pediatric surgical patients.

## MATERIALS AND METHODS

All parents of pediatric patients having surgery at one of six pediatric medical facilities were asked to participate in the study from October 5, 2020 until July 15, 2021. Those who chose to participate accessed the initial Enrollment Survey using a QR code on a handout provided. The next day they received an emailed link to a daily survey until their child was not requiring opioids and had pain scores less than 4 for the previous 48 hours

## RESULTS

A total of 1,759 families were asked to participate in the study. The parents of 44 patients completed the initial Enrollment survey by accessing the QR code (response rate 2.5%) Of those who completed the initial survey, 67% were lost to follow-up during the survey series.

## DISCUSSION

We found an extremely low response rate for a self-initiated survey accessed by QR code. We found a drop in response rate with each successive daily email based survey and the loss of the majority of the initial participants by the end of the survey series.

## CONCLUSION

We recommend using alternative modalities (informed consent, telephone call, weekly surveys) for initiating and delivering surveys to improve response rates for similarly designed studies.

## Introduction

Survey response rates have declined dramatically in the past two decades. In a British postal survey of new mothers regarding their experience while in hospital for delivery, the response rate dropped from 67% in 1995 to 29% in 2018.[1] Surveyors continue to search for new modalities to improve response rates while reducing the resources required. Web based surveys offer the advantage of lower administrative cost (printing, postage), reduced manual data processing and shorter time requirements for participants and survey personnel. However, the majority of survey studies have reported reduced response rates for web based surveys compared to postal and telephone surveys.[2,3] A quick response (QR) code allows

rapid access to the online digital version of the survey by framing the QR code in the camera of a smart phone and may improve response rates for web based surveys.[4] There is a paucity of information on the effect of different survey modalities on survey response rates. We are not aware of any reports of survey response rates associated with QR code access to a self-initiated, self-administered longitudinal survey. The primary aim of this study is to report the response rates of parents of recently discharged post-surgical pediatric patients to a self-initiated survey accessed by QR code in six cities in the United States.

## Methods

Following approval from the Washington Institutional Review Board, parents of pediatric surgical patients were asked to participate in the study from October 5, 2020 until July 15, 2021. All children under 19 years of age having surgery at one of six pediatric medical facilities were eligible to participate in the study (Lexington, Kentucky; Honolulu, Hawaii; Shreveport, Louisiana; St. Louis, Missouri; Pasadena, California and Spokane, Washington). The number of eligible participants during this time period was released by each site without further disclosure of any Protected Health Information.

Due to limited research-trained staff, written consent was deferred at the time of study introduction. Rather, the nurse or anesthesiologist caring for the patient would provide parents with a brief verbal introduction to the study and an explanation on how to use QR codes. Parents were then given a handout containing a QR code, a Uniform Resource Locator (URL) link and a detailed explanation of the study (Appendix 1). Those who chose to participate accessed the initial Enrollment Survey using the QR code. This survey presented information about the study and asked parents to provide attestation that they had read and agreed to participate in the study. Parents who did not understand English or Spanish or who did not have internet access were excluded from the study. All surveys were designed on the survey platform Qualtrics (Seattle, WA). All study materials, including the surveys, were available in Spanish and English.

Our study schema is presented in Figure 1. During the study, parents received four types of surveys. The Enrollment Survey which, in addition to requesting consent for participation, collected demographic data such as child's birthdate, the surgery date and an email address to receive links to subsequent Health Insurance Portability and Accountability Act (HIPAA) compliant surveys. The Introduction Survey was sent on the day of hospital discharge asking if any opioid was prescribed. Next came the Follow-up Survey which asked for the highest pain score (0-10) and the number of opioids taken in the previous 24 hours – parents received this until the child had not required opioids and reported a pain score less than 4 for the previous 48 hours. Lastly, the Final Survey was sent asking how opioids were stored, the number of remaining opioids, if unused opioids were disposed, if any non-opioid pain medications were used, side effects experienced from the pain medications and parent's satisfaction with their child's pain control. The Final Survey also asked a series of questions regarding the child's previous history with opioids, diagnoses of anxiety or depression and the parents' opinion of their child's pain tolerance. The total number of surveys a parent received varied as surveys were designed to continue until no opioids

were required and pain was well controlled. The minimum time to complete the study was four days after surgery.

On April 12, 2021 an error occurred in the survey platform resulting in participants receiving no subsequent surveys after completing the Enrollment Survey. The study was terminated on July 15, 2021 because of an inadequate survey response rate.

The primary outcome for this report is the response rate to the initial Enrollment Survey by QR code. Secondary outcomes include the number of participants who were lost at each successive survey, mean time to complete each survey, survey completion rate and item response rate for completed surveys.

## Results

A total of 1,759 families were asked to participate in the study. Only 44 parents accessed the Enrollment survey using the QR code (response rate 2.5%). The response rate of individual cities is shown in Table 1. The range of response rates was 0.7% in Pasadena to 3.2% in Spokane, with all sites other than Spokane being under 2%. Forty percent (21/52) of the respondents were from the Spokane site.

Table 1. Response rate by site for initial survey accessed by QR code

City	Number of Patients	Number of Respondents	Response Rate (%)
Honolulu, Hawaii	183	2	1.1
Lexington, Kentucky	180	2	1.1
Pasadena, California	136	1	0.7
Shreveport, Louisiana	360	4	1.1
Spokane, Washington	660	21	3.2
St. Louis, Missouri	240	4	1.7
Total	1,759	44	2.5

The percentage of participants who were lost at each successive survey is displayed in Table 2. This analysis only includes patients who responded prior to the platform error. Here, 1379 families were asked to participate and 33 enrolled. There was a loss of participants with each successive survey. Of those 33 enrolled, 19 (67%) failed to complete the longitudinal study leaving an overall study completion rate of 1% (14/1379).

Table 2. Loss of participants with each successive survey.

Survey Name	Enrollment Survey	Introduction Survey	Follow-up Survey	Final Survey
Responses	33	25	15	14
Number lost	-	8	10	1
% lost	-	24	40	6

The number of questions for each survey, the mean time for survey completion, survey completion rate and the item response rate appear in Table 3. Of the 52 parents who used a QR code to access the Enrollment survey, only 44 (85%) completed the Enrollment survey. All parents that accessed subsequent surveys completed that survey. There were no skipped questions in any of the surveys. The number of questions for each survey, the mean time for survey completion, survey completion rate and the item response rate appear in Table 3. All surveys were brief, with the longest having 16 questions (Final Survey) and the longest mean time for completion of any survey was 5 minutes and 5 seconds (Enrollment Survey, including attestation). There were no skipped questions in any of the surveys.

Table 3. The number of questions, mean duration for survey completion, survey completion rate and item response rate for each completed survey.

Survey Name	Enrollment	First Sent	Follow-up	Opioid Repeat	Final
Number Questions	10	7	3	2	16
Mean Time (min)(sec)	5:05	1:32	0:14	0:25	2:49
Completion Rate (%)	85	100	100	100	100
Item Response Rate (%)	100	100	100	100	100

## Discussion

The important findings of this study are an extremely low response rate (2.5%) for a self-initiated longitudinal survey accessed by QR code in six cities in the United States. We found a drop in the response rate with each successive email based survey and the loss of the majority (67%) of the initial participants by the end of the survey series. These results were comparable in each participating region of the country.

The use of the QR code to access a survey by smartphone was first described in 2016.[5] It holds promise as a means of survey access. It is estimated that over 85% of American adults own a smart phone.[6] The use of the QR code solves the challenges related to web-based surveys by directing the person to the correct survey without any need for URL entry, web search or recollection. However, there are limited reports of the use of the QR code in medical research and all utilized small, targeted populations such as a class of medical students or COVID patients in an urgent care waiting room.[7,8] This is the first report of the use of the QR code for survey distribution in a large study population. In

addition, we are unaware of a report demonstrating the response rate decline in a daily, longitudinal survey of any modality.

There are conflicting views on what merits an adequate survey response rate. The standard in federally funded public policy research is an 80% response rate. A survey of editors of journals in the social and health sciences found a response rate of 60% considered marginal, 70% reasonable, 80% good and 90% excellent.[9] Pew and other polling agencies conduct public opinion polls with reported response rates in the single digits yet have produced accurate results.[10] The concern about surveys with low response rates is that the findings may not represent the intended population, producing non-response bias. More recent evidence suggests that, above a low threshold response rate, there is a weak relationship between the response rate and the measured non-response bias.[11] The absolute value of the low threshold is not defined but the 3% response rate we found likely falls below that threshold.

The reasons for the decline in survey response rates observed in the past two decades are many and likely influenced our response rate. One reason is increasing survey fatigue secondary to the large number of surveys being distributed. In addition to our study, all our participants were also given a tablet to complete a survey while waiting for their first clinic appointment after surgery and many were approached to take part in a genomics study at their first clinic visit prior to surgery that includes a long survey of over 100 questions. Other reasons for declining survey response rates include concerns about privacy and confidentiality. This may have been an issue in our patient population as parents may have been hesitant to divulge their child's opioid use for fear of identifying their child as having a persistent opioid use problem. We tried to account for this by making the survey anonymous. Our parents may have also been overwhelmed with caring for their child after surgery and having their other children at home during the COVID pandemic lockdown period and required remote learning. The use of a web-based survey accessible by a smart phone has been shown to produce lower response rates in patients over 75 years of age.[12] Our participants were all parents of children under 19 with the majority being in their third and fourth decades of life. We found the highest response rate in the Spokane site. This site initiated the study and participated in the study the longest, which may have allowed increased time to disseminate information about the study.

We found a loss of participants with each successive survey. Longitudinal studies that re-survey the same population every few years report a decrease in participation rates with each follow-up because of waning interest in the survey subject matter.[13] This may have been a factor in our study as some participants remained in the survey for up to three weeks. Long and complicated surveys may produce a low survey completion rate and a high dropout rate with successive surveys. However, the brief survey duration and excellent survey and item completion rates in all four surveys make it unlikely the surveys were the cause of the low response rates and high dropout rate.

We included data on participants after the error with survey distribution to illustrate the issues that web based surveys present. Considerable time must be dedicated to designing these web-based surveys (6 months) and continued vigilance is required to ensure proper function. Proper selection of a survey

vendor is also key. Our study platform was designed for business applications so we were limited in our functionality when adapting it for a healthcare longitudinal study. We recommend thorough and thoughtful planning of the survey process, then ensuring the chosen vendor is able to execute this process.

Short message service (SMS) text messaging has shown improved response rates compared to email messaging, and the combination of email and SMS messaging has produced the best results. [14] This study was intended to use SMS text messaging but because of technical issues with Qualtrics we were forced to use email. Although this may have improved our results, it is unlikely to have reached an acceptable response rate.

Other survey modalities have been associated with improved response rates compared to QR code access and email distribution. In a similar study that surveyed adult opioid use post-operatively after hospital discharge, patients were required to give informed, written consent prior to hospital discharge and were reached by phone calls on a weekly basis for four weeks. [12] A comparison in response rates reveals dramatically improved results. They had a similarly sized patient population of 1,880 patients who were approached to be in the study and 705 provided written, informed consent (38% response rate vs 2.5%). Of these, 134 were lost to follow-up at the first phone call (20% vs 24%). They lost 10 additional patients over the next month (1.4% vs 40%). They reported that 561 patients completed the study (29.8% vs 1.0%). These response rates are far greater than what we observed and suggests that informed, written consent and phone call follow-up at weekly intervals produces far superior results.

In conclusion, we found an unacceptably low response rate for a self-initiated, longitudinal survey accessed by QR code in a large study population. We found a loss of participants with successive daily surveys and the loss of the majority of the participants by the end of the survey series. We recommend using alternative modalities (informed written consent, telephone call, weekly surveys) for initiating and delivering surveys to improve response rates for similarly designed studies.

## **Declarations**

1. Ethics approval and consent to participate: In this study all methods were performed in accordance with the relevant guidelines and regulations as approved by the WCG IRB on 12/07/2020, IRB tracking number 20201412. Informed consent was obtained from all participants prior to participation in the study.
2. Availability of Data and Materials: The datasets analyzed for this study may be accessed at Qualtrics.com where all survey data is stored. The data is not immediately publicly available as there is required access information by Qualtrics (user name, password protected) which can be provided by the author on request with approval by the Shriners Hospital for Children research department.
3. The authors have no competing interests to report.

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5. Authors contributions: The first two authors participated in study design, data collection, data analysis and manuscript creation. The third author is a medical student who assisted in data collection and the creation of the manuscript.
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7. Authors' information: The first two authors are pediatric anesthesiologists who have a keen interest in research.

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## Figures

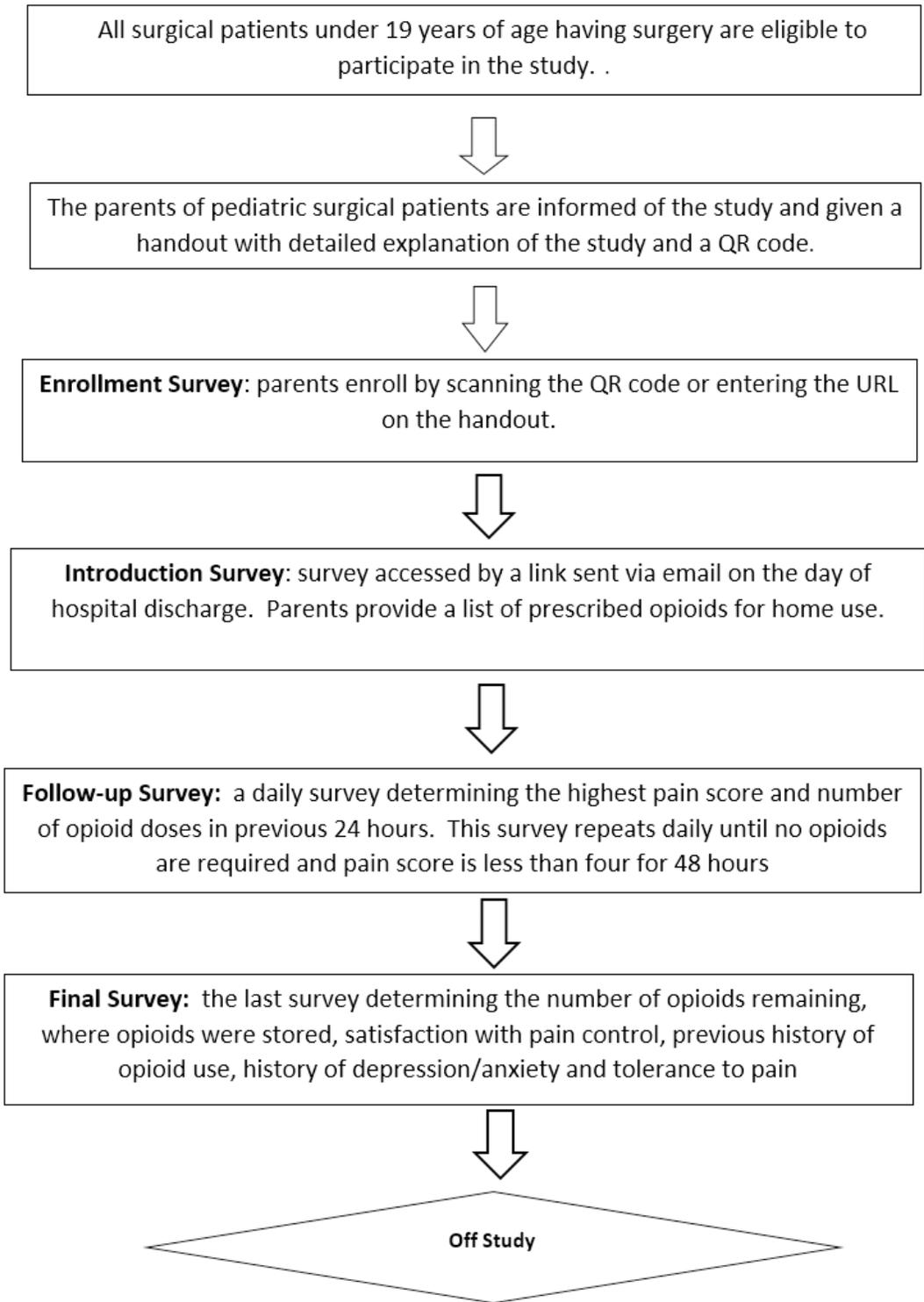


Figure 1

Study Schema