

Automated Patient Follow-up: Descriptive and univariate analysis of over 6,000 regional anesthesia patients

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Introduction

Follow-up of surgical patients who receive peripheral anesthetic procedures can help identify procedure-related complications. Traditional telephone follow-ups are time-intensive and have low success rates(1). Peer-reviewed studies have explored automated text messaging, email, and app-based systems, showing improved response rates and provider preference for single-bolus blocks compared to calls(1-5). Automated follow up has shown success for single bolus blocks(2), but data on response rates and associated factors for continuous catheters remain limited(1,4). This study presents response rates for both techniques and a preliminary univariate analysis of variables associated with automated follow-up response rates.

Methods

MGH IRB approved this retrospective cohort study. 7,122 patients receiving regional anesthesia at a MGH ambulatory surgical center (April 2022–April 2024) were enrolled in an automated follow-up system(2). Patient records are created in a REDCap database, and SMS messages with secure links to REDCap surveys are sent on postoperative day 1 (POD1, 27 hrs) and day 4 (POD4, 99 hrs). Inclusion criteria: receipt of surveys via email or SMS-capable phone and English proficiency. Phone follow-ups are made if patients request or do not respond to the survey. Patient and procedural demographic data are collected. Patients with missing demographic data are excluded. Data analysis and plotting are performed in RStudio (v2024.09.0) and Prism (v10.4.0). Univariate analysis entails Chi-square, unpaired t-tests, and Mann-Whitney tests, with p=<0.05.

Table 1: Patient and procedure demographics and follow-up completion rates

Patient Demographics		Single Bolus	Continuous	Procedure Demographics		Single Bolus	Continuous
Sex: Female Male		2,001 (50.1%) 1,990 (49.9%)	929 (42.8%) 1,240 (57.2%)	Resident involved? Yes No		1,843 (46.2%) 2,148 (53.8%)	823 (37.9%) 1,346 (62.1%)
Ethnicity: Non-Hisp Hisp		3,705 (92.8%) 286 (7.2%)	2,046 (94.3%) 123 (5.7%)	Proc Location	Upper Lower Extremity	1,558 (39.1%) 2,292 (57.4%)	1,379 (63.6%) 783 (36.1%)
Race: White Other		3,341 (83.7%) 650 (16.3%)	1,897 (87.4%) 274 (12.6%)		Truncal Other	56 (1.4%) 85 (2.1%)	1 (0.05%) 6 (0.3%)
English Primary Language		3,877 (97.1%)	2,134 (98.4%)	Comm Method	SMS Email	3,958 (99.2%) 33 (0.8%)	2,150 (99.1%) 19 (0.9%)
Age (median [range])		47 [15-86]	51 [15-89]	POD1 Follow-up Completion Method	Survey	3,256 (81.5%)	1,720 (79.3%)
BMI (median [range])		27 [16-47]	27 [16-45]		Phone call	385 (9.6%)	319 (14.7%)
ASA Class	I	1,010 (25.3%)	608 (28.0%)	POD4 Follow-up Completion Method	Survey	2,696 (67.6%)	1,544 (71.2%)
	II	2,521 (63.2%)	1,289 (59.5%)		Phone call	81 (2.0%)	625 (28.8%)
	III	460 (11.5%)	272 (12.5%)	No Follow Up	POD1 POD4	350 (8.8%) 1,214 (30.4%)	130 (6.0%) 0 (0.0%)

Data represented as # of patients (%) unless otherwise specified.
Non-Hisp = Non-Hispanic; Hisp = Hispanic; Proc Location = procedure location; Comm Method = survey communication method; SMS = short message service, i.e. text messaging; POD1 = postoperative day 1; POD4 = postoperative day 4.

Results

Out of 4,606 single bolus and 2,516 continuous catheter regional anesthesia patients, 3,991 and 2,169 are included after exclusions (Figure1&2). Demographic data (Table 1) reveal skewed distributions by ethnicity, race, and ASA classification (<ASA 4). Procedural data show most surveys are delivered via text (99% for both groups). Regional anesthesia is applied predominantly to the upper and lower extremities. Patient response rates to automated surveys are 81.5% (single bolus) and 79.3% (continuous catheter) on POD1, and 67.6% and 71.2% on POD4, respectively. With phone follow-ups, all continuous catheter patients have POD4 survey data.

Univariate analysis of single bolus patients (Tables2) shows higher response rates for females, non-Hispanic ethnicity, older age, and SMS messaging delivery, while resident involvement and upper extremity anesthesia are associated with lower rates. Continuous catheter analysis (Table3) reveals similar trends, except female sex (POD4), race, and regional anesthesia location show no association with response rates.

Discussion

This study represents the largest cohort analysis of factors associated with regional anesthesia automated, follow-up survey responses. A novel finding here is the reduced response rate associated with upper extremity blocks in the single bolus cohort, with handedness needing further study. The strongest association of improved response was SMS delivery compared to email. Our response rates (~80%) are higher than text-message invitation to app-based regional anesthesia system (~25%)(1), but variable(2,4) compared to a similar system depending on regional anesthetic method. Compared to daily survey approaches(4), our limited follow-up frequency yielded higher POD4 catheter response rates (71% vs. 62%). Immediate future work aims to explore causal relationships and temporal trends through explanatory modeling.

References

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Table 2: Associations between demographics variables and response rates to automated surveys after SINGLE-BOLUS regional anesthesia

Demographics		Postoperative Day 1			Postoperative Day 4		
Variable	Subgroup	Response Rate (% (# resp))	Relative Risk (95%CI)**	p-value	Response Rate (% (# resp))	Relative Risk (95%CI)**	p-value
Sex	Female v. Male	82.9% (1659) v. 80.3% (1597)	1.033 (1.003-1.064)	0.0304	72.1% (1443) v. 63.0% (1253)	1.145 (1.097-1.196)	<0.0001
Ethnicity	Non-Hisp v. Hisp	82.4% (3053) v. 71.0% (203)	1.161 (1.083-1.260)	<0.0001	68.0% (2518) v. 62.2% (178)	1.092 (1.001-1.206)	0.0463
Race	White v. Other	82.2% (2745) v. 78.6% (511)	1.045 (1.003-1.094)	0.0329	68.3% (2283) v. 63.5% (413)	1.075 (1.013-1.148)	0.0169
Language	Eng v. Non-Eng	82.3% (3190) v. 57.9% (66)	1.421 (1.235-1.690)	<0.0001	68.0% (2637) v. 51.8% (59)	1.314 (1.118-1.596)	0.0003
Age*	Response: Yes v. No	46 [29-61] v. 48 [30-60]	N/A	0.62	47 [30-61] v. 45 [29-60]	N/A	0.0369
Resident involved?	Yes v. No	79.2% (1459) v. 83.7% (1797)	0.946 (0.918-0.975)	0.0003	63.7% (1174) v. 70.9% (1522)	0.899 (0.860-0.939)	<0.0001
Regional Anesthetic Location	Extremity: Upper v. Lower	77.0% (1199) v. 84.9% (1945)	0.907 (0.878-0.9360)	<0.0001	61.9% (964) v. 71.5% (1638)	0.867 (0.826-0.907)	<0.0001
Survey Distribution Method	SMS v. Email	82.1% (3249) v. 21.2% (7)	3.870 (2.174-7.690)	<0.0001	68.0% (2693) v. 9.1% (3)	7.484 (2.886-21.67)	<0.0001

*Data presented as median [IQR] in “Response Rate” column. Statistical difference highlighted in yellow.

**Highlighted cells for primary comparison variable’s relative risk, with increased in green and reduced in red.

Non-Hisp = Non-Hispanic; Hisp = Hispanic; Eng = English; Non-Eng = Non-English; BMI = Body Mass Index; SMS = short message system, i.e. text messaging.

Table 3: Associations between demographics variables and response rates to automated surveys after CONTINUOUS regional anesthesia

Demographics		Postoperative Day 1			Postoperative Day 4		
Variable	Subgroup	Response Rate (# (%))	Relative Risk (95%CI)**	p-value	Response Rate (# (%))	Relative Risk (95%CI)**	p-value
Sex	Female v. Male	761 (81.9%) v. 959 (77.3%)	1.059 (1.015-1.105)	0.009	680 (73.2%) v. 864 (69.7%)	1.051 (0.995-1.108)	0.07
Ethnicity	Non-Hisp v. Hisp	1632 (79.8%) v. 88 (71.5%)	1.115 (1.010-1.268)	0.029	1471 (71.9%) v. 73 (59.4%)	1.211 (1.060-1.426)	0.0028
Race	White v. Other	1514 (79.9%) v. 206 (75.5%)	1.058 (0.991-1.144)	0.09	1362 (71.4%) v. 182 (66.7%)	1.078 (0.992-1.185)	0.078
Language	Eng v. Non-Eng	1698 (79.6%) v. 22 (62.9%)	1.266 (1.034-1.718)	0.0155	1526 (71.5%) v. 18 (51.4%)	1.390 (1.065-2.012)	0.0093
Age*	Response: Yes v. No	52 [28-63] v. 48 [26-61]	N/A	0.0223	52 [29-63] v. 47 [25-61]	N/A	0.0026
Resident involved?	Yes v. No	618 (75.1%) v. 1102 (81.9%)	0.917 (0.874-0.960)	0.0002	577 (70.1%) v. 967 (71.8%)	0.976 (0.922-1.031)	0.39
Regional Anesthetic Location	Extremity: Upper v. Lower	1081 (78.4%) v. 632 (80.7%)	0.9712 (0.930-1.016)	0.20	978 (70.9%) v. 560 (71.5%)	0.992 (0.9388-1.050)	0.77
Survey Distribution Method	SMS v. Email	1713 (79.7%) v. 7 (36.8%)	2.163 (1.350-4.162)	<0.0001	1538 (71.5%) v. 6 (31.6%)	2.265 (1.324-4.658)	0.0001

*Data presented as median [IQR] in “Response Rate” column. Statistically different comparisons highlighted in yellow.

**Highlighted cells for primary comparison variable’s relative risk, with increased in green and reduced in red.

Non-Hisp = Non-Hispanic; Hisp = Hispanic; Eng = English; Non-Eng = Non-English; BMI = Body Mass Index; SMS = short message system, i.e. text messaging.