

Supplementary Material

A. Inpatient portal features

Table A.1 Available bedside features and their descriptions

Portal feature group	Description
MyChart Ambulatory	Access the ambulatory patient portal through the bedside conduit
Dining on demand	Order food from a predefined menu
Happening soon	Review scheduled upcoming tests or procedures
I would like	Request one of several ancillary services
My health	Review vital signs including blood pressure, heart rate, and temperature
Notes	Record and review personal notes (audio and written)
Secure messages	Communicate with the care team
Taking care of me	Review active members of the care team
To learn	Access training materials through a link to an external health information content provider
Tutorial	Access video tutorial on how to use MyChart Bedside

Table A.2 Inpatient portal usage by feature group summarized by the median number of sessions and the overall proportion of patients that utilized the feature

Portal feature group	Sessions, median (Q1, Q3)	Patient proportion, %
MyChart ambulatory	2 (0, 4)	72%
Dining on demand	10 (5, 20)	95%
Happening soon	19 (6, 61)	88%
I would like	0 (0, 0)	12%
My health	1 (0, 14)	54%
Notes	0 (0, 0)	3%
Secure messages	2 (0, 4)	71%
Taking care of me	2 (1, 5)	77%
To learn	0 (0, 1)	35%
Tutorial	6 (4, 10)	100%

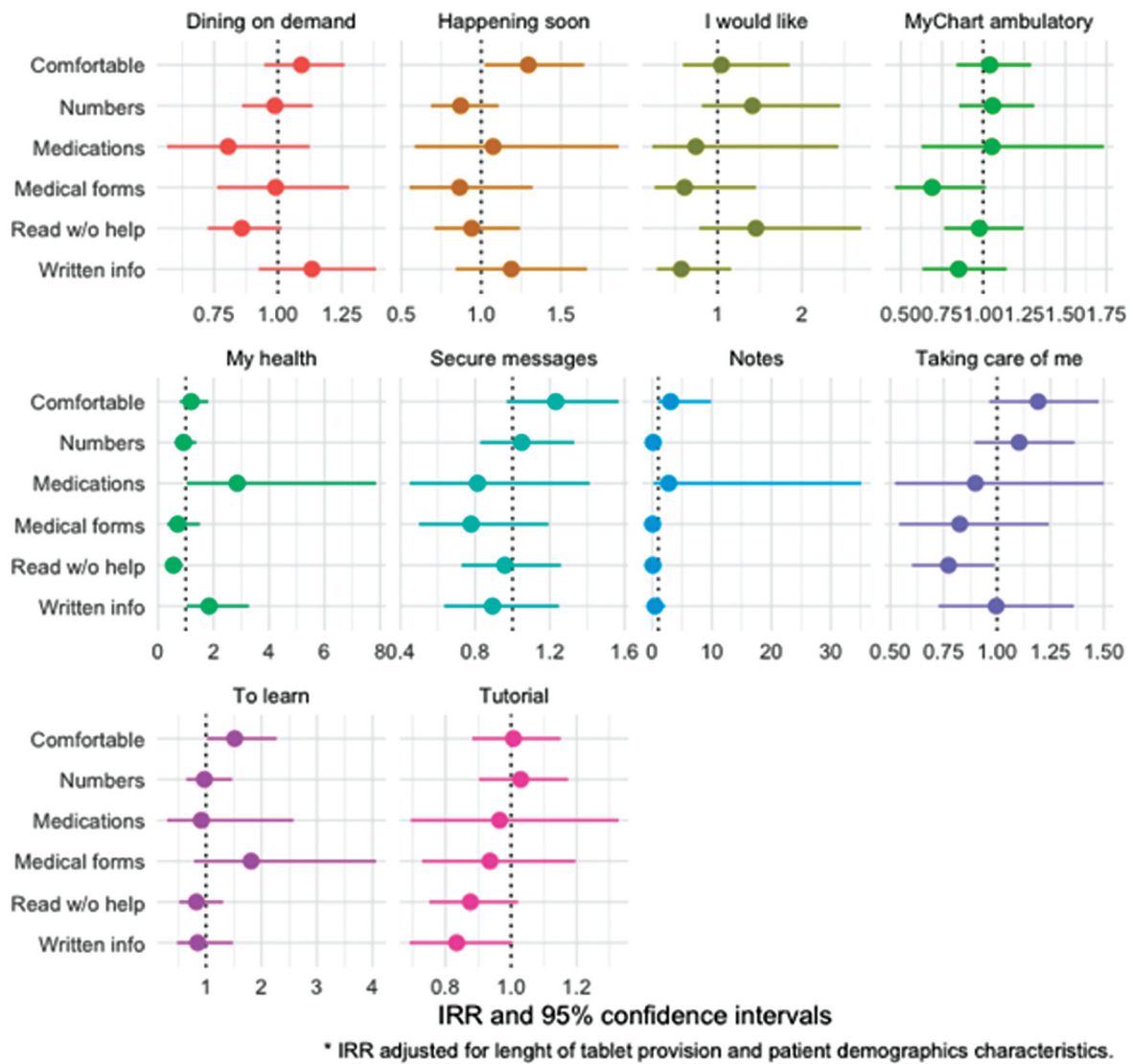


Fig. A.1 Association between patient health literacy and numeracy skills and frequency of inpatient portal feature use modeled by negative binomial regressions.

Legend

Comfortable	Disagree with the statement: "I feel uncomfortable with health information that has a lot of numbers"
Numbers	Agree with the statement: "I depend on numbers and statistics to help me make decisions about my health"
Medications	Agree with the statement: "I know how to take my medications"
Medical forms	Agree with the statement: "I can fill out medical forms"
Read without help	Disagree with the statement: "I frequently have someone help me read hospital material"
Written information	Disagree with the statement: "I frequently have difficulty using written health information"

B. Outpatient Portal Features

Table B.1 Available MyChart features and their descriptions

Portal feature group	Description
Messaging	Links to messaging center, letters to the patient, prescription refill option
Visits	List of past and upcoming visits
My record	List of medications, allergies; medical history, immunizations; test results and health summary; and preventive care and a summary of the plan of care
Medical tools	Share medical records with other services; participate in research studies; and connect tracking devices
Billing	Account summary and payment
Resources	Terms and conditions; patient education; and frequently asked questions
Proxy	Request or renew proxy
Preferences	Personal and security settings; and notification preferences
Custom	Miscellaneous (e.g., send document to personal health record)

Table B.2 Outpatient portal usage by feature group summarized by the median number of sessions and the overall proportion of patients that utilized the feature

Portal feature group	Sessions, median (Q1, Q3)	Patient proportion, %
Messaging	2 (0, 15)	61%
Visits	1 (0, 7)	58%
My record	3 (0, 13)	64%
Medical tools	0 (0, 0)	18%
Billing	0 (0, 4)	49%
Resources	0 (0, 0)	0%
Proxy	0 (0, 0)	12%
Preferences	0 (0, 1)	33%
Custom	0 (0, 0)	15%

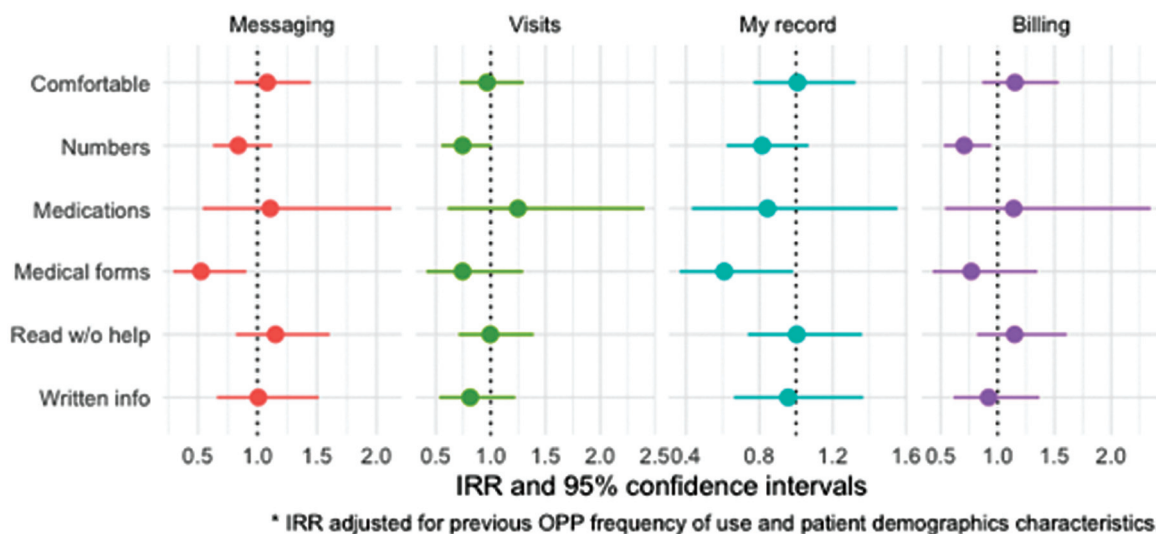


Fig. B.1 Association between patient health literacy and numeracy skills and frequency of outpatient portal feature use modeled by negative binomial regressions. Results limited to the four functions use by approx. 50% of the patients.

Legend

Comfortable	Disagree with the statement: "I feel uncomfortable with health information that has a lot of numbers"
Numbers	Agree with the statement: "I depend on numbers and statistics to help me make decisions about my health"
Medications	Agree with the statement: "I know how to take my medications"
Medical forms	Agree with the statement: "I can fill out medical forms"
Read without help	Disagree with the statement: "I frequently have someone help me read hospital material"
Written information	Disagree with the statement: "I frequently have difficulty using written health information"

C. Sensitivity Analysis

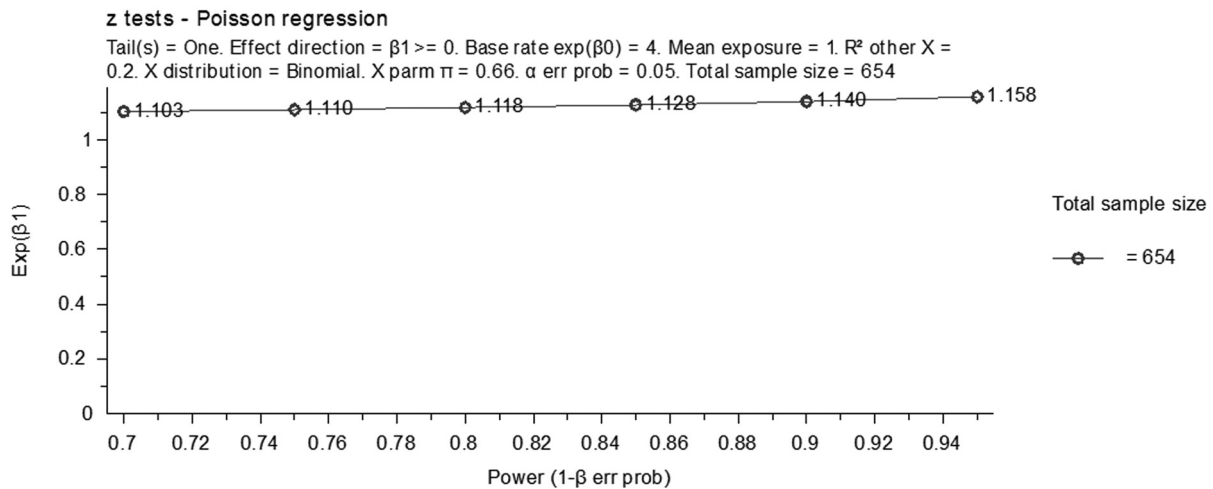


Fig. C.1 Detectable effect size based on total sample size corresponding to an increase in inpatient portal session counts associated with higher health literacy and numeracy skills.

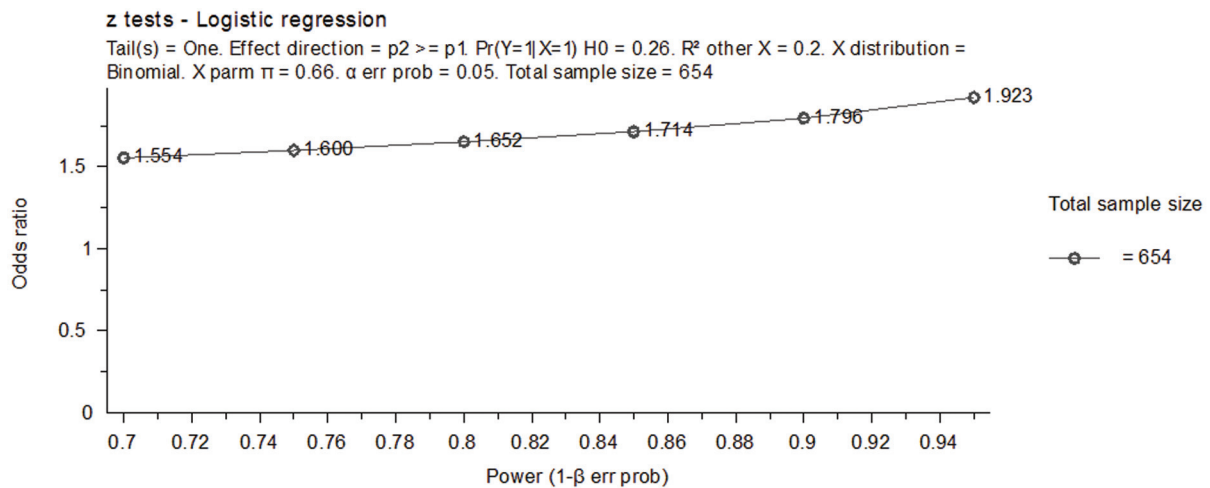


Fig. C.2 Detectable effect size based on total sample size corresponding to the likelihood of comprehensive inpatient portal use associated with higher health literacy and numeracy skills.

Table C.1 Inpatient portal (IPP) frequency and comprehensiveness of use, negative binomial and logistic regression models, showing incidence rate and odds ratios, with 95% confidence intervals, for all predictors and covariates

Variable	IPP frequency of use		IPP comprehensiveness of use	
	IRR	95% CI	OR	95% CI
<i>I feel uncomfortable with health information that has a lot of numbers</i>				
Strongly agree to neutral	–	–	–	–
Somewhat to strongly disagree	1.13 ^a	1.01, 1.28	1.27	0.83, 1.95
<i>I depend on numbers and statistics to help me make decisions about my health</i>				
Strongly disagree to neutral	–	–	–	–
Somewhat to strongly agree	1.01	0.89, 1.13	1.26	0.83, 1.91
<i>I know how to take my medications</i>				
Strongly disagree to neutral	–	–	–	–
Somewhat to strongly agree	0.88	0.65, 1.16	1.20	0.44, 3.59
<i>I can fill out medical forms</i>				
Strongly disagree to neutral	–	–	–	–
Somewhat to strongly agree	0.98	0.79, 1.21	1.12	0.52, 2.51
<i>I frequently have someone help me read hospital material</i>				
Strongly agree to neutral	–	–	–	–
Somewhat to strongly disagree	0.94	0.82, 1.08	0.88	0.55, 1.43
<i>I frequently have difficulty using written health information</i>				
Strongly agree to neutral	–	–	–	–
Somewhat to strongly disagree	1.02	0.86, 1.21	0.94	0.53, 1.71
Charlson score	0.98	0.95, 1.01	0.96	0.86, 1.07
<i>Age</i>				
18–29	–	–	–	–
30–39	0.94	0.78, 1.13	1.02	0.52, 2.03
40–49	0.96	0.78, 1.17	1.48	0.72, 3.06
50–59	0.81	0.66, 1.00	1.09	0.51, 2.33
60–69	0.89	0.70, 1.13	0.95	0.39, 2.28
≥70	0.67 ^a	0.47, 0.97	0.64	0.16, 2.38
<i>Gender</i>				
Male	–	–	–	–
Female	1.02	0.90, 1.14	1.32	0.87, 2.00
<i>Race</i>				
White	–	–	–	–
Black	0.91	0.78, 1.06	0.86	0.49, 1.48
Other	0.84	0.64, 1.13	0.86	0.32, 2.17
<i>Educational attainment</i>				
Less than high school	–	–	–	–
High school	1.09	0.83, 1.41	0.74	0.30, 1.87
Some college	1.24	0.95, 1.61	1.11	0.46, 2.79
College graduate	1.31	0.98, 1.73	1.48	0.58, 3.91
Graduate or beyond	1.26	0.91, 1.74	1.34	0.45, 4.07
<i>Marital status</i>				
Married	–	–	–	–

Table C.1 (Continued)

Variable	IPP frequency of use		IPP comprehensiveness of use	
	IRR	95% CI	OR	95% CI
Living as married	1.16	0.91, 1.50	1.41	0.57, 3.28
Widowed	0.99	0.83, 1.18	1.42	0.78, 2.54
Divorced	0.88	0.65, 1.22	1.29	0.44, 3.44
Separated	1.03	0.74, 1.48	1.86	0.61, 5.43
Single, never married	1.00	0.85, 1.18	0.94	0.52, 1.69
<i>Employment</i>				
Employed	–	–	–	–
Unemployed	1.24 ^a	1.01, 1.53	1.22	0.59, 2.48
Homemaker	1.10	0.79, 1.56	0.74	0.20, 2.31
Student	1.03	0.64, 1.73	1.52	0.21, 8.84
Retired	1.21	0.96, 1.52	1.64	0.72, 3.73
Disabled	1.13	0.96, 1.34	1.07	0.59, 1.90
Other	1.15	0.85, 1.59	0.93	0.29, 2.72
<i>Household income</i>				
\$0–\$19,999	–	–	–	–
\$20,000–\$49,999	1.05	0.90, 1.23	0.81	0.46, 1.41
\$50,000–\$99,999	1.12	0.94, 1.34	0.73	0.39, 1.35
\$100,000–\$199,999	1.16	0.93, 1.44	0.77	0.35, 1.64
\$200,000 or more	1.01	0.70, 1.49	1.27	0.35, 4.39
<i>General health</i>				
Excellent	–	–	–	–
Very good	1.22	0.85, 1.72	2.59	0.62, 18.0
Good	1.36	0.97, 1.88	2.79	0.70, 18.9
Fair	1.33	0.94, 1.85	3.09	0.76, 21.2
Poor	1.13	0.78, 1.63	2.30	0.51, 16.6
<i>Have you ever used a patient portal?</i>				
Yes	–	–	–	–
No	1.09	0.94, 1.26	1.21	0.73, 2.01
I don't know	1.25	0.98, 1.60	1.29	0.52, 2.97
No. Obs.	654		654	

Abbreviations: CI, confidence interval; IRR, incidence rate ratio; OR, odds ratio.

^a $p < 0.05$.^b $p < 0.01$.^c $p < 0.001$.

D. Imputation of Missing Values

Table D.1 Patient demographic characteristics, summary statistics of patient portals use, and dichotomized survey items representing patient health literacy and numeracy skills. Summaries are reported for all available patients, including missing values

Characteristic	<i>n</i> = 718 ^a
<i>Age</i>	
18–29	109 (15.2%)
30–39	152 (21.2%)
40–49	140 (19.5%)
50–59	162 (22.6%)
60–69	121 (16.9%)
≥70	34 (4.7%)
<i>Gender</i>	
Male	276 (38.4%)
Female	442 (61.6%)
<i>Race</i>	
White	566 (78.8%)
Black	122 (17.0%)
Other	30 (4.2%)
<i>Educational attainment</i>	
Less than high school	38 (5.3%)
High school	185 (25.8%)
Some college	226 (31.6%)
College graduate	186 (26.0%)
Graduate or beyond	81 (11.3%)
(Missing)	2
<i>Marital status</i>	
Married	352 (49.3%)
Living as married	37 (5.2%)
Widowed	103 (14.4%)
Divorced	26 (3.6%)
Separated	24 (3.4%)
Single, never married	172 (24.1%)
(Missing)	4
<i>Employment</i>	
Employed	349 (48.9%)
Unemployed	71 (10.0%)
Homemaker	21 (2.9%)
Student	9 (1.3%)
Retired	81 (11.4%)
Disabled	157 (22.0%)

Table D.1 (Continued)

Characteristic	<i>n</i> = 718 ^a
Other	25 (3.5%)
(Missing)	5
<i>Household income</i>	
\$0–\$19,999	232 (34.7%)
\$20,000–\$49,999	162 (24.3%)
\$50,000–\$99,999	159 (23.8%)
\$100,000–\$199,999	95 (14.2%)
\$200,000 or more	20 (3.0%)
(Missing)	50
<i>General health</i>	
Excellent	25 (3.5%)
Very good	103 (14.3%)
Good	266 (37.0%)
Fair	245 (34.1%)
Poor	79 (11.0%)
<i>Have you ever used a patient portal?</i>	
Yes	527 (73.7%)
No	150 (21.0%)
I don't know	38 (5.3%)
(Missing)	3
<i>Charlson score</i>	1 (0, 2)
<i>Length of provision (days)</i>	4 (3, 7)
<i>Count of IPP sessions in admission</i>	16 (9, 29)
<i>Comprehensive IPP use</i>	195 (27.2%)
<i>Count of OPP sessions 6 month postdischarge</i>	10 (0, 46)
<i>I feel uncomfortable with health information that has a lot of numbers</i>	
Strongly agree to neutral	414 (58.1%)
Somewhat to strongly disagree	299 (41.9%)
(Missing)	5
<i>I depend on numbers and statistics to help me make decisions about my health</i>	
Strongly disagree to neutral	411 (57.7%)
Somewhat to strongly agree	301 (42.3%)
(Missing)	6
<i>I know how to take my medications</i>	
Strongly disagree to neutral	31 (4.4%)
Somewhat to strongly agree	678 (95.6%)
(Missing)	9
<i>I can fill out medical forms</i>	

Table D.1 (Continued)

Characteristic	<i>n</i> = 718 ^a
Strongly disagree to neutral	65 (9.2%)
Somewhat to strongly agree	644 (90.8%)
(Missing)	9
<i>I frequently have someone help me read hospital material</i>	
Strongly agree to neutral	229 (32.3%)
Somewhat to strongly disagree	480 (67.7%)
(Missing)	9
<i>I frequently have difficulty using written health information</i>	
Strongly agree to neutral	131 (18.5%)
Somewhat to strongly disagree	578 (81.5%)
(Missing)	9

^a*n* (%).

Note: Median (Q1, Q3).

Table D.2 Health literacy and numeracy skill levels by income reporting status

Dichotomized HLN item	Household income		<i>p</i> -Value ^b
	Missing, <i>n</i> = 50 ^a	Reported, <i>n</i> = 668 ^a	
<i>I feel uncomfortable with health information that has a lot of numbers</i>			
Strongly agree to neutral	32 (65.3%)	382 (57.5%)	0.3
Somewhat to strongly disagree	17 (34.7%)	282 (42.5%)	
(Missing)	1	4	
<i>I depend on numbers and statistics to help me make decisions about my health</i>			
Strongly disagree to neutral	31 (64.6%)	380 (57.2%)	0.3
Somewhat to strongly agree	17 (35.4%)	284 (42.8%)	
(Missing)	2	4	
<i>I know how to take my medications</i>			
Strongly disagree to neutral	2 (4.2%)	29 (4.4%)	> 0.9
Somewhat to strongly agree	46 (95.8%)	632 (95.6%)	
(Missing)	2	7	
<i>I can fill out medical forms</i>			
Strongly disagree to neutral	5 (10.4%)	60 (9.1%)	0.8
Somewhat to strongly agree	43 (89.6%)	601 (90.9%)	
(Missing)	2	7	
<i>I frequently have someone help me read hospital material</i>			
Strongly agree to neutral	18 (37.5%)	211 (31.9%)	0.4
Somewhat to strongly disagree	30 (62.5%)	450 (68.1%)	
(Missing)	2	7	
<i>I frequently have difficulty using written health information</i>			
Strongly agree to neutral	9 (18.8%)	122 (18.5%)	> 0.9
Somewhat to strongly disagree	39 (81.2%)	539 (81.5%)	
(Missing)	2	7	

Abbreviation: HLN, health literacy and numeracy.

^a*n* (%).

^bPearson's chi-square test; Fisher's exact test.

Table D.3 Inpatient portal (IPP) and outpatient portal (OPP) frequency and comprehensiveness of use, negative binomial and logistic regression models, showing incidence rate and odds ratios, with 95% confidence intervals, for all predictors and covariates. Estimates computed on data with missing values imputed via fully conditional specification

Variable	IPP frequency of use		IPP comprehensive-ness of use		OPP frequency of use	
	IRR	95% CI	OR	95% CI	IRR	95% CI
<i>I feel uncomfortable with health information that has a lot of numbers</i>						
Strongly agree to neutral	–	–	–	–	–	–
Somewhat to strongly disagree	1.11	0.99, 1.25	1.17	0.78, 1.77	0.92	0.69, 1.22
<i>I depend on numbers and statistics to help me make decisions about my health</i>						
Strongly disagree to neutral	–	–	–	–	–	–
Somewhat to strongly agree	1.02	0.91, 1.14	1.30	0.88, 1.93	0.83	0.63, 1.09
<i>I know how to take my medications</i>						
Strongly disagree to neutral	–	–	–	–	–	–
Somewhat to strongly agree	0.92	0.70, 1.21	1.26	0.46, 3.44	1.09	0.55, 2.18
<i>I can fill out medical forms</i>						
Strongly disagree to neutral	–	–	–	–	–	–
Somewhat to strongly agree	0.97	0.79, 1.19	1.13	0.54, 2.38	0.61	0.37, 1.03
<i>I frequently have someone help me read hospital material</i>						
Strongly agree to neutral	–	–	–	–	–	–
Somewhat to strongly disagree	0.95	0.84, 1.08	0.88	0.56, 1.39	0.88	0.64, 1.21
<i>I frequently have difficulty using written health information</i>						
Strongly agree to neutral	–	–	–	–	–	–
Somewhat to strongly disagree	0.99	0.85, 1.16	0.96	0.55, 1.68	1.07	0.73, 1.58
Charlson score	0.97	0.95, 1.00	0.95	0.85, 1.05	1.06	0.98, 1.13
<i>Age</i>						
18–29	–	–	–	–	–	–
30–39	0.98	0.81, 1.17	1.16	0.60, 2.24	1.09	0.69, 1.72
40–49	0.99	0.81, 1.20	1.57	0.79, 3.14	0.84	0.52, 1.37
50–59	0.87	0.71, 1.06	1.18	0.58, 2.43	1.05	0.64, 1.73
60–69	0.94	0.75, 1.18	0.83	0.35, 1.95	1.28	0.71, 2.28
≥70	0.74	0.53, 1.04	0.57	0.16, 2.11	0.99	0.42, 2.33
<i>Gender</i>						
Male	–	–	–	–	–	–
Female	1.06	0.95, 1.18	1.40	0.94, 2.08	1.21	0.92, 1.59
<i>Race</i>						
White	–	–	–	–	–	–
Black	0.89	0.77, 1.03	0.81	0.48, 1.40	0.74	0.52, 1.06
Other	0.84	0.65, 1.08	0.82	0.34, 1.95	1.32	0.69, 2.52
<i>Educational attainment</i>						
Less than high school	–	–	–	–	–	–
High school	1.07	0.83, 1.37	0.72	0.31, 1.69	1.01	0.53, 1.91
Some college	1.18	0.92, 1.52	0.95	0.41, 2.23	1.47	0.78, 2.78
College graduate	1.23	0.95, 1.61	1.14	0.46, 2.80	1.61	0.82, 3.15
Graduate or beyond	1.18	0.87, 1.60	0.90	0.32, 2.56	1.66	0.78, 3.55

Table D.3 (Continued)

Variable	IPP frequency of use		IPP comprehensive-ness of use		OPP frequency of use	
	IRR	95% CI	OR	95% CI	IRR	95% CI
<i>Marital status</i>						
Married	–	–	–	–	–	–
Living as married	1.13	0.89, 1.44	1.16	0.48, 2.77	0.65	0.35, 1.18
Widowed	1.02	0.87, 1.20	1.47	0.85, 2.56	0.66 ^a	0.45, 0.98
Divorced	0.89	0.67, 1.18	1.17	0.43, 3.15	0.83	0.41, 1.68
Separated	1.03	0.77, 1.39	2.09	0.81, 5.36	0.64	0.30, 1.38
Single, never married	1.00	0.86, 1.17	0.87	0.49, 1.56	0.95	0.64, 1.42
<i>Employment</i>						
Employed	–	–	–	–	–	–
Unemployed	1.25 ^a	1.02, 1.52	1.23	0.61, 2.48	0.90	0.55, 1.48
Homemaker	1.27	0.93, 1.73	0.83	0.27, 2.48	0.45 ^a	0.20, 0.99
Student	1.03	0.63, 1.67	1.55	0.25, 9.71	0.87	0.26, 2.87
Retired	1.19	0.96, 1.48	1.88	0.85, 4.16	0.82	0.47, 1.43
Disabled	1.11	0.95, 1.30	1.19	0.69, 2.05	0.80	0.54, 1.17
Other	1.15	0.86, 1.53	1.00	0.35, 2.83	0.55	0.26, 1.15
<i>Household income</i>						
\$0–\$19,999	–	–	–	–	–	–
\$20,000–\$49,999	1.04	0.88, 1.23	0.86	0.47, 1.55	1.34	0.91, 1.98
\$50,000–\$99,999	1.11	0.92, 1.33	0.79	0.42, 1.48	1.91 ^b	1.25, 2.92
\$100,000–\$199,999	1.14	0.91, 1.43	0.95	0.42, 2.14	3.19 ^c	1.78, 5.70
\$200,000 or more	0.98	0.68, 1.42	1.82	0.53, 6.26	2.38	0.92, 6.15
<i>General health</i>						
Excellent	–	–	–	–	–	–
Very good	1.03	0.75, 1.40	2.28	0.58, 8.93	1.18	0.52, 2.67
Good	1.16	0.86, 1.55	2.34	0.62, 8.77	1.33	0.60, 2.94
Fair	1.12	0.83, 1.51	2.85	0.75, 10.8	1.70	0.75, 3.87
Poor	1.00	0.72, 1.40	2.18	0.53, 9.07	1.19	0.49, 2.92
<i>Have you ever used a patient portal?</i>						
Yes	–	–	–	–	–	–
No	1.07	0.94, 1.23	1.07	0.66, 1.73	0.30 ^c	0.21, 0.42
I don't know	1.20	0.95, 1.52	1.21	0.53, 2.77	0.67	0.38, 1.20
<i>OPP frequency of previous use (6 mo)</i>					1.02 ^c	1.02, 1.02
No. Obs.	718		718		718	

Abbreviations: CI, confidence interval; IRR, incidence rate ratio; OR, odds ratio.

^a $p < 0.05$.^b $p < 0.01$.^c $p < 0.001$.

E. Postdischarge survey response

Table E.1 Health literacy and numeracy and postdischarge survey response

Dichotomized HLN item	Postdischarge survey		p-Value ^b
	Nonrespondents, n = 390 ^a	Respondents, n = 264 ^a	
<i>I feel uncomfortable with health information that has a lot of numbers</i>			
Strongly agree to neutral	235 (60%)	138 (52%)	0.043
Somewhat to strongly disagree	155 (40%)	126 (48%)	
<i>I depend on numbers and statistics to help me make decisions about my health</i>			
Strongly disagree to neutral	230 (59%)	145 (55%)	0.3
Somewhat to strongly agree	160 (41%)	119 (45%)	
<i>I know how to take my medications</i>			
Strongly disagree to neutral	22 (5.6%)	7 (2.7%)	0.068
Somewhat to strongly agree	368 (94%)	257 (97%)	
<i>I can fill out medical forms</i>			
Strongly disagree to neutral	43 (11%)	17 (6.4%)	0.046
Somewhat to strongly agree	347 (89%)	247 (94%)	
<i>I frequently have someone help me read hospital material</i>			
Strongly agree to neutral	140 (36%)	69 (26%)	0.009
Somewhat to strongly disagree	250 (64%)	195 (74%)	
<i>I frequently have difficulty using written health information</i>			
Strongly agree to neutral	79 (20%)	43 (16%)	0.2
Somewhat to strongly disagree	311 (80%)	221 (84%)	

^an (%).

^bPearson's chi-square test.