

# Waiting for Radiology Test Results: Patient Expectations and Emotional Disutility

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## Abstract

**Purpose:** To measure patient willingness to wait and emotional disutility of waiting for outpatient imaging test results.

**Methods:** A prospective HIPAA-compliant multicenter outpatient quality improvement survey was administered by a trained interviewer to 218 outpatients from November 1, 2016, to February 1, 2017. The survey was vetted by patient- and family-centered care advocates with experience in survey design and underwent precognitive testing for readability. Six clinical scenarios were tested. Descriptive statistics were calculated.

**Results:** The response (93% [202 of 218]) and completion (93% [188 of 202]) rates were excellent. Anxiety (28% [57 of 202]), depression (26% [53 of 202]), and cancer (23% [46 of 202]) histories were common. Median stated expectations for imaging test results receipt were 3 days after a screening examination (interquartile range [IQR] 5 days); 2 days after chest x-ray for chest pain (IQR 3) or MRI or CT for back pain (IQR 2); and 1 day after chest x-ray for pneumonia (IQR 2), MRI or CT for brain tumor (IQR 2), or CT for cancer treatment (IQR 3). If imaging results are not received, the median time patients stated they would wait to call their provider was 1 to 5 days (varied by indication). Waiting for imaging results exerts an emotional change in 45% (91 of 202) of individuals, with the majority (85% [77 of 91]) experiencing anxiety (minimal 28%, mild 45%, moderate 22%, severe 4%, extreme 1%).

**Conclusions:** Patients expect outpatient imaging results within 1 to 3 days and will call providers by 1 to 5 days. Waiting for test results commonly induces anxiety.

**Key Words:** Patient preference, radiology results, waiting, anxiety, communication

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## INTRODUCTION

Diagnostic radiology examinations are important components of patient care that generally require patients to interface with a department (ie, radiology) that is not primarily responsible for their care decisions. This creates a paradigm in which results from those examinations are not immediately available for review or discussion between patients and their provider. In the period between when an examination is performed and the results from that examination are received, patients can experience a range of negative emotions, and their health status can evolve or deteriorate [1-3]. In

recognition of these issues, modern radiology practices often consider results turnaround time to be an important quality metric that is measured and optimized to verify that radiology results are available as soon as possible.

However, a radiologist finalizing a report does not complete the exchange of information. Once a report is finalized, infrastructure needs to be in place to ensure timely receipt of those results by the ordering provider, facilitate determination of the best course of action on the basis of those results, and enable efficient communication of the results and plan to the patient. All of these steps take time, and in that indefinite period, patients wait anxiously.

Results turnaround time therefore is a multi-specialty problem. As administrators weigh the challenges and goals of this problem, it would be useful to know the patient's perspective. How long are patients willing to wait for radiology test results and what is the emotional cost of that waiting? Are their expectations the same for all diagnostic radiology test results? Are they the same for all patients? These questions are relevant because competing priorities dictate that ordering providers will not always immediately be available to interpret and transform radiology results into actionable care plans or immediately be able to communicate those results to the patient. If we had a more accurate sense of patient expectations, those expectations could be built into optimized institutional policies (eg, shared provider pools in the electronic medical record system, systems of results communication by physician extenders, and automated release of online patient portal results).

The purpose of our study was to measure patient willingness to wait and emotional disutility of waiting for outpatient imaging test results. The data generated from this effort will be useful when establishing local policies for radiology results turnaround, use of telephone and virtual results communication, outpatient appointment schedule optimization, and automated online patient portal embargo periods.

## METHODS

This HIPAA-compliant prospective quality assurance initiative was considered “not regulated” by the host institutional review board. No extramural funding was used. The data and population have not been published previously in part or in whole.

## Study Population

As part of a quality improvement effort to study and optimize patient wishes regarding receipt of radiology test results, we conducted a prospective HIPAA-compliant survey from November 1, 2016, to February 1, 2017. The survey was administered to consecutive outpatients using a convenience sample by a trained interviewer at two outpatient centers immediately after completion of an imaging examination (eg, radiography, ultrasonography, CT, MRI, mammography, bone densitometry). The convenience sample was determined by the availability of the trained interviewer; all available subjects who had a related imaging examination on the days and times the interviewer was available were approached for possible participation. A total of 218 subjects were recruited and 202 subjects (93%) consented to participate.

## Questionnaire Development

The questionnaire was formed by creating six imaging scenarios to test patient expectations for receiving imaging results. The imaging scenarios consisted of different imaging indications and modalities. Scenarios for receipt of radiology test results included routine screening test for cancer, chest x-ray to find the cause of chest pain, chest x-ray to evaluate for pneumonia, MRI to determine the cause of back pain, CT or MRI to evaluate for brain tumor, and CT or MRI for cancer treatment response. Each scenario was followed by questions testing patient expectations for receiving imaging results and the amount of time they would be willing to wait before calling their provider about results. The survey also contained questions derived from the test morbidities index [4-6]. These questions were designed to assess the emotional disutility associated with waiting for test results. The full index [4-6] was not administered because portions of the index were not applicable to the patient population. Lastly, the survey contained questions about preferred methods of results communication and prior use of an online patient portal.

The survey content was developed by three radiologists with expertise in quality improvement; two are faculty in different radiology subspecialties and one is a diagnostic radiology house officer. The contents of the experiment were vetted by patient advocates with experience in survey design. The experiment also underwent patient precognitive testing for readability. The data from the survey were expressed with descriptive statistics. A

copy of the survey is provided in [Appendix A](#). The primary outcome was determination of the length of time patients are willing to wait to receive imaging test results before contacting their provider. Secondary outcomes included emotional changes induced by waiting for radiology test results, personal use of and preferences for use of an online patient portal, and methods used by patients to interpret unclear language in radiology reports.

## RESULTS

The response (93% [202 of 218]) and completion rates (93% [188 of 202]) were excellent. Details of the patient

**Table 1.** Study population details (n = 202)

Characteristic	%	n
Gender		
Female	64	130
Male	36	72
Age (years)		
18-29	5	10
30-49	24	48
50-64	37	74
65 or older	35	70
Ethnicity		
White	71	143
African American	12	25
Hispanic	1	3
American Indian or Alaska Native	0.5	1
Asian or Pacific Islander	7	14
Other	8	16
Education		
Some high school	1	3
High school graduate	21	42
Trade or technical or vocational training	21	42
College graduate	27	55
Graduate school	22	44
Postgraduate training	6	12
Other	2	4
Employee of the study institution		
Yes	5	10
No	95	192
Answering on behalf of self or as a caregiver?		
Self	93	188
Caregiver	7	14
Medical history		
Anxiety	28	57
Depression	26	53
Cancer	23	46
Cardiovascular disease	15	31
Transplant	3	7

**Table 2.** Subject experience with imaging tests (n = 202)

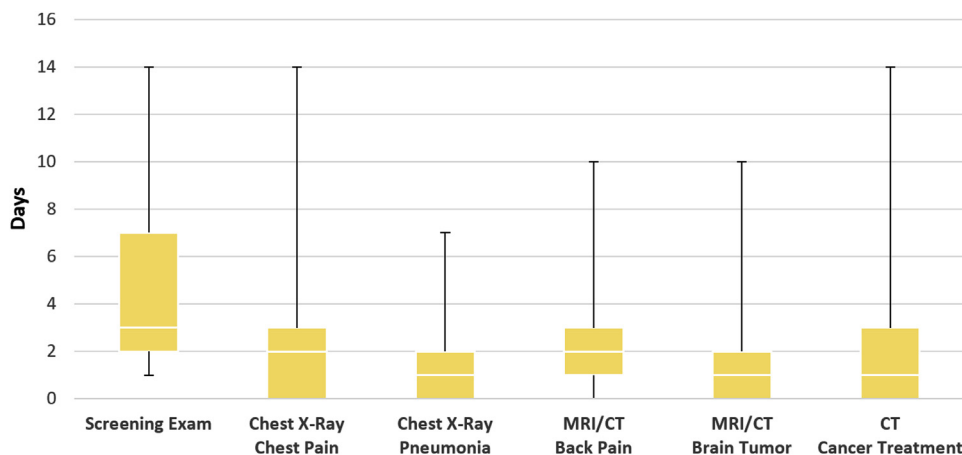
Characteristic	%	n
Imaging test performed today*		
X-ray	5	11
Mammogram	9	18
Bone densitometry	2	5
CT scan	41	82
Ultrasound	30	61
MRI	16	33
Unsure of imaging	0	0
Last imaging test performed before today		
First imaging test	0.5	1
Within the last week	5	10
Within the last month	14	28
Within the last year	41	82
More than a year ago	40	81

\*Numbers do not sum to 202 because some subjects underwent more than one imaging test on the day of the survey.

population are provided in [Tables 1](#) and [2](#). The majority (71% [144 of 202]) of subjects were 50 years in age or older ([Table 1](#)). Most subjects were answering on behalf of themselves (93% [188 of 202]) rather than as a caregiver, and many (53% [106 of 202]) reported a known diagnosis of anxiety (28% [57 of 202]), depression (26% [53 of 202]), or cancer (23% [46 of 202]; [Table 1](#)). Nearly all subjects (99.5% [201 of 202]) had previously undergone an imaging test ([Table 2](#)).

## Primary Outcome

In general, patients reported that they want radiology test results within 1 to 3 days and will call their provider within 1 to 5 days if they have not yet received them ([Figs. 1](#) and [2](#)). Median stated expectations for imaging test results receipt was 3 days after a screening examination (interquartile range [IQR] 5 days); 2 days after chest x-ray for chest pain (IQR 3) or MRI or CT for back pain (IQR 2); and 1 day after chest x-ray for pneumonia (IQR 2), MRI or CT for brain tumor (IQR 2), or CT for cancer treatment (IQR 3; [Fig. 1](#)). The median number of days patients stated they would wait for results before contacting their provider was 5 days after a screening examination (IQR: 4 days); 2 days after chest x-ray for chest pain (IQR: 4 days), MRI or CT for back pain (IQR: 3 days), or CT for cancer treatment (IQR: 3 days); and 1 day after chest x-ray for pneumonia (IQR: 3 days) or MRI or CT for brain tumor (IQR: 3 days; [Fig. 2](#)).



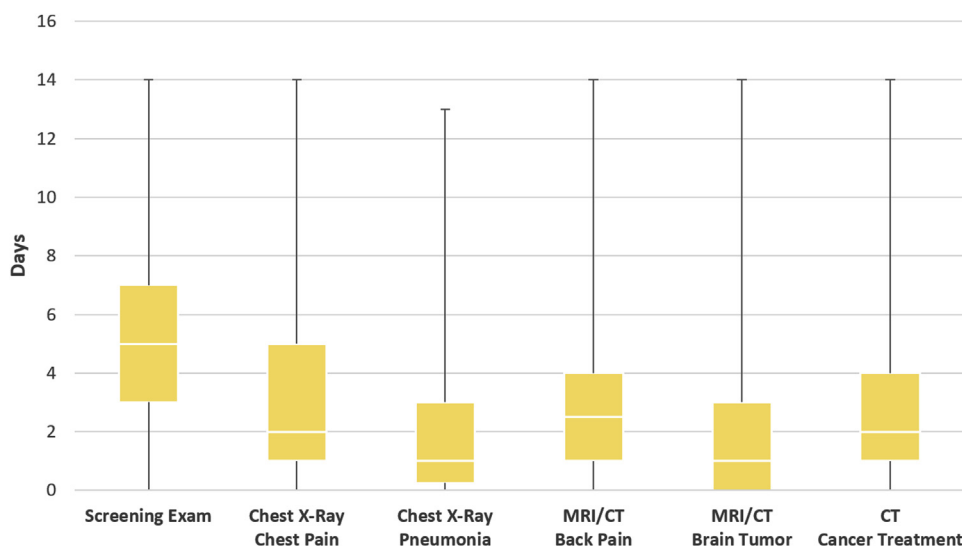
**Fig 1.** Patient expectations for radiology results receipt. Box and whisker plot of patient-reported time expectations for receipt of imaging test results with different indications and modalities. The gold boxes indicate the 95% confidence interval, white line represents the median value, and black line signifies the range.

## Secondary Outcomes

Among subjects answering the survey on behalf of themselves (rather than as a caregiver), 20% (38 of 188) reported that waiting for radiology test results negatively affects their state of mind (Table 3). Approximately half of all patients (45% [91 of 202]) reported experiencing an emotional change of some kind (minimal 28%, mild 45%, moderate 22%, severe 4%, extreme 1%); in such individuals, the most common emotional state (85% [77 of 91]) was anxiety (Table 3).

In general, patients preferred to learn about incidental radiology findings from their provider over the phone rather than in their provider's office, though both options were preferred compared with receiving results through an online portal or from a staff member in their provider's office (Fig. 3).

A little more than half reported prior experience using an online patient portal (58% [118 of 202]), and of those who had, nearly all reported liking it (94% [111 of 118]; Table 4). The most common uses were viewing test results (94% [111 of 118]), viewing health records



**Fig 2.** When patients would call their provider if they have not received imaging test results. Box and whisker plot of patient-reported amount of time to call provider after finishing an imaging test exam without receipt of results in different indications and modalities. The gold boxes indicate the 95% confidence interval, white line represents the median value, and black line signifies the range.

**Table 3.** Patient-reported emotional disutility associated with waiting for radiology test results

Characteristic	%	n
State of mind		188
Strong negative effect	3	6
Minor negative effect	17	32
No effect	77	145
Minor positive effect	3	5
Strong positive effect	0	0
Emotional change (if any)		202
Anxious	38	77
Scared	4	7
Joyful	1	3
Sadness	0.5	1
Angry	0.5	1
Other	7	15
No change in emotions	55	111
Severity of emotional change (when present)		91
Minimal	30	27
Mild	41	37
Moderate	23	21
Severe	4	4
Extreme	2	2

Not all respondents answered every question.

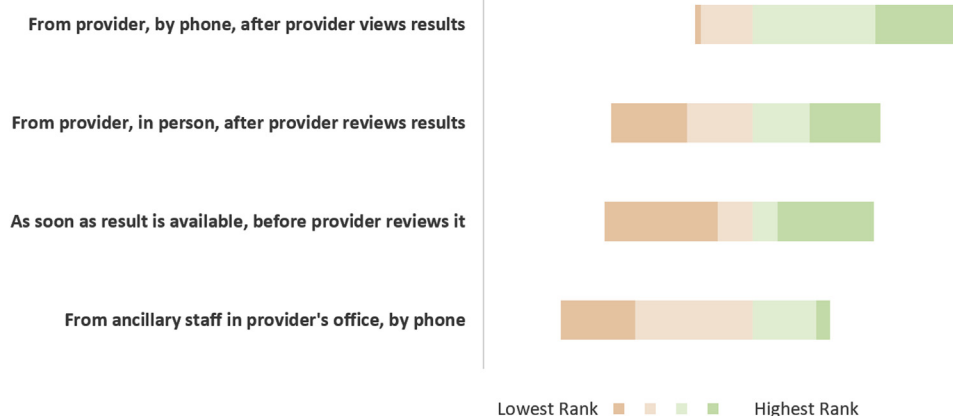
(75% [89 of 118]), and communicating with the medical team (69% [81 of 118]; [Table 3](#)). When seeking clarification of ambiguous radiology test results, patients reported that they would ideally be able to use the following resources to resolve that ambiguity, in order of preference: provider (first),

radiologist (second), online portal resources (third), the Internet (fourth), friends or family (fifth) ([Fig. 4](#)). Among those who reported never using an online patient portal, the majority (68% [57 of 84]) indicated an interest in using it in the future ([Table 4](#)). Approximately half indicated interest in being able to customize the timing of automatic release of radiology test results through the online portal (56% [113 of 202]; [Table 4](#)).

## DISCUSSION

These data indicate that patients expect to receive outpatient diagnostic radiology test results within 1 to 3 days. The longest delays acceptable by patients in our cohort were for screening examinations and imaging for back pain, but even in those instances, patients expected their results within 2 to 3 days and would call their provider within 5 days if results were not received before then. Patients expect results within 1 day if their imaging is performed to evaluate an acute or serious condition such as pneumonia, brain tumor, or cancer treatment outcome; if results are not obtained within 1 to 2 days in these cases, patients indicated they would contact their provider rather than wait further. These patient-reported data can be used when establishing policies regarding holistic approaches to radiology results turnaround.

There are emotional harms from waiting on diagnostic radiology test results related to anticipation of what those results might reveal, worry about treatment



**Fig 3.** Rank data indicating how patients would prefer to learn about incidental findings detected on radiology test results (n = 202). The subjects rated all four answer choices. The highest aggregate ranked choice is at the top of the y axis and lowest aggregate ranked choice at the bottom of the y axis. The bar graphs represent a rank distribution for each answer choice demonstrated as the darkest shade of green for the highest rank assigned by individual respondents and the darkest shade of red for the lowest rank assigned by individual respondents.

**Table 4.** Respondent experience with an online patient portal (n = 202)

Characteristic	%	n
Have you ever used the online patient portal? If so, how did you like it?		202
Yes, I've used it commonly, and like it	44	88
Yes, I've used it commonly, but do not like it	1	2
Yes, I've used it occasionally, and like it	11	23
Yes, I've used it occasionally, but do not like it	2	5
I've never used it, but it sounds like something I would use	9	18
I've never used it, but it sounds like something I might use	19	39
I've never used it, and would never use it	13	27
How have you previously used the online portal?		118
View test results	94	111
View health records	75	89
Communicate with medical team	69	81
Request medical appointments	36	42
Request prescription renewal	46	54
Pay bills	42	49
Would you be interested in a customizable release date for receiving radiology test results through an online patient portal?		202
Strongly interested	45	90
Somewhat interested	11	23
Neutral	16	33
Somewhat not interested	4	9
Strongly not interested	18	37

Not all respondents answered every question.

(or lack thereof) that may be forthcoming, or fear that waiting on test results is delaying appropriate therapy [1-3]. In our cohort, 45% of patients stated that waiting on a diagnostic radiology test result induces a change in their emotional state, 20% stated that waiting produces a negative state of mind, and 38% stated that waiting creates anxiety. Emotional harm related to imaging is important and has influenced policy by the US Preventative Service Task Force regarding mammogram appropriateness [7]. Discovering ways to minimize the wait time for imaging results while maintaining patient-preferred methods of communication is necessary to optimize the patient experience. One of the interesting secondary outcomes of our study was that patients indicated that besides their provider, their most preferred source of information regarding

radiology test results was the radiologist, rather than the Internet, patient portal, friends, or family. Radiologist involvement in direct results communication has been previously explored [8,9], found to be potentially viable, and aligns with the ACR's Imaging 3.0 initiative [10].

Previous studies have indicated that patients in general prefer their imaging test results as soon as possible and prefer to receive those results by their provider over the telephone [11-14]. A survey by Basu et al [11] queried 129 subjects (response rate: 23%) and found that almost all (95%) indicated that results needed to be communicated within a few hours to be considered acceptable; 31% wanted results to be delivered by the fastest method possible, 35% preferred to receive results by telephone, and 68% wanted the results to be communicated to them by their physician. Johnson et al [12] surveyed 53 subjects and found that immediate access to reports was preferred by 60% for "nearly normal" results, 47% for "seriously abnormal" results, and 47% for "indeterminate" results. Our results support many of these findings. However, most prior work [11-14] did not determine whether patient expectations for results receipt vary by clinical scenario or determine when patients will call their provider if results are not received. Therefore, our data may more directly inform an optimal time for results communication, balancing the wishes of patients and the competing priorities of providers.

Our results have some limitations. Although nearly all (99.5%) of the patients we surveyed had previous personal experience waiting for radiology test results, the survey was conducted within 30 min after a radiology test was performed. Therefore, patients had not immediately experienced a lengthy delay in receiving their results and were either projecting forward or relying on past experience. Risk of bias was minimized by vetting the survey with patient advocates, using a trained interviewer to deliver the survey, and having excellent response and completion rates. The survey was only administered to outpatients and may not reflect inpatients or acute care environments. We did not measure referring provider preferences or referring provider availability to communicate imaging findings. In the balance between what patients want and what is feasible, provider availability is important to meet the needs of patients. If providers are unable to meet this demand, technology may offer some solutions





**Fig 4.** Rank data indicating what method(s) patients who have previously used the online patient portal use to clarify difficult to understand imaging test results received through the online patient portal (n = 105). The subjects rated all four answer choices. The highest aggregate ranked choice is at the top of the y axis and lowest aggregate ranked choice at the bottom of the y axis. The bar graphs represent a rank distribution for each answer choice demonstrated as the darkest shade of green for the highest rank assigned by individual respondents and the darkest shade of red for the lowest rank assigned by individual respondents.

(eg, automated release of test results through on online patient portal).

In conclusion, patients expect to receive outpatient diagnostic radiology test results 1 to 3 days after undergoing the test and will call their provider within 1 to 5 days if results are not received. The median values derived in this study can serve as benchmarks for optimizing provider-to-patient communication. Given that not all patients have the same preferences, personalizing methods and speed of communication (eg, patient-specified variable embargo periods on an online patient portal) may be helpful.

### TAKE-HOME POINTS

- Patients expect to receive outpatient diagnostic radiology test results 1 to 3 days after undergoing the test and will call their provider within 1 to 5 days if results are not received.
- The median values derived in this study can serve as benchmarks for optimizing provider-to-patient communication.
- Given that not all patients have the same preferences, personalizing methods and speed of communication (eg, patient-specified variable embargo periods on an online patient portal) may be helpful.

### ADDITIONAL RESOURCES

Additional resources can be found online at: <https://doi.org/10.1016/j.jacr.2017.09.017>.

### REFERENCES

1. Wiljer D, Leonard KJ, Urowitz S, et al. The anxious wait: assessing the impact of patient accessible EHRs for breast cancer patients. *BMC Med Inform Decis Mak* 2010;10:46.
2. Pahade J, Couto C, Davis RB, et al. Reviewing imaging examination results with a radiologist immediately after study completion: patient preferences and assessment of feasibility in an academic department. *AJR Am J Roentgenol* 2012;199:844-51.
3. Flory N, Lang E. Distress in the radiology waiting room. *Radiology* 2011;260:166-73.
4. Swan JS, Kong CY, Lee JM, et al. Patient and societal value functions for the testing morbidities index. *Med Decis Making* 2013;33:819-38.
5. Swan JS, Kong CY, Hur C, et al. Comparing morbidities of testing with a new index: screening colonoscopy versus core-needle breast biopsy. *J Am Coll Radiol* 2015;12:295-301.
6. Swan JS, Kong CY, Lee P, et al. Responsiveness of the testing morbidities index in colonoscopy. *Value Health* 2013;16:1046-53.
7. Nelson HD, Pappas M, Cantor A, et al. Harms of breast cancer screening: a systemic review to update the 2009 U.S. preventive services task force recommendation. *Ann Intern Med* 2016;164:256-67.
8. Mangano MD, Bennett SE, Gunn AJ, et al. Creating a patient-centered radiology practice through the establishment of a diagnostic radiology consultation clinic. *AJR Am J Roentgenol* 2015;205:95-9.

9. Domina J, Zeeshann B, Brown R. Journal club: patient perception of radiology and radiologists: a survey analysis of academic and community institutions. *AJR Am J Roentgenol* 2016;207: 811-9.
10. American College of Radiology. Imaging 3.0. Available at: <https://www.acr.org/Advocacy/Economics-Health-Policy/Imaging-3>. Accessed August 17, 2017.
11. Basu PA, Ruiz-Wibbelsmann JA, Spielman SB, et al. Creating a patient-centered imaging service: determining what patients want. *AJR Am J Roentgenol* 2011;196:605-10.
12. Cabarrus M, Naeger D, Rybkin A, et al. Patients prefer results from the ordering provider and access to their radiology reports. *J Am Coll Radiol* 2015;2:556-62.
13. Johnson AJ, Easterling D, Nelson R, et al. Access to radiologic reports via a patient portal: clinical simulations to investigate patient preferences. *J Am Coll Radiol* 2012;9:256-63.
14. Mangano MD, Rahman A, Choy G, et al. Radiologist role in the communication of imaging examination results to patients: perceptions and preferences of patients. *AJR Am J Roentgenol* 2014;203: 1034-9.