

Critical Test Result Notification via Mobile Phone-Based Automated Text Message System in the Radiologic Field: Single Institutional Experience

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Abstract

Purpose: To investigate the feasibility of sharing critical test result (CTR) notifications (CTRNs) via automated text messaging.

Materials and methods: CTRNs via automated text messaging was used to notify physicians of CTRs in a tertiary hospital with 1,786 beds. From June 2016 to September 2016, notifications for 545 CTRs were given via a CTRN system. Among them, 490 CTRs (292 male and 198 female patients; mean age, 53.6 years old [range, 1-88]) were included in analysis. CTR levels (CTRLs) were assigned to four categories (CTRL1 to CTRL3 and unclassified) when reported, and reclassified into three CTRLs according to their clinical relevance and urgency. Response time was defined as time lapse between CTR reporting and documentation by physicians. Analysis of variance was performed to compare response times according to CTRLs and patients' location.

Results: Corresponding actions were taken in 404 of 490 cases (82.4%) without any delayed CTRN-related morbidity. There were 15 CTRL1 (3.1%), 50 CTRL2 (10.2%), 112 CTRL3 (22.9%) cases, and the remaining 313 CTRL cases were unclassified. After reclassification, CTRL1, CTRL2, and CTRL3 were 81 (16.5%), 177 (36.1%), and 232 cases (47.3%), respectively. Response time of reclassified CTRL3 was significantly longer than that of reclassified CTRL1 (median 23.0, [interquartile range 2.0-133.5] hours versus 4.0 [0.0-22.0] hours; $P < .001$). Response time of outpatient cases (80.0 [6.0 to 157.0] hours) was significantly longer ($P < .001$) than those of inpatient (3.0 [0.0-16.0]) and emergency department cases (5.0 [1.0-21.0]).

Conclusion: Automated text messaging could be a feasible option for CTRNs in the radiologic field. Further large-scale investigations regarding efficiency of this system are warranted.

Key Words: Critical test result, notification, text message, radiology

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INTRODUCTION

Radiologic imaging tests such as ultrasonography, CT, and MRI are widely and increasingly utilized and have become one of the most important diagnostic and surveillance tools in clinical practice [1]. Radiologic reports as the results of the interpretations of radiologic tests and communication methods with primary care physicians or patients should contain precise and clear content and thus facilitate proper and timely patient management [2].

The use of structured radiology reporting templates and constrained lexica is part of these efforts [3-11], which can enhance the completeness of reports and

have the potential to reduce communication errors as well as reading errors. In addition, there have been cases requiring urgent and prompt reporting, including life-threatening conditions such as ischemic bowel disease, acute aortic syndrome, massive hemorrhage, and so on [12,13]. To initiate critical management and improve the management results in these cases, timely and prompt communication between the radiologists and primary care physicians is as important as the accurate and meticulous interpretation of imaging tests [12,14].

In this context, radiologists should be familiar with these critical situations and pay attention to how to communicate with primary care physicians about such critical test results (CTRs) [12,14]. Several studies [12,14] have pointed to the classification of these CTRs according to their clinical urgency and the corresponding mode of communication as key components for a successful CTR system. Several hospitals have actually adopted a type of CTR system, specifying the clinical situations requiring direct communication, including verbal and telephone communication [14-18].

However, there is no detailed investigation into whether CTR systems work well in clinical practices, particularly in the cases of indirect communication in the radiologic field. Thus, in this retrospective study, we aim to investigate the feasibility of the CTR notification (CTRN) system, particularly via automated text messaging, in our institution.

MATERIALS AND METHODS

Our institutional review board has approved this retrospective study with a waiver of patients' informed consent.

CTRN System

In our institution, a tertiary hospital with 1,786 beds, a CTRN system has been in operation since October 2011 to notify primary care physicians (including the attending physicians and the residents who are primarily in charge of the patients) of critical or unexpected radiologic abnormalities. According to our CTRN system, radiologists added the phrase "CRS [critical result reporting system] transmission" to radiologic reports to notify physicians of critical findings, and the information from inputted reports was transmitted to the hospital information system. In this process, mobile phone-based text messages that contained patient identification number, name, and date of radiologic tests were automatically transmitted to

primary care physicians if radiologic reports contained the phrase of "CRS transmission." The institutional quality assurance committee instructed clinicians to document the appropriate actions according to the CTRNs in our electronic medical records (EMRs), and monitored and checked the input rate of the corresponding actions for each CTRN.

CTR Levels

CTRs were classified into three CTR levels (CTRLs) according to their urgency and clinical relevance [12-14]: (1) CTRL1 covered radiologic findings that were potentially immediately life-threatening (eg, tension pneumothorax, intracerebral hemorrhage); (2) CTRL2 included unexpected findings that could lead to a substantial morbidity or mortality if not treated urgently enough (eg, intra-abdominal abscess, impending fractures); (3) CTRL3 meant abnormal findings that could lead to substantial morbidity or mortality, but immediate treatment might not be required (eg, suspicious pulmonary or intrahepatic malignancy). However, specific disease entities corresponding to each CTRL were not actually specified in our institute, and the CTRL assignment was at the discretion of reading radiologists. In addition, any discrepant result that was initially reported by an on-duty radiology resident during night duty and substantially revised in the final radiologic report by attending radiology staff was also noted to the primary care physicians.

Data Collection

From June 2016 to September 2016, a total of 481,904 radiologic examinations were performed in our institution. Among them, a CTRN was initially done in 545 cases (0.1%) (320 male and 225 female patients; mean age, 59.3 years old [range, 1-93]), and their detailed data, including CTRL, modality of radiologic tests, body parts, and patient settings (ie, emergency department, outpatient department [OPD], and inpatient department) were investigated. In addition, EMRs were reviewed to ensure whether primary care physicians recognized each CTRN and took the corresponding action. In our study, actions for CTRNs included referral to other clinicians to respond to the CTRN, performing additional diagnostic workups, and treatment for the problem reported within 1 month. If the patients were transferred to other hospitals with only preliminary report results and the final reports were substantially changed, the EMR was checked to see whether the primary care physicians had notified

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