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Redefining the sonography workflow through the application of a departmental computerized workflow management system

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ABSTRACT

Purpose: The purpose of this study is to demonstrate and evaluate the effective application of a computerized workflow management system (WMS) into sonography workflow in order to reduce patient exam waiting time, number of waiting patients, sonographer stress level, and to improve patient satisfaction.

Methods: A computerized WMS was built with seamless integration of an automated patient sorting algorithm, a real-time monitoring system, exam schedules fine-tuning, a tele-imaging support system, and a digital signage broadcasting system of patient education programs. The computerized WMS was designed to facilitate problem-solving through continuous customization and flexible adjustment capability. Its effects on operations, staff stress, and patient satisfaction were studied.

Results: After implementation of the computerized WMS, there is a significant decrease in patient exam waiting time and sonographer stress level, significant increase in patient satisfaction regarding exam waiting time and the number of examined patients, and marked decrease in the number of waiting patients at different time points in a day.

Conclusion: Through multidisciplinary teamwork, the computerized WMS provides a simple and effective approach that can overcome jammed exams associated problems, increase patient satisfaction level, and decrease staff workload stress under limited resources, eventually creating a win-win situation for both the patients and radiology personnel.

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1. Introduction

1.1. Background

Radiology, which plays a more important role in today's ever-changing medical era, has experienced the explosive growth

in volume and variety of available services during the past 2 decades [1,2]. In order to solve the challenging issues of shrinking budgets, increasing cost pressure, manpower shortage, and growing demands to increase both the efficiency and quality of services under resource-limited health facilities [3–5], a simple and effective method is needed [6]. Workflow

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Table 1 – Service volume and number of sonographers from 2007 to 2009.

Year	Sonography service volume (exams performed)	Number of sonographers
2007	45,732	5
2008	49,100	5
2009	50,133	5

re-engineering, that can lead to process streamlining and simplification, is inevitably a solution [7].

A radiology department is responsible for routine examinations that are frequently performed with high volume, and approximately 80% of these exams are highly structured, which are suitable targets to apply workflow management principles [8]. To keep a radiology department running smoothly and efficiently, a department must keep information flowing between working nodes and use information technology as a tool to implement checks, defaults, and automation to harvest potential benefit of simplification and standardization [6,9]. Therefore, introducing IT into the radiology departmental workflow management becomes the appropriate solution since it can target toward workflow deficiencies and enhance departmental operation in different aspects to improve quality and reduce errors [10]. IT integrated workflow management approach allows for dynamic adaptation to react quickly to the ever-changing needs in today's radiology ecosystem. Exam process automation improves the efficiency and effectiveness of radiology services with reduced costs and faster response times from staff, especially faster report delivery to affect medical judgments in time. Such real-time radiology can benefit the patients by avoiding unnecessary waiting time from the hindrance between intramural or interdisciplinary communication. With free and accurate exchange of information available through IT means, various data and parameters can also be collected to evaluate departmental performance and identify potential defective design for further improvement [6,8,10–12].

1.2. Local problem

Our radiology department provides more than 45,000 sonography exams per year, and the sonography service volume had been increasing without the corresponding increase in the number of sonographer over the past few years (Table 1). In addition, sonography had the lowest patient satisfaction due to lengthy exam waiting time according to the annual anonymous questionnaire surveys conducted in our radiology department over the last 3 years. In order to improve the quality of service, previous workflow (Fig. 1) was scrutinized, and the following three workflow defects were identified:

1. The previous manual workflow (Fig. 1), including the sequence of initial service registration at the front desk, time scheduling, and exam room assignment, was tedious and time-consuming [13]. It was solely dependent on the experience of individual staff member, causing the process to be unreliable and prone to human errors. For instance, breast sonography may be assigned erroneously to male

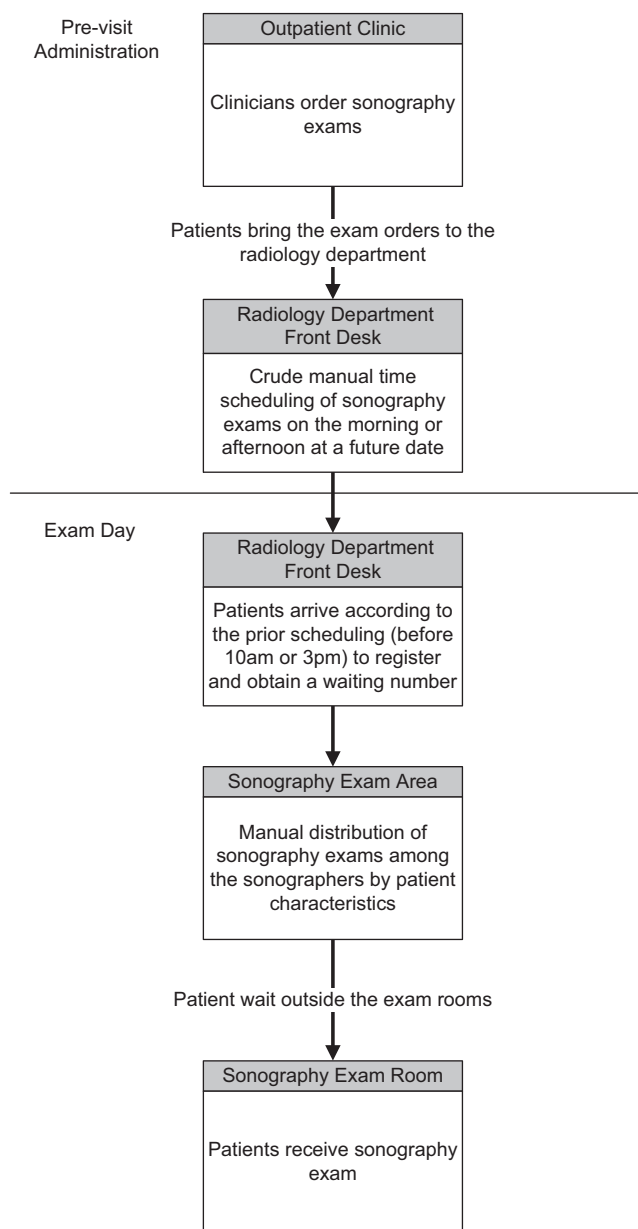


Fig. 1 – Manual workflow before the computerized workflow management system.

sonographers, or critical patients could not receive prompt exams as needed.

2. Much more patients were waiting than needed due to a crude manual exam scheduling, i.e., asking all patients to report to the front desk at two fixed time points in a day (10am and 3pm) and wait until the exam. The patients had to wait longer, and the sonographers were stressed out from the numerous patients waiting outside the exam rooms or interrupting the ongoing exams. Quarrels and disputes between our staff and patients often ensued.
3. There was no means to monitor the execution status of each exam room so that immediate problem detection was not possible.

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