

Stakeholders' Perceptions Regarding the Use of Patient Photographs Integrated with Medical Imaging Studies

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Abstract Integrating digital facial photographs of pediatric patients as identifiers (ID) with medical imaging (integrated photographic IDs) may increase the detection of mislabeled studies. The purpose of this study was to determine how different stakeholders would receive this novel technology. Parents or guardians of patients in a children's hospital outpatient radiology department, radiology faculty and residents, and radiology technologists and nurses were asked to complete a survey. The perception about the anticipated use of integrated photographic ID in different clinical scenarios was investigated, and its predictors were determined using logistic regression analysis. Four hundred ninety-eight parents responded (response rate 83 %); 96 and 97 % supported the use of integrated photographic ID, if it improves the radiologist's imaging interpretation or decreases the rate of mislabeled errors, respectively. Thirty-eight percent were worried that photographic IDs would impact patients' privacy. Ninety-four percent believed that they should be asked for their consent prior to obtaining their child's photograph. Seventy-eight radiologists responded (response rate 39 %); 63 and 59 % believed that the use of integrated photographic ID would result in improvement in accurate interpretation of images and identification of mislabeled patient errors,

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Srini Tridandapani stridan@emory.edu respectively. Forty-nine percent of radiologists had concern that integrated photographic ID would increase interpretation time. Fifty technologists and nurses responded (response rate 59 %); 71 and 73 % supported the technology if it resulted in more acute interpretation of images and identification of mislabeled patients, respectively. A majority of stakeholders support integrated photographic ID in order to improve safety. A majority of parents believe that consent should be obtained.

Keywords Integrated photographic identifiers · Imaging · Wrong-patient error · Quality and safety · Radiology

Introduction

An estimated 98,000–400,000 Americans die in hospitals each year due to medical errors [1, 2]. More specifically in radiology, in just 1 year (2009), the Pennsylvania Patient Safety Authority reported 196 misidentification events that resulted in serious patient harm [3]. Many safety experts believe that these events are underestimated and underreported [4].

The Joint Commission in its National Patient Safety Goals (NPSG) provides a specific requirement that at least two patient identifiers be used when providing care, treatment, and service to avoid wrong patient errors [5]. An individual's name, date of birth, assigned identification number, telephone number, or other person-specific numbers are considered acceptable patient identifiers [5]. Integrating patients' digital facial photographs as identifiers (ID) with medical imaging (integrated photographic ID) [6] (Fig. 1) has been shown to increase the detection of mislabeled studies in adults [7, 8]. Such photographs will not replace numerical identifiers, but rather supplement and strengthen identification. In some instances, such as unconscious and unidentified trauma patients, these photographs may be the only available identifiers.

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Fig. 1 Example showing a wrong-patient error: **a** current study shows an 81-year-old white man. **b** The comparison radiograph belongs to an 89-year-old white man. The differences in the radiographic features are subtle and may be missed during interpretation. However, the differences in facial features are much more obvious despite the masking to protect patient privacy. Please note that the masking was

only for the purposes of the manuscript. In the clinical workflow, interpreting clinicians and radiologists would be able to see all the facial features to help with the identification and diagnosis. Permission was obtained from the American Journal of Roentgenology for republishing of this image

We have previously described a system that can automatically obtain patient digital photographs simultaneously with portable chest radiographs [6]. These patient facial photographs are automatically converted into Digital Image and Communication in Medicine (DICOM) format, integrated with the medical imaging studies, and stored as a single integrated folder in the Picture Archiving and Communications System (PACS). During interpretation, the photographs and the medical images are displayed together on the PACS display workstations.

Although photographs are routinely used in several ambulatory electronic medical records (EMR), there is no widespread use of such integrated photographic IDs with imaging modalities such as radiography, CT, ultrasound, or MRI. Further, the use of integrated photographic IDs raises concerns about patient privacy, and there is no available study to show whether this technology will be accepted by the caregivers and the public. The perception various stakeholders have regarding this new technology will impact the degree of their acceptance.

The purpose of this study was to determine how different stakeholders including the pediatric patients' parents and guardians, radiologists, radiology technologists, and nurses would receive this technology.

Methods

Study Population

Parents and Legal Guardians

Over a 2-month period in January and February 2014, 600 consecutive parents or guardians of patients in the ambulatory waiting room of the radiology department of a children's

hospital were asked by one of the radiology department staff to complete a paper survey at the check-in desk. Only one parent or guardian per patient was asked to complete the survey. For the purpose of this study, an a priori sample size of approximately 500 responses was established. An institutional review board waiver was obtained, and the study was HIPPA compliant.

Radiologists

Over a 2-week period in August 2014, 199 diagnostic radiology, interventional radiology, and nuclear medicine faculty, as well diagnostic radiology residents of an academic institution consisting of five adult and one children's hospitals were sent an email and asked to complete an online survey.

Radiology Technologists and Nurses

Over a 2-month period in January and February 2014, all 84 technologists and nurses working in the radiology department of a children's hospital were asked to complete a paper survey.

Survey

The 13-question survey consisted of three sections: [1] anticipated perception about the value of technology in improving patient safety and patient care if the technology improves the imaging interpretation or decreases mislabeled error rates; [2] anticipated worries about the negative aspects of this new technology, such as affecting patient privacy; [3] and demographic characteristics. A pilot study of parents' and legal guardians' surveys was performed among the first ten parents.

Data Analyses

Survey responses were analyzed using STATA 10 (Stata Corp., College Station, TX). Study outcomes were different stakeholders' anticipated perception and concerns about the use of patients' photographs with medical imaging and its predictors.

Levels of agreement or support for a given statement in the survey were scored on a 1 to 5 scale, with 1 being the lowest level of agreement and 5 the highest. These variables were further categorized into a dichotomous variable where positive responses of "strongly agree/significantly more" and "agree/ slightly more" were collapsed into an "agree/supportive" category. Neutral and negative survey responses of "no preference/no difference," "disagree/slightly less," and "strongly disagree/significantly less" were collapsed into a "disagree/not supportive" category.

Categorical variables were reported as frequency and percentage, and quantitative variables were reported as mean and standard deviation (SD). Chi-squared test and, where needed, Fisher's exact test were used for categorical variables (comparison of outcomes for nurses vs. technologists). Correlation between the degree of parents' support of technology (1 to 5 scale) and their concern about its impact on their child's privacy was assessed using Spearman rank correlation test. Predictors for stakeholders' anticipated perceptions or concerns about technology were determined using multiple regression analysis, adjusting for independent variables and were reported as coefficient and 95 % confidence intervals. For parents and guardians, analyses were performed after adjustments for parent's and child's age, ethnicity, income, education, and gender. For radiologists' and technologists/nurses' survey, predictors were identified after adjusting for respondents' age, gender, years in practice, and status (e.g., faculty vs. in-training for radiologists; nurse vs. technologist). Statistical significance was set at p < 0.05.

Results

Parents and Legal Guardians

Of 600 parents, 498 (83 %) responded to the survey. Eightysix percent were female with a mean age of 37 years, range of 17 to 68 years. Seventy-seven percent had more than a high school diploma. Fifty-one percent had >\$50,000 annual household income. The mean age of a respondents' child was 7 years with a range of newborn to 25 (there were four patients with age over 18 years).

The majority of parents supported the use of integrated photographic ID if it improves the radiologist's imaging interpretation (96 %) or decreases the rate of mislabeled errors (97 %). A minority of respondents (38 %) were worried that

obtaining their child's photo would impact his/her privacy. There was a negative correlation between parents' degree of concern about the impact on their child's privacy and their support for the use of integrated photographic ID (Spearman rho=-0.33; P<0.001). Ninety-four percent of parents believed that they should be asked for their consent prior to obtaining their child's photo (Table 1). The majority of parents responded that they would support the new technology regardless of whether their child was slightly sick, i.e., their child was being treated as an outpatient (90 %), brought into the emergency department after trauma (91 %), or hospitalized in an intensive care unit (92 %).

After adjusting for independent covariates, Caucasian parents were less worried about the impact of the new technology on their child's privacy compared to other ethnicities (coefficient, 0.39; 95 % CI, 0.67 to 0.11; P=0.006). No other significant difference was seen for each of the reported outcomes in Table 1, after adjusting for independent covariates, including for parent's and child's age, ethnicity, income, education, and gender.

Radiologists

Seventy-eight out of 199 (39 %) radiology faculty and residents responded to the survey. Sixty-eight percent were male with mean age of 40 years, ranging from 26 to 72 years. Forty-three percent were diagnostic radiology residents. Mean years in practice for faculty was 11 years.

Sixty-three percent of respondents believed that the use of integrated photographic ID would result in significant or slight improvement in accurate interpretation of images; 41 % believed it would improve accurate interpretation of lines and tubes, and 52 % believed it would improve evaluation of patients' health status. Fifty-nine percent of radiologists believed integrated photographic IDs would improve identification of mislabeled patient errors. Half of the respondents (49 %) felt that integrated photographic IDs would increase the interpretation time of images. One third of radiologists (33 %) thought that use of integrated photographic IDs would be distracting (Table 1).

After adjusting for independent covariates, as radiologists get older, they were more likely to believe that the use of integrated photographic IDs will improve interpretation of lines and tubes (coefficient, 0.04; 95 % CI, 0.002 to 0.08; P=0.04). No other significant difference was seen for each of the reported outcomes in Table 1, after adjusting for independent covariates including age, gender, years in practice, and career status (e.g. faculty vs. in-training).

Radiology Technologists and Nurses

Fifty of 84 (59 %) radiology technologists and nurses responded to the survey. Eighty-six percent were female with

 Table 1
 Social acceptance of integrating patients' photographs with imaging studies among stakeholders

	Overall agreement
Parents and legal guardians	
I support if it helps the doctors better interpret the imaging.	476/493 (96 %)
I support if it decreases mislabeled errors.	477/490 (97 %)
I am worried that a photographic ID of my child will hurt my child's privacy.	185/486 (38 %)
I should be asked for my consent for obtaining my child's photograph with the imaging.	455/485 (94 %)
Radiologists	
Photographic IDs would result in more accurate interpretation of images.	49/78 (63 %)
Photographic IDs would result in more accurate interpretation of lines and tubes.	30/74 (41 %)
Photographic IDs would result in more accurate identification of mislabeled patients.	46/78 (52 %)
Photographic IDs would result in spending more time for image interpretation.	38/77 (49 %)
With photographic IDs I would feel more distracted.	23/71 (33 %)
Radiology technologists and nurses	
I would support if photographic IDs would result in more accurate interpretation of images.	35/49 (71 %)
I would support if photographic IDs would result in faster interpretation of images.	28/47 (59 %)
I would support if photographic IDs would result in more accurate identification of mislabeled patients.	36/49 (73 %)
I am worried that a photographic ID would hurt patients' privacy.	16/49 (33 %)
Patients' consent is needed for obtaining their photographs with the imaging.	40/49 (82 %)
Technologists	
I think it will take more time to take an X-ray if I use the new photography technology.	15/37 (41 %)
I anticipate trouble (technical/software issues) using the new photography technology.	21/37 (57 %)

mean age of 40 years, ranging from 27 to 60 years. Seventysix percent were radiology technologists and the remaining were nurses. Mean years in practice was 14 years.

Seventy-one percent of respondents supported the use of integrated photographic ID if it would result in more accurate interpretation of images and therefore improve patient care (73 % technologists, 58 % nurses); 59 % supported the technology if it would result in faster interpretation of images (68 % technologists, 30 % nurses); and 73 % supported the technology if it would lead to more accurate identification of mislabeled patients, respectively (79 % technologists, 50 % nurses). A minority of respondents (33 %) were worried that obtaining patient's photo would impact his/her privacy (38 % technologists vs. 25 % nurses). Eighty-two percent believed that patient consent is needed prior to obtaining their photo (88 % technologists, 75 % nurses) (Table 1). No significant difference was seen between nurses and technologists in any of the questioned outcomes.

After adjusting for independent covariates, those with longer years in practice were less worried that the new technology would impact patients' privacy (coefficient, -0.02; 95 % CI, -0.05 to -0.0009; P=0.04). Furthermore, technologists were more likely to believe that consent is needed prior to obtaining patients' photographs as opposed to nurses (coefficient, 0.33; 95 % CI, 0.04 to 0.62; P=0.03). No other significant difference was seen for each of the reported outcomes in Table 1, after adjusting for independent covariates including age, gender, years in practice, and career status (e.g., technologists vs. nurses).

Subgroup analyses of technologists further showed that 41 % of technologists anticipated spending more time to take a radiograph, and 57 % anticipated encountering technical or software issues if they use the new technology. Younger technologists were more likely to anticipate that using the new technology will increase the time of obtaining the radiograph after adjusting for independent variables (coefficient, 0.03; 95 % CI, 0.06 to 0.005; P=0.02).

Discussion

The results of the current survey from 498 parents or legal guardians of pediatric patients demonstrated that the vast majority of parents (96 %) support integrating their child's photograph with imaging studies in order to improve safety, and 94 % believed that consent should be obtained. Only 38 % of parents were worried that obtaining their child's photo would impact his/her privacy. More than half of the 78 radiology faculty and residents who responded to the survey believed that use of photographic IDs would improve accurate interpretation of images and reduce mislabeled patient errors. Furthermore, more than half of 50 radiology technologists

and nurses were supportive of such technologies if it improves interpretation and decreases wrong patient errors.

Despite the use of the Joint Commission's mandated dualidentifier technique, wrong-patient events continue to occur. Prior studies of misidentification events in single institutions' departments of radiology report 6.5–16.8 events per 100,000 exams performed [9, 10]. A recent review at our adult hospitals demonstrated a lower bound on the occurrence rate of near-miss misidentification errors to be 2 for every 100,000 imaging studies [4]. A 22-h median time interval from the time of occurrence of the event to the time of identification of the error was observed. It is generally believed that events, and particularly near-miss events that cause no patient harm, are underreported with only about 10 % being reported [11].

Increased workload, feeling confident that one knows the patient, feeling secure with one's own competence, not feeling the need to engage in checking or verifying the correct identification of the patient, and communication barriers were among the most common reported reasons by healthcare staff for failure to check the two patient identifiers [12, 13]. Moreover, many staff members would like to deliver personalized care to the patients and establish a relationship with the patient. For this group, the requirement of precise and repetitive patient identification verification is perceived as a less personal approach [12]. Finally, the Joint Commission's identifiers can be difficult to verify in the clinical setting, particularly in unconscious, uncooperative, or non-communicative patients. In part, the difficulty arises because these identifiers are not intrinsically related to the individual: for instance, an individual can change his or her name or telephone number. However, many physical features are intrinsically related to individuals. Specific examples include facial features, scars, tattoos, fingerprints, and retinal signatures. Thus, these intrinsic features would seem to be more reliable and perhaps faster and easier to identify for purposes of patient identification.

Prior studies have assessed use of facial photographs as patient identifiers to decrease wrong-patient errors. Including patients' photos in EMR in an order verification screen prior to final signing of orders is an effective strategy for reducing the risk that medication orders will be placed in an unintended patient's EMR [14]. In radiology, observer studies demonstrated that facial photographs obtained at the time of portable chest radiographs increase detection rate of wrong-patient errors [7, 8]. Other small studies (sample size of less than 50) assessing the impact of having patients' photographs available at the time of radiologists' interpretation of imaging showed no significant difference in the presence and number of clinically significant findings, when compared to studies without attached patient's photographs [15]. However, the impact on reporting of incidental findings and recommendations were controversial with another study showing longer reports including more incidental findings and more recommendations after addition of patients' photographs to imaging [16].

However, both of these studies reported increased "personalization" of the reporting process and feeling of empathy and responsibility in radiologists [15, 16].

When assessing the social acceptance among radiologists for adding patients' digital photographs to imaging, our study showed more than 50 % approval. This positive view of such technologies differs from the view expressed in a 2010 study, which reported 67 % of surveyed radiologists believed that facial pictures "should not" be included with imaging [17]. Our study also reported approval among radiology technologists and nurses (more than 50 %) and patients (more than 90 %) if the technology decreases wrong-patient errors or improves interpretation of the images.

Concerns have been raised that addition of photographic IDs may impact radiologists' workflow and diminish report productivity by nearly half the radiologist respondents in our study. However, prior observer studies on integrating photographic IDs with imaging had demonstrated minimal potential impact on interpretation times [7, 8, 16]. Additionally, 33 % of radiologists in the current study believed that photographic IDs might be distracting. A prior study of ten radiologists assessing chest radiographs with photographic IDs demonstrated that only two of the radiologists found the photographic IDs distracting [7]. Finally, 41 and 57 % of technologists anticipated spending more time in obtaining the radiographs or encountering technical or software issues with the new technology, respectively. This process has been shown in a prior pilot study to be automated for portable radiographs so that there is no extra work for the technologist at the time of the chest portable studies [18]. Thus any new technology that incorporates photographs with medical imaging is more likely to be accepted if it does not slow down technologists or adversely impact workflow.

Thirty-eight percent of parents in the current study had concerns about the impact of the new technology on patients' privacy, and 94 % of them believed consent is needed prior to obtaining patients' photograph. In comparison to pathology or radiology images, patient photographs are more likely to be considered by parents and guardians as identifiable and private, evoking fear regarding their unnecessary dissemination [19]. This study did not provide an example of the limitations of the photograph to the face to be displayed nor did the study provide any information about the current state of information technology security in the healthcare setting. It is interesting to note that many hospital, surgical, and outpatient consent forms for treatment, including those at our children's hospital and our adult affiliated institutions, include a statement regarding the potential need for patient photography clinically. However, many patients and guardians may not pay sufficient attention to this statement buried in the long written consent forms when they sign them. Further, it is not clear whether this statement within the general consent form for treatment, which discusses patient photography for clinical purposes, is sufficient for the

purpose of integrated photographic ID. Striking a balance between protecting patient privacy and the potential medical benefits that can be derived from the use of such photography technologies is a challenge, as discussed by the dermatology community [20]. Efforts should be made to ethically archive medical images and to secure the photographic data just like the individually identifiable health information under the Health Insurance Portability and Accountability Act of 1996. The data should be available only to medical personnel who are charged with the care of the patient.

As with any survey, ours should be interpreted in the context of its methodological limitations. The survey of parents and legal guardians was limited to outpatients who were stable enough to be brought to the radiology department. This survey of parents does not provide any information about what adult patients' perceptions would be regarding such a technology. We started surveys with families of pediatric patients because we felt that most people would be more concerned about privacy issues related to their children than they would be about themselves; however, this needs to be studied further. Additionally, we acknowledge that survey results from radiologists and radiology technologists and nurses could be subjected to sample bias created by respondents with strong opinions regarding the survey topic. In addition, the survey did not include images of the technology or photo examples to help stakeholders understand what has been used in prior pilot studies at this institution.

In summary, the majority (96 %) of parents support use of their child's photograph in order to improve safety. Over half the radiologists believed that use of photographic IDs will improve accuracy in interpretation of images and identification of wrong-patient errors. Further, more than half of technologists and nurses were supportive of such technology. However, some radiologists were concerned that photographic IDs may be distracting at the time of interpretation and may increase interpretation time and examination time. Future studies evaluating the level of radiologists' distraction in a clinical setting using this new technology are necessary. Further studies are also required to assess whether the general consent forms for treatment are sufficient to be used for integrated photographic ID.

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