

Title of manuscript:

“Make No Mistake:
Reducing Errors in Hospital Pathology Samples and Information Flow”

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Abstract:

Inaccuracies and errors in hospital pathology work can occur due to missing information or improperly prepared specimen samples. We report on the use of operations management tools and principles to reduce a hospital's pathology error rates. Using a team approach to process improvement, we developed a process map and collected baseline data to quantify the extent of pathology problems. We illustrate the steps taken to improve the process. Although the overall error rate reduction was not sparkling, the team did manage to nearly eradicate a crucial information inaccuracy in pathology requests. We provide some lessons learned that are guiding our ongoing activities in improving hospital processes.

1.0 Introduction

Hospital errors and adverse events can contribute to a wide range of unintended consequences, ranging from unnecessary patient delays through to prolonged hospital stays and death (Baker et al., 2004). Reflecting the need to improve patient safety, the Institute for Healthcare Improvement recently launched a pair of initiatives designed to avoid 100,000 hospital deaths (Institute for Healthcare Improvement, 2004) and to protect 5 million patients from medical harm (Institute for Healthcare Improvement, 2006).

In an effort to reduce errors, researchers have studied a variety of healthcare areas, including pathology. Pathology involves the science of studying and diagnosing disease via a thorough assessment of tissues or organs. Making errors in the examination of a patient's tissues or organs could lead to incorrect diagnoses, additional tests, unnecessary patient anxiety and treatment delays. Nakhelh (2008) addressed the multiple factors that contribute to surgical pathology errors and described the specific segments of a pathology test cycle in which errors are bound to occur. Meier et al. (2005) documented that defective reports are the most likely source of pathology errors.

Several incidents – some rather sensational – highlight the critical nature of pathology errors. In particular, a University of Chicago hospital was sued for an error that resulted in the unnecessary removal of a breast (Fisher, 2005). Recently, a rash of episodes within the Canadian healthcare system has illustrated the prevalence of pathology errors. An external review of an Ontario pathologist's work revealed a 6% error rate (Nguyen, 2008). These errors led to missed cancers and an inaccurate reporting of cancer stages. Moreover, the specific hospital was required to contact at least 600 patients about these inaccuracies. In New Brunswick, authorities documented the case of a pathologist in which 18% of tests were incomplete and 3% of them were inaccurate (Weeks, 2008). Mistakes made by a senior Manitoba pathologist led to 17 cancer patients receiving the wrong prognosis or treatment (Skerritt, 2008). An audit of a Prince Edward Island pathologist showed an error rate approaching 19%. In this particular case, healthcare officials noted that these errors could significantly add to the workload of a department that was seemingly already swamped (CBC News, 2008).

It was against this backdrop that we launched our study of pathology errors at a hospital in the Province of Saskatchewan. Hospital officials wanted to determine the prevalence of problems in pathology samples sent from the operating room (OR) to the main laboratory, and to apply the science of operations management in analyzing the data and investigating possible process improvement opportunities. Although the hospital had anecdotal evidence of pathology errors, no one had ever conducted a rigorous analysis of the pathology processes including a calculation of actual error rates. It was the sense of hospital management that a lack of standards and poor communication channels between the OR and pathology could eventually lead to a misdiagnosis for the patient, delays in

obtaining pathology reports, staff dissatisfaction, and unnecessary rework and extra steps. However, no one had ever tested this claim. This became the focus of our project.

Our paper proceeds as follows. In Section 2, we discuss the operations management methods that we followed to analyze the overall pathology process and to understand sources of pathology errors. We elaborate on our attempts to improve the process in Section 3. In the final section, we offer some concluding remarks as well as some lessons learned.

2.0 Methods

We used a team approach in order to understand, analyze and improve this critical healthcare process. The specific team members included a surgeon, pathologist, laboratory services director, OR nurse and laboratory specialist. Besides bringing together folks with a breadth of clinical knowledge, we were confident that this would facilitate the “buy-in” required to endorse our process analysis work with other healthcare staff. The team eventually determined an aim to ensure that all information forwarded from the OR to the laboratory was 100% complete and accurate.

To allow us to better visualize the process, our team created a process map (see Figure 1). Such a map – a common operations management tool used within process improvement work – permitted us to see the sequence and myriad assortment of activities from booking a patient in the OR through to the preparation and evaluation of a pathology sample. We completed the process map in an iterative fashion as team members would use “post-it” notes to label the different activities and place them in their corresponding location on the map. We found this approach to be especially productive

as team members could quickly re-arrange activity sequences; in fact, it was particularly illuminating for team members to see the activities that occurred on the “other side of the wall”. To an academic audience, the creation of a process map may seem like a trivial exercise. However, we strongly believe that one cannot underestimate the value of this type of tool in articulating the interrelated nature of any real-world process, especially those in the healthcare area.

===== insert Figure 1 about here =====

After generating the map, our team determined that there were at least 5 process points where pathology errors could potentially occur. These points are identified by the diamond-shaped boxes on the right-hand side of the process map. Errors could include mistakes such as information discrepancies or improperly prepared pathology samples.

In chronological sequence, these process points are:

1. “First matching”. This represents the initial point at which the pathology specimen enters the laboratory area. A technician would determine if the specimen matches the OR requisition and also make an initial check for inaccurate or missing information.
2. “Laboratory Information System (LIS) matching”. At this particular juncture in the process, the information on the specimen requisition is matched to corresponding information in the LIS database.
3. “Proper preparation”. A laboratory specialist would ensure that staff members have properly prepared the sample.
4. “Errors in specimen”. Here, the pathologist may identify problems in the specimen as he/she begins to assess it.

5. “All information available”. This comprises a final check to determine if all the required information is complete and accurate.

We next developed a method to determine the number of errors at each point. Our team created “tick sheets” to be used at each of the 5 process points. When a pathology sample would pass by a particular juncture in the process, a hospital staff member (laboratory technician, specialist or pathologist) would indicate if the specimen and any accompanying information were complete and accurate. If some information or specimen errors occurred, the staff member would note the exact type of inaccuracy.

Tick sheets were manually completed by hospital staff during a one-week data collection period. In this particular one-week stretch, the hospital processed 99 pathology samples. Team members felt confident that such a volume during the one-week period offered them sufficient ability to collect reliable data about pathology error rates.

In total, the team identified 37 information and specimen errors in the 99 samples. We wish to point out that the apparent $37/99 = 37.4\%$ error rate may seem abnormally high given the 3-19% error rates documented in the reports discussed in this paper’s first section. However, one needs to remember that our study captures both specimen and information flow inaccuracies, while the accounts cited in the literature most likely involved specimen errors alone.

Our data collection revealed a definite “Pareto” relationship as 20% of the “categories” accounted for over 80% of the process errors. As illustrated in Figure 2, the “first matching” process step comprised 31 errors. “All information available” had 4 errors while “proper preparation” had 2. The remaining process points were error-free.

This led us to the conclusion that any improvement efforts ought to be targeted at the “first matching” point in the process.

===== insert Figure 2 about here =====

Recall that when staff members used the tick sheets, they also indicated the type of inaccuracy on the data collection form. This information proved invaluable, for it helped us to “drill down” to the specific source of error in the first matching part of the process. We identified that – within the 31 errors in the first matching area – there were three particularly prominent items that were frequently missing or inaccurate. These included the name of the specific procedure (11 errors), the doctor’s name who had originally requested the procedure (10 occurrences) and the date of the procedure (9 instances). The one remaining occurrence involved a pathology sample that lacked an appropriate set of accompanying medical history notes. In Figure 3, we illustrate the contribution of each error category within the first matching area, and note that nearly 97% of the inaccuracies resulted from the three most common categories.

===== insert Figure 3 about here =====

The process mapping work and error rate data collection clearly outlined that one needed to explore ways of reducing or eliminating instances in which any of those three first matching categories were missing. We remark that this corresponds with the notion of Meier et al. (2005), in which the authors concluded that defective reports are a very prevalent source of pathology errors.

3.0 Results

In order to reduce error rates, we needed to improve the manner in which the name and date of the procedure, as well as the doctor's name, were captured. Our team realized that this information was currently tracked on the Surgical Pathology Consultation Request form, a document that had been used for over a decade (a copy is included as Figure 4).

===== insert Figure 4 about here =====

We noted several details in the current form which may have contributed to its apparent inability to effectively capture all relevant pieces of information. For example, no parts of the form really “stood out”. There was no attempt to introduce shading, bolding or boxes to highlight particularly key areas. In addition, there was some unnecessary duplication between information from the patient's hospitalization card (imprinted in the blank upper right corner of the form) and the details requested in the upper left-hand side of the form. Finally, staff members felt that this form – although it may have been appropriate when initially developed – failed to track critical pieces of information that were now relevant to pathology sample analysis.

Our team collaborated on an improved pathology request information form. We wanted a form that would highlight particularly important areas, reduce the duplication of information, be more user-friendly, and ensure that we capture details that were frequently missing in our current form. After a few iterations, the team created a version that we felt would result in reduced pathology error rates (see Figure 5).

===== insert Figure 5 about here =====

We tested the improved version of the form by requiring that surgeons and OR staff requesting a pathology consultation complete the form prior to sending their order to the laboratory area. In this way, we hoped that the important details at the first matching stage – previously missing or inaccurate during our baseline data collection – would now be complete and accurate.

However, our experience with pathology error rate reduction did not prove as sparkling as anticipated. During our one-week baseline data collection, we had 31 first matching errors out of 99 pathology samples (31.3%). We evaluated our improved form over a 3-week period in which the laboratory processed 142 samples. Of these samples, 42 (29.6%) had errors or inaccuracies at the first matching stage. Thus, use of the form produced a very modest reduction in error rates, but nowhere close to the team's objective of error-free, complete and accurate pathology information.

Nonetheless, when we inspected the contribution of each error category within the first matching part of the process, we obtained some intriguing findings. Recall that during our baseline data collection with the previous form, the missing "Name of procedure" was the most common error. It accounted for 11 out of the 31 errors (35.5%). Using our improved pathology request form, this particular inaccuracy occurred just once out of 42 first matching errors (2.4%). The team's improvement efforts had nearly eradicated this specific error. In fact, the team indicated that the act of missing the procedure name is a far more crucial error than failing to include the doctor's name or procedure date on the pathology request form. Therefore, the team had substantially reduced the most critical error source. The contribution of each error category in our previous and improved request forms is depicted in Figure 6. Interestingly, the

occurrence of the other two most common error sources (doctor's name and procedure date) had moderate increases.

===== insert Figure 6 about here =====

4.0 Conclusions

This paper has reported on the use of operations management tools and principles to reduce a hospital's pathology error rates (inaccurate information content, poorly-prepared specimen samples). After developing a process map and coordinating some baseline data collection, the team collaborated on the creation of an improved pathology request form. Although it was hoped that error rates would be significantly reduced, the improvement was rather modest. However, the team did observe a substantial reduction in a very crucial information inaccuracy; namely, the absence of the specific procedure name in a pathology request. The team also received anecdotal evidence from staff members that the new form was more user-friendly and informative. Moreover, it captured critical information (e.g. priority level of pathology request, referral facility) that was not obtained under the previous form.

Given that we did not achieve the remarkable improvement originally anticipated, we have explored reasons why this may have occurred. Perhaps the team did not provide enough training with the new form prior to launching its use in the hospital, or perhaps it ought to have been evaluated for a greater duration of time (rather than the 3-week test). Was changing the form the right thing to do, or is there some other improvement idea that could have substantially reduced pathology error rates? These are questions that our team is addressing on its continual pursuit of process improvement.

One particularly valuable lesson focused on the need to keep various hospital staff “in the loop” about our improvement work. As it turned out, we had the involvement of a single surgeon on our team, but the remaining five surgeons in the hospital played no role at all in developing the form. Obviously, the surgeon plays a vital role in this process since he/she is the staff member who makes the initial request for a pathology consultation. Of the 42 errors we observed with our improved request form, 38 came from surgeons who were not on our team. Of course, it would be inadvisable to directly involve every surgeon at each team meeting, but if all surgeons had been made sufficiently aware of the form and its intended use, perhaps our error rates would have shown more substantial improvement.

This improvement project was not merely a “one and done” study; rather, it is part of an ongoing initiative to improve processes throughout the hospital. Indeed, our work with reducing pathology error rates is continuing. The lessons learned from this particular endeavor have informed our path to process improvement.

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Figure 1:
Operating room to pathology laboratory process map

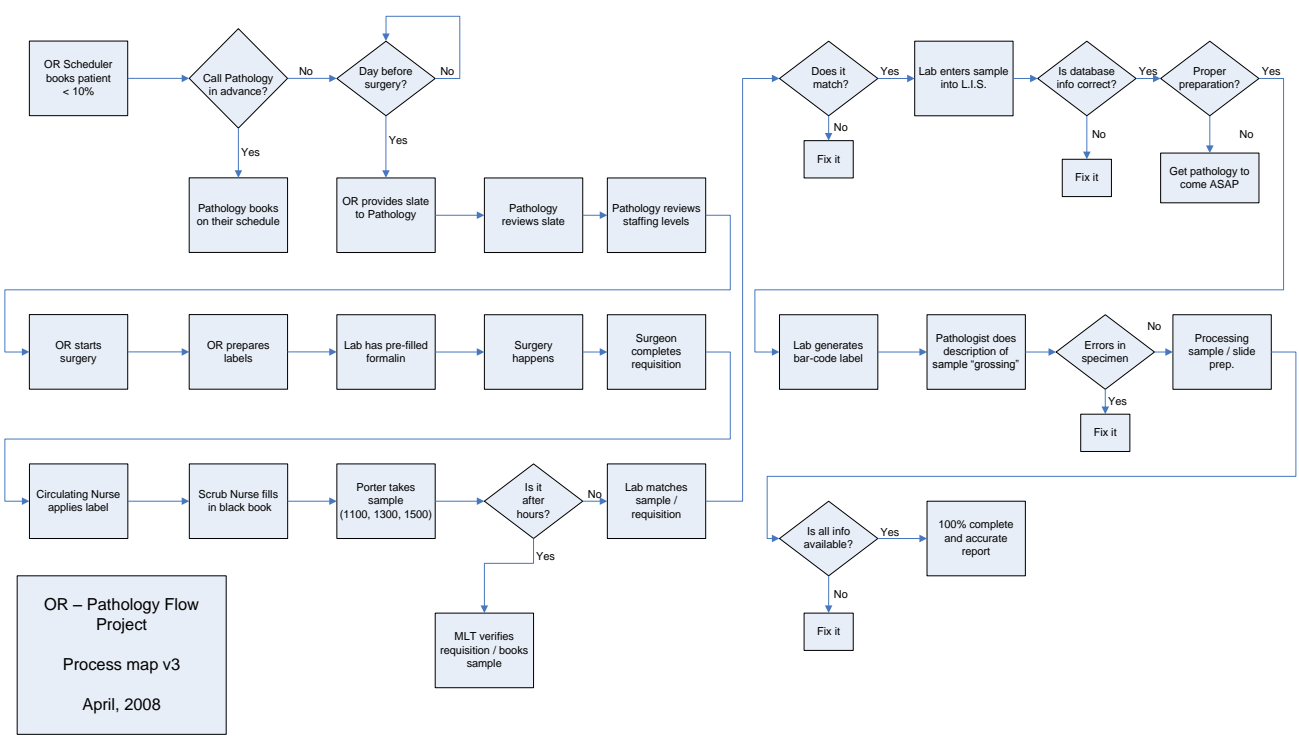


Figure 2

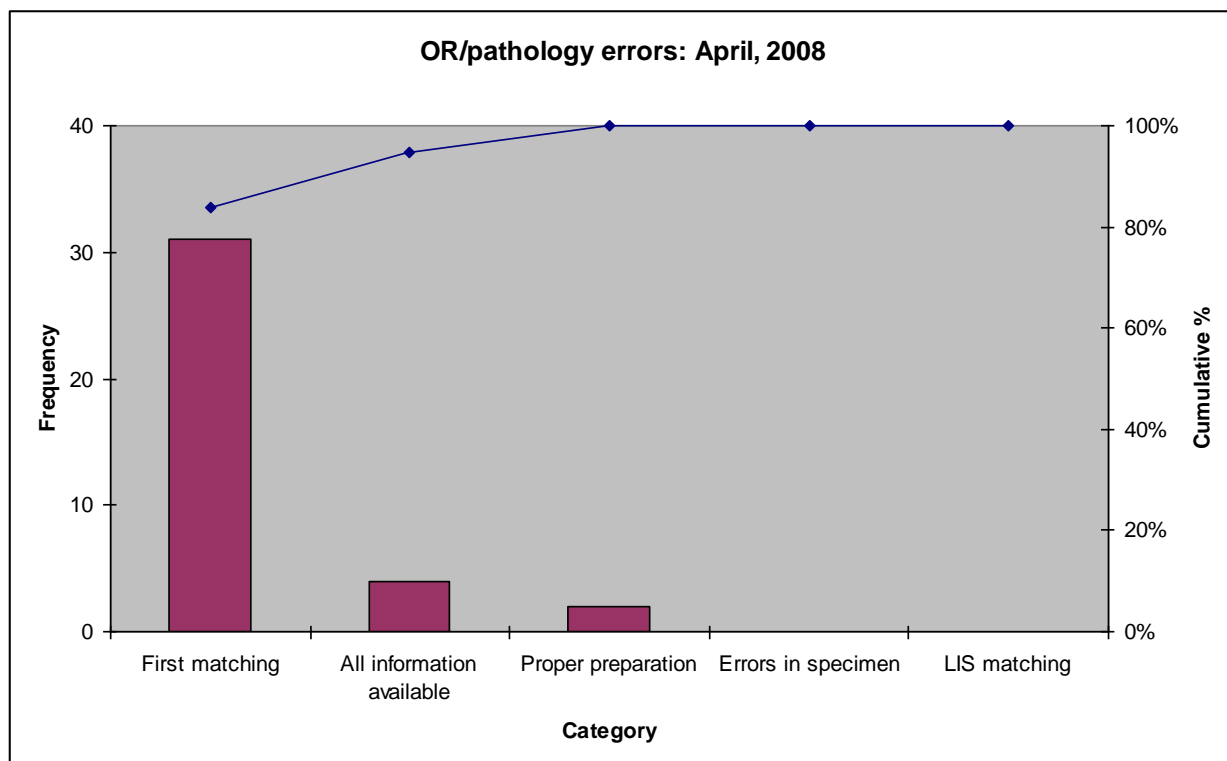


Figure 3

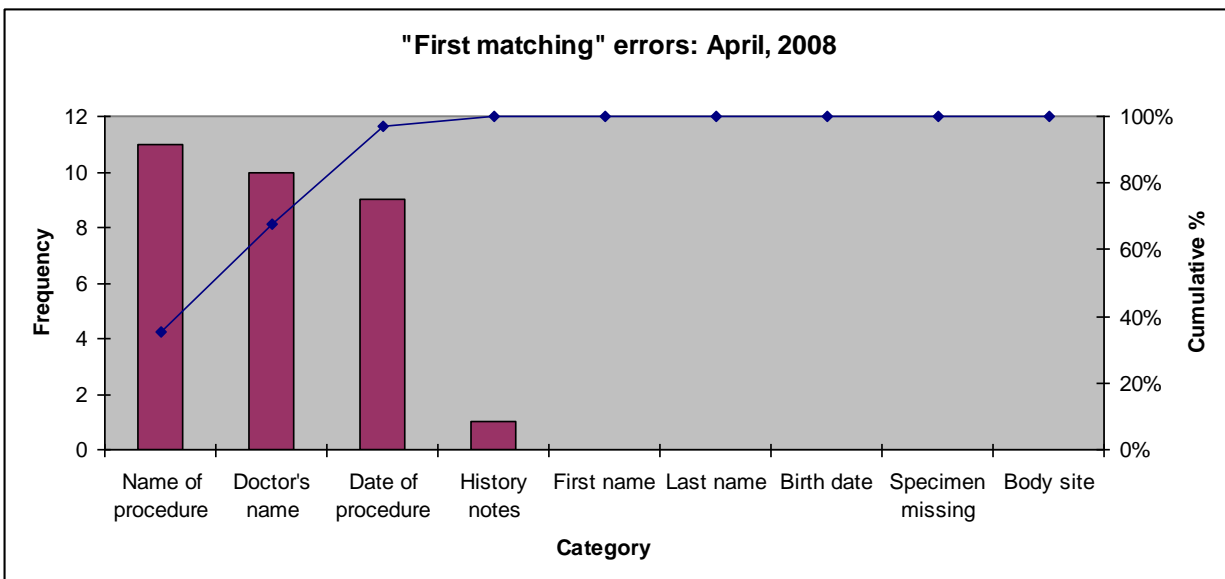
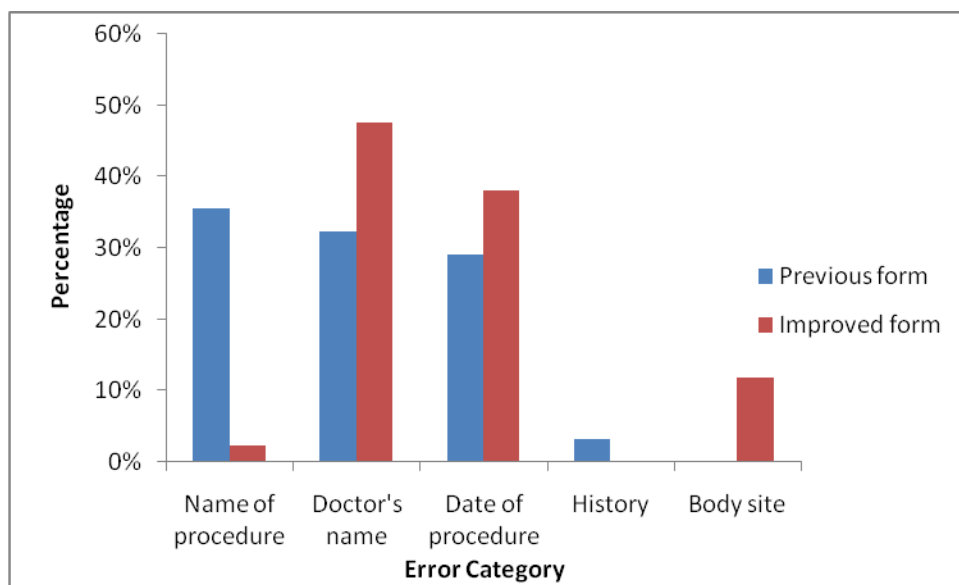


Figure 6
Error rate comparison



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