Improving Pregnancy Screening Prior to Computed Tomography Imaging

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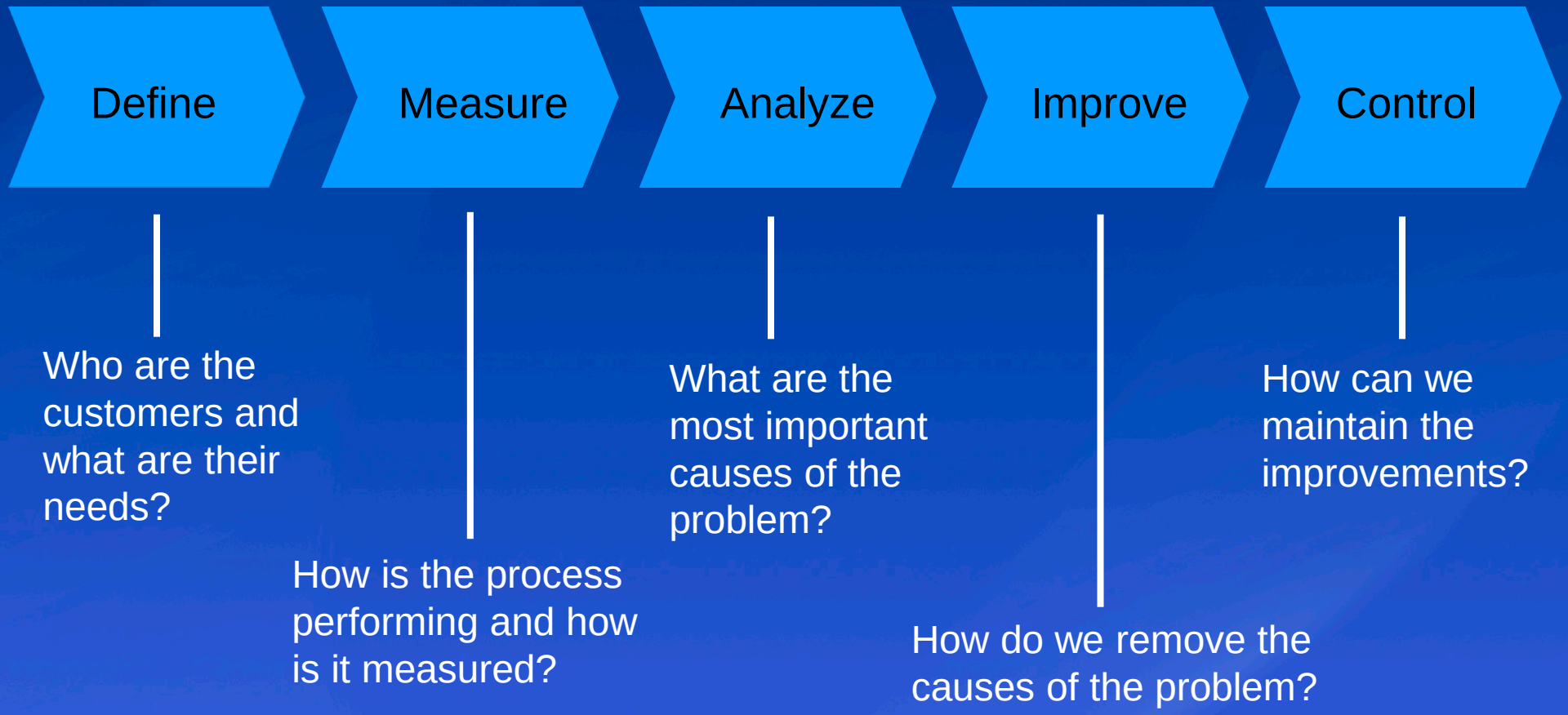
DMAIC Quality Improvement Framework



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Define | Measure | Analyze | Improve | Control

- Gap:
  - At Mayo Clinic Arizona, in accordance to current American College of Radiology (ACR) Practice Parameters[1], it is department policy to screen all females between 10-55 years of age for pregnancy status before proceeding to a computed tomography (CT) examination in order to reduce the risk of fetal radiation exposure. All inpatient and emergency patients are screened via an automatic digital process initiated on our electronic medical records (EMR) system, which has historically led to relatively high screening accuracy rates based on audits. However, since our outpatients are screened via paper questionnaire, we have found a screening rate which is far below our expectations.
- Target:
  - The target goal was to increase screening rates of relevant patients for pregnancy before undergoing a CT scan from 81.2% to 95%.

[1] American College of Radiology. ACR-SPR Practice Parameter for Imaging Pregnant or Potentially Pregnant Adolescents and Women with Ionizing Radiation. Available at: https://www.acr.org/-/media/ACR/Files/Practice-Parameters/pregnant-pts.pdf. Accessed February 1, 2018.

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- Stakeholder analysis and input:
  - Input from stakeholders were collected via verbal interview surveys by team members and collated for review. Common concerns reported were: safety of unscreened patients, time spent filling out forms, misplacing paper screening forms, and wasted time looking for both paper and electronic forms.
- Potential impact:
  - Ionizing radiation exposure to a fetus confers a minimal, albeit increased, risk of malformation, cancer, or death. Exam appropriateness, potential alternative imaging modalities, dose reduction methods, and, when necessary, informed consent need to be considered in pregnant patients. Comprehensively screening women of childbearing age will help prevent unnecessary fetal radiation exposure and decrease potential medical malpractice liability.

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Define | **Measure** | Analyze | Improve | Control

- Baseline:
  - The overall percentage of relevant patients being correctly screened for pregnancy prior to a CT scan that would result in significant fetal exposure was 81.2% (96.8% emergency patients, 86.8% inpatients, 72.4% outpatients).
- Data source:
  - Softek Illuminate InSight® was utilized to generate a spreadsheet of all female patients from 10-55 years old who underwent a CT scan during a two-week timeframe. CT head & neck studies were excluded as these studies did not confer significant fetal radiation. The Cerner Millennium® EMR was manually reviewed for the presence of pregnancy screening forms. Each form was individually audited for correct completion per institutional guidelines. The nature of each screening error was logged and compiled into a Pareto chart (Figure 1) to help prioritize error types for improvement.

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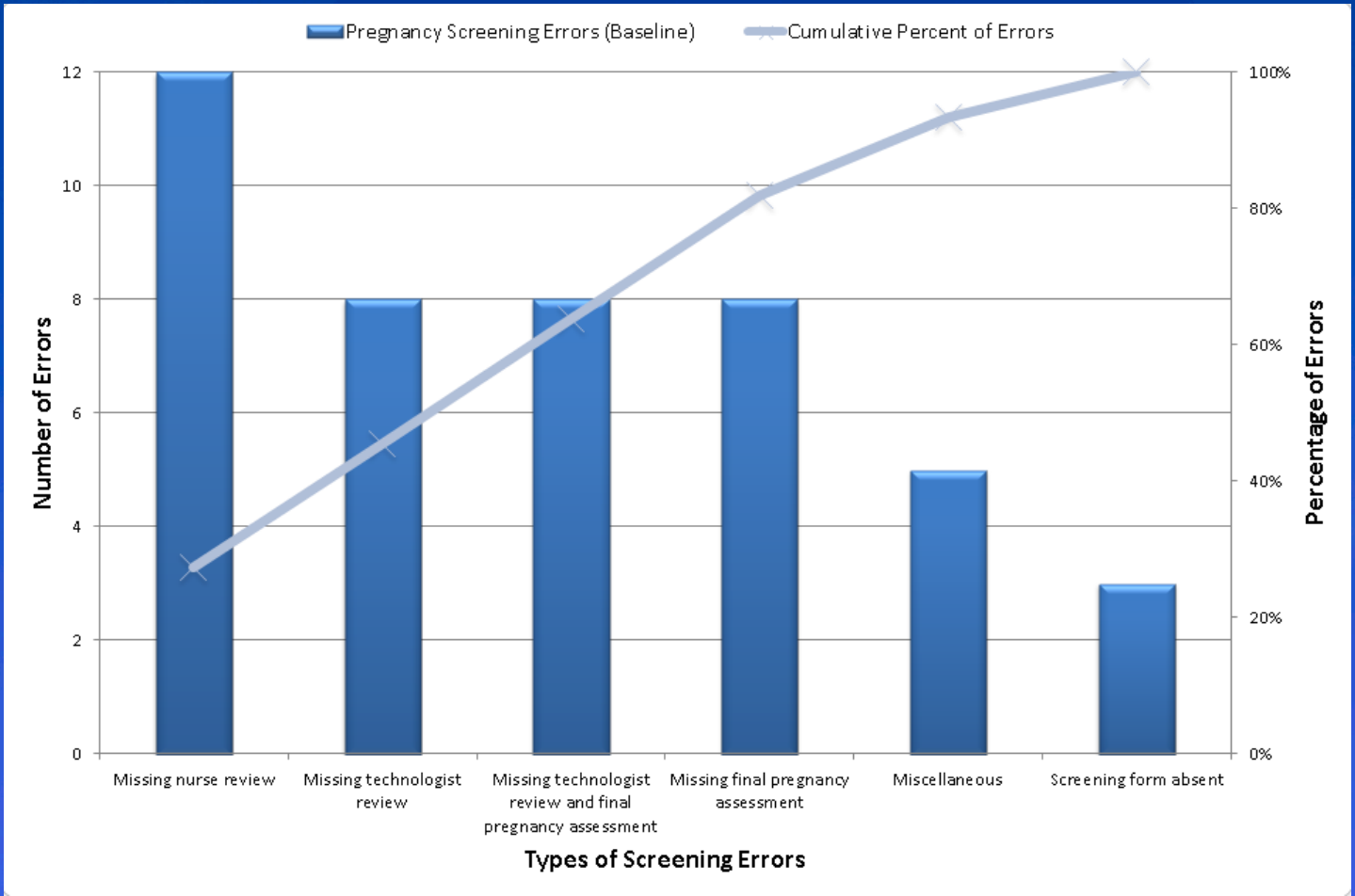
Figure 1. Pareto chart reflecting number and types of pregnancy screening errors identified at baseline.



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- Sample size:
  - The baseline sample size was 234 patients.
- Counterbalance measure:
  - Screening patients for pregnancy is a time-consuming process and we did not want any potential changes to delay patient care. This metric was best monitored by the average wait time of patients receiving pregnancy screening prior to CT scans. The baseline wait time between check-in and scan was 88 minutes. The wait time decreased to 77 minutes by the end of the project which confirmed that the process changes did not delay patient care.

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- Factors contributing to gap:
  - The electronic pregnancy screening process used for emergency patients and inpatients worked fairly well as the form initiates automatically when a CT is ordered on a patient of childbearing age. However, paper-based screening forms used for outpatients performed poorly with many lacking nurse/technologist signatures or unchecked boxes indicating pregnancy disposition (pregnant, not pregnant, declined, not applicable).
- Quality improvement methodology used:
  - This project utilized a DMAIC framework. Tools included Pareto Chart, 5 Whys, brainstorming via StormBoard.com, Impact Effort Matrix, Current State Mapping, and Fishbone Diagram. Two (2) Plan-Do-Study-Act (PDSA) cycles were used in the Improve phase.

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- Interventions implemented:
  - PDSA cycle #1 focused on decreasing human errors and process inefficiencies. Based on our analysis, we hypothesized that our screening process failed because of unclear screening expectations and reduplication of tasks. We chose the following interventions to address these concerns:
    - Eliminated redundancy where the technologist repeats the same screening steps that the nurse performed.
    - Implemented “built in quality assurance” whereby the technologist checks that nursing tasks were completed.
    - Applied change management principles to improve participation from staff.
  - PDSA cycle #1 (n = 109)
    - Accurate pregnancy screening increased from 81.9% to 89.9% overall.
    - Outpatient screening improved (72.4% to 86.6%).
    - Inpatient screening improved (86.8% to 100%).
    - Emergency patient screening worsened (96.8% to 93.3%).

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- Interventions implemented (continued):
  - PDSA cycle #2 focused on the identified problem of knowing when an electronic screening form is awaiting nurse or technologist review and knowing which fields of the form must be filled out. We chose the following interventions to address these concerns:
    - Separated nursing and technologist tasks on the screening form.
    - Reprogrammed important fields to be mandatory.
    - Had form display as red in EMR when incomplete.
  - PDSA cycle #2 (n = 101)
    - Accurate pregnancy screening increased from 89.9% to 96% overall.
    - Outpatient screening improved (86.6% to 93.7%).
    - Inpatient screening was unchanged at 100%.
    - Emergency screening improved (93.3% to 100%).

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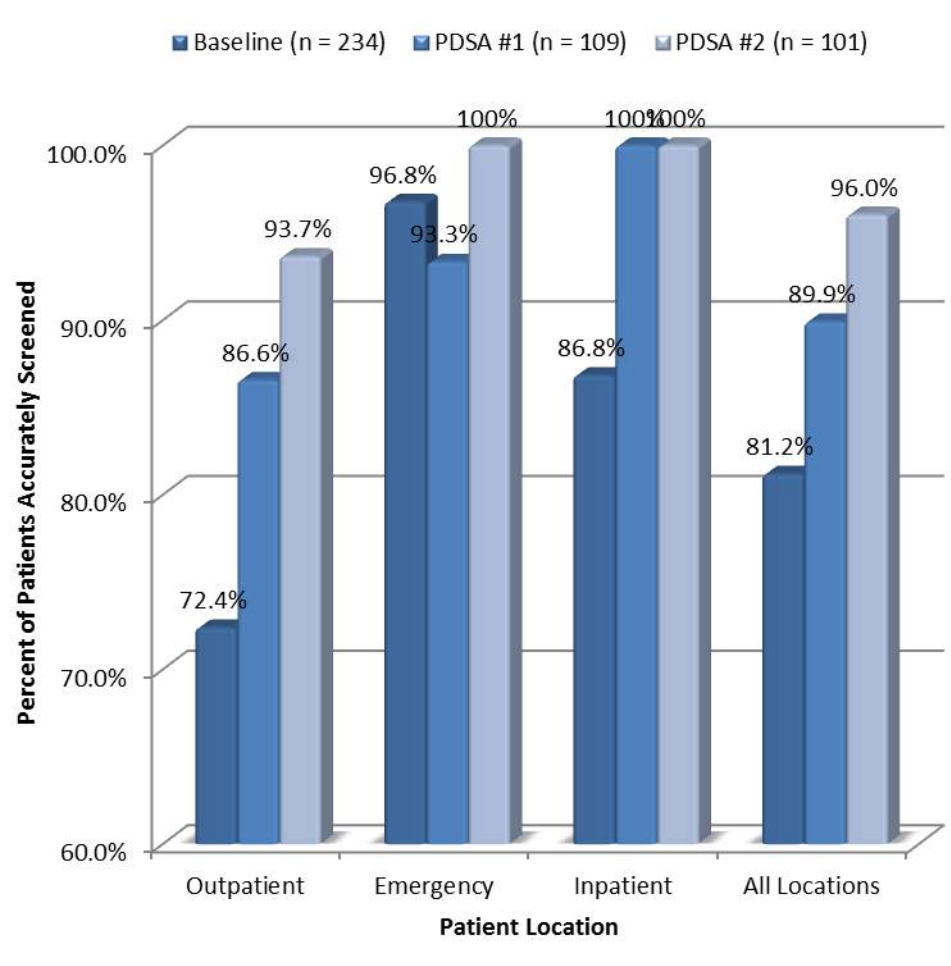
Figure 2. Percent of relevant patients screened for pregnancy before having a CT scan measured at baseline, after PDSA cycle #1, and after PDSA cycle #2.



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- Lessons learned:
  - Having conversations with small groups of staff while they are in their normal work areas is more effective than bringing up topics of change via formal large staff meetings or email messages.
  - Combination of both educational conversations that ask for staff assistance and developing novel technological solutions complement each other which makes for a more acceptable change process.
  - Some patients displayed a strong negative emotional reaction to being questioned about pregnancy status which may be secondary to lack of education regarding the importance of screening.
  - Incidentally uncovered a programming error in our EMR that allowed a pregnancy test result to be visible in one area of the record but non-visible from another area of the same medical record.

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Define → Measure → Analyze → Improve → **Control**

- Control plan:
  - The Radiology Department Quality and Safety Committee will perform a random audit of pregnancy screening forms biannually. Any screening errors reported via the online Radiology Safety and Event Reporting (SERF) form will be investigated immediately. If pregnancy screening accuracy falls below 90%, the Radiology Department Quality and Safety Committee will initiate a review and implement any indicated interventions.
- Suggested next steps:
  - Replacing the outpatient paper screening form with the electronic inpatient/emergency department screening form.
  - Developing a process to filter out patients who are permanently unable to become pregnant from receiving pregnancy screening forms.
  - Developing methods to defuse confrontational patients regarding pregnancy status by training staff to employ effective educational talks.

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Conclusion

- Successful. Improved CT pregnancy screening rates from 81.2% to 96% overall.
- Pregnancy screening process was inefficient due to several obstacles. Identifying the root causes of suboptimal performance was critical for improvement.
- Communication via small staff groups in their normal work areas is more effective than email messages or bringing up topics of change via formal staff meetings.
- Utilizing a combination of both non-technical interventions that engage the staff and technologic interventions that support the staff produces a more acceptable and effective change process.

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