Improving Infection Preventionist Effectiveness Through Workflow Optimization in a University Health System

Matthew Bakos[1], Laura Pallay[1], Seth Rounds[1], Nathanael Querry[1], and Makenzie Keepers[1,*]
[*] *Corresponding Author: makenzie.keepers@mail.wvu.edu*

[1] Industrial and Management Systems Engineering Department
West Virginia University
Morgantown, WV (USA)

***Abstract*— Effective infection prevention is paramount to achieving patient safety in healthcare. Infection preventionists (IPs) play a critical role in mitigating healthcare risks through surveillance and protocol enforcement. Currently, a university health system employs 48 Infection Preventionists across 19 of its hospitals to support these statewide efforts. However, preliminary observations revealed a heavy imbalance between administrative and clinical work, limiting the time available for high-value tasks. Additionally, substantial variability existed among individual IP workflows. The existing processes were also largely retrospective rather than prevention focused, which limited proactive infection prevention. This project applies the DMAIC (Define, Measure, Analyze, Improve, Control) problem-solving framework to optimize infection preventionist workflows within the health system. Industrial engineering methodologies, including Pareto analysis and a robust data collection plan (DCP), were used to establish baseline metrics with a small sample of IPs at a central location. Quantitative time study data provided by the sponsoring department combined with in-person interviews, surveys, and stakeholder engagement were conducted to capture the Voice of the Customer (VOC) and further understand current workflows. These data sources formed the foundation for the Analyze phase activities, including root cause analysis and additional process evaluation using industrial engineering tools to identify inefficiencies in the current process. The study was structured to increase the ratio of value-added tasks to nonvalue-added tasks by identifying process improvements and reallocating tasks to more appropriate individuals. Solutions developed through the Improve phase focused on increasing time allocated to high-value tasks like rounding and frontline education while reducing non-value-added tasks, such as administrative burden. The project emphasized standardization to ensure scalability to all 19 hospitals under the sponsor's portfolio and thus the long-term sustainability of the optimized workflow across the entire system. By using structured decision-making methods, the optimal solution was identified and presented to stakeholders. With the creation of a thorough implementation plan and detailed recommendations to control the solution post-implementation, this project successfully improved the workflow for infection preventionists, supporting increased value-added task time for IPs and thus improved hospital and health systems for citizens.**

Keywords—infection prevention, DMAIC, workflow optimization, healthcare systems engineering

I. INTRODUCTION

West Virginia University Health System (WVU Medicine) is the largest healthcare system in West Virginia, comprising 25 hospitals and 5 specialized institutes that serve patients across the state and surrounding regions [1]. As part of its commitment to high-quality patient care, WVU Medicine's Infectious Diseases department provides adults with advanced diagnostic and treatment services for illnesses caused by bacteria, fungi, and viruses [2].

Hospital-associated infections (HAI) remain a significant challenge, with approximately one in every 31 hospitalized patients acquiring an infection related to their care and an estimated 75,000 patients die each year as a result [3]. Through surveillance, data analysis, and collaboration with clinical teams, Infection Preventionists (IPs) work to reduce the risk of healthcare-associated infections.

WVU Medicine employs 48 IPs across 19 hospitals to support infection prevention efforts. However, current workflows place greater emphasis on reactive surveillance and administrative responsibilities rather than proactive prevention activities. Preliminary observations and stakeholder input indicated substantial variability in individual workflows and limited time allocated to high-value tasks such as clinical rounding and frontline education.

Best practices in infection prevention emphasize a proactive approach over a reactive approach. The imbalance between administrative and clinical work limits the effectiveness of IPs in achieving this goal.

This study aims to evaluate and optimize IP workflows using a structured, data-driven approach. By identifying inefficiencies and reallocating time toward value-added activities, the project seeks to improve workflow consistency, increase prevention-focused work, and enhance overall patient safety outcomes. This study applies the DMAIC framework to evaluate and improve IP workflows.

II. Methodology

A. Data Collection

A structured data collection plan was developed to quantify time allocation and capture qualitative insights regarding workflow inefficiencies.

Quantitative data consisted primarily of time study data, where IPs self-reported weekly labor hours across workflow categories within a personalized Excel sheet to establish baseline workload distribution.

To supplement quantitative findings, qualitative methods were also used to better understand contextual factors influencing IP workflow efficiency. During in-person site visits, the team conducted job shadowing and interviews with IPs. Real-time observations captured workflow sequencing, redundancy, and system inefficiencies, while one-on-one questioning clarified observed challenges.

In addition, the team distributed an electronic Voice of the Customer (VOC) survey prior to site visits. The questionnaire gathered IP perspectives on current workload, pain points, and areas for improvement. Receiving this feedback in advance informed more targeted observation during on-site visits.

The survey consisted of two primary components. The first section included three scaled questions from 1 (Very Low) to 5 (Very High), which measured perceived productivity, satisfaction with quality of work, and how well current systems and tools supported efficient job performance. The second section included open-response questions that asked IPs to identify value-added tasks, tasks they did not have time to complete, tasks that they felt took too much time, redundant work, and work that felt misaligned with professional training and expertise.

B. Process Mapping and Workflow Analysis

Process mapping techniques were used to document both high-level and detailed workflows, capturing task sequencing, decision points, and variability in execution.

The current state high-level process map, shown in Fig. 1, summarizes the typical daily workflow of a hospital-based IP based on sponsor meetings, early observations, and discussion with department leadership.

A detailed process map was also created by breaking the 5-step process into subcategories and highlighting key decision points and potential interruptions.

C. Analytical Methods

To evaluate how labor hours were distributed across tasks, a Pareto analysis was conducted using the self-reported time study data from IPs.

To identify contributing factors to the workflow inefficiencies, a fishbone diagram was developed with information gathered from survey data and shadowing.

To further investigate the underlying causes of workflow inefficiencies, a Failure Modes and Effects Analysis (FMEA) was created to evaluate potential failure modes based on severity, occurrence, and detection. By assigning values to each failure mode, Risk Priority Numbers (RPNs) were generated, allowing for ranking of each failure mode.

A Five Why Analysis was developed to further investigate the failure modes and workflow challenges by tracing each issue to its root cause.

III. Results and Disuccsion

A. Baseline Findings

The Pareto analysis shown in Fig. 2 revealed that the largest time commitment for IPs by a large margin was surveillance. The next largest time category was miscellaneous meetings. Together, these two categories made up 52% of total time commitments.

Miscellaneous meetings were especially problematic, as many were not necessary for IPs to effectively complete their responsibilities, representing a significant investment of time for a limited return. Surveillance, while considered to be a value-added activity, was still excessive in proportion and limited the ability to focus on prevention-focused activities.

In contrast, rounding, research projects, professional development, and education were identified as value-added tasks but accounted for a significantly smaller portion of total time. The greatest opportunity for improvement lies in reducing time spent on meetings and streamlining surveillance to reallocate time toward higher-value activities such as rounding and education.

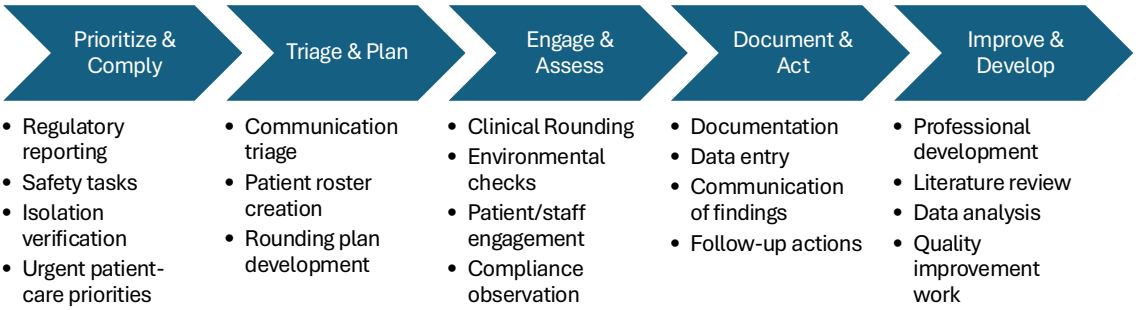

Fig. 1. High-Level Process Map

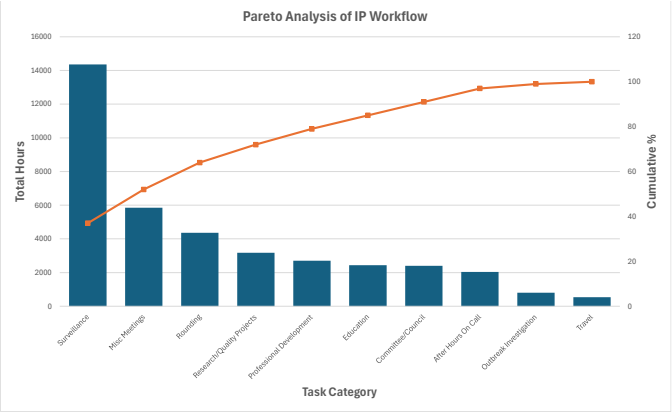

Fig. 2. Pareto Analysis of IP Workflow.

This distribution highlights an imbalance in time allocation, where a large portion of daily workflows are concentrated in surveillance and meetings, while prevention-focused activities such as rounding and education remain underrepresented. This creates an opportunity to redistribute time from non-value-added tasks toward higher-impact tasks without increasing overall workload.

Qualitative findings from shadowing, interviews, and Voice of the Customer (VOC) survey responses provided additional context to the baseline workflow. IPs reported that surveillance activities, reporting requirements, and meetings consume a substantial portion of their time, often limiting their ability to focus on higher-value tasks.

As shown in Fig. 3, the average productivity rating among respondents was 3.95 out of 5, while satisfaction with quality of work averaged 3.85. Perceived systems and tools support received the lowest rating at 3.45. These responses suggest that while IPs have generally felt productive and confident in the quality of their work, existing systems may not fully support an efficient workflow.

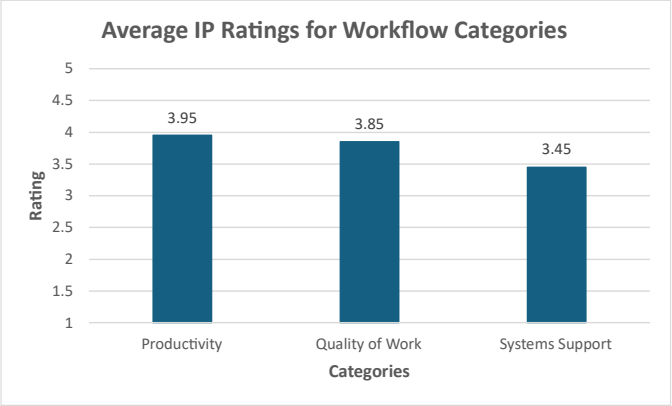

Fig. 3. Average IP Ratings from VOC Survey

Observations from shadowing further highlighted workflow variability and frequent interruptions, with IPs often reprioritizing tasks in response to emerging issues. These findings reinforce that current workflows are heavily administrative and reactive, limiting time available for prevention-focused activities such as rounding and frontline education.

B. Root Cause Identification

To further investigate these findings, root cause analysis was conducted using a fishbone diagram, Failure Modes and Effects Analysis (FMEA), and Five Why Analysis.

The fishbone diagram analysis identified multiple contributing factors to inconsistent IP workflows across categories including personnel, methods, measurement, environment, and systems. Variation in experience levels and differing perceptions of task prioritization led to inconsistent workflow execution, with some IPs prioritizing surveillance over rounding. Frequent interruptions and reliance on IPs for non-specialized tasks further disrupted workflow consistency.

Process-related issues included manual documentation requirements, inconsistent rounding approaches, and variation in communication practices between individual IPs. Measurement limitations, such as reliance on lagging indicators and inconsistent data tracking, created additional inefficiencies. Environmental factors, including the unpredictable nature of hospital settings and outbreak response, introduced variability in daily work. System-related challenges, including manual validation requirements and redundant reporting processes, further increased administrative burden and reduced time available for higher-value activities.

Failure Modes and Effects Analysis identified several high-risk contributors to workflow inefficiency based on risk priority numbers (RPN). The RPNs were calculated using scoring criteria that defined how each failure mode was evaluated based on severity, occurrence and detection. The highest-risk issue was significant variation in rounding procedures across IPs, reflecting a lack of standardization in preparation, execution, and documentation.

Additional high-priority failure modes included inconsistent completion of rounding, often due to prioritization of surveillance and competing time demands such as meetings and reporting requirements. Surveillance processes were also characterized by high redundancy, particularly in repeated case review activities requiring manual validation of patient information.

The third-highest RPN of 216 was attributed to the failure mode of surveillance being prioritized over rounding in the IP workflow. Discussions with IPs supplemented VOC survey results in revealing that IPs generally considered surveillance to be the most important piece of their work. Therefore, it could be inferred that the IPs would prioritize surveillance over rounding by starting surveillance earlier in the day and not leaving for another task until surveillance has been completed, which matched with on-site observations. This phenomenon was seen often, and with heavy demands on the surveillance side, could easily result in rounding being deprioritized to the point of being omitted entirely.

The second highest RPN of 240 was attributed to the failure mode of rounding not being performed regularly, specifically daily. This was a severe issue that could result in quality and safety issues not being caught and addressed in a timely manner.

As previously mentioned, prioritization of surveillance over rounding often resulted in little time remaining for rounding. This was reportedly even more common around the 15th day of each month, which is a major day for National Healthcare Safety Network (NHSN) validation. For multiple IPs, an excess of meetings was another frequent cause of other tasks being delayed. The existing preference for surveillance resulted in the little remaining time after meetings being used for surveillance, with rounding being neglected entirely. Variable work such as surgical procedure observations and surveillance of areas affected by water leaks produced similar results.

The highest RPN of 320 was attributed to the failure mode of rounding procedures differing significantly between each IP. This was seen in all rounding observed on-site by the team, implying that this was a frequent occurrence. In discussions with the team, the IPs also emphasized differences in rounding procedures based on little more than personal preference, with a fundamental lack of any standardization. IPs prepared differently before rounding, used different tools to document their findings while rounding, looked for different risk factors while rounding, and took different approaches to addressing clinical staff. Lack of standardization resulted in an increased risk of variation in the quality of work performed.

Five Why Analysis revealed that many workflow inefficiencies stem from a set of interconnected systemic issues. A primary root cause was the lack of standardized processes, particularly in rounding and workflow prioritization, resulting in significant variation in how tasks are performed across IPs.

Unclear ownership of infection-related documentation tasks also contributed to inefficiencies, with IPs frequently completing work that could be performed by other clinical staff. Inconsistent system utilization and reliance on manual data compilation further increased time required for surveillance and reporting activities.

Frequent interruptions and inconsistent communication practices across roles disrupted planned workflows and contributed to administrative burden. Collectively, these root causes explain the imbalance between administrative and prevention-focused work.

These root causes explain why time is heavily concentrated in surveillance and administrative work and why rounding and other prevention-focused activities are deprioritized.

C. Proposed Solutions and Prioritization

Based on these root causes, targeted solutions were developed using an extended FMEA to address key inefficiencies and their underlying contributing factors. The extended FMEA, shown in Table IV, includes recommended actions, responsible parties, implementation timelines, and updated RPN values reflecting the impact of proposed solutions.

The primary solution for surveillance-related challenges was the creation of two specialized teams, with one focusing on surveillance and the other on rounding. This approach reduces the risk of surveillance tasks consuming time allocated for rounding while maintaining completion of critical surveillance activities. This solution is supported by retraining efforts to streamline the case review process and reduce redundancy through improved use of available tools and best practices.

By separating surveillance and rounding responsibilities, this approach enables a redistribution of workload, allowing IPs to reduce time spent on surveillance activities and reallocate that time toward rounding and frontline education.

Hospital-based rounding proposed solutions included the development of a detailed Roles and Responsibilities table and standard operating procedures (SOPs) for rounding. These solutions address observed variability in workflow execution and clarify expectations among leadership and IPs while reducing the risk of overlooking important considerations due to personal preference

TABLE IV. EXTENDED FAILURE MODES AND EFFECTS ANALYSIS

Process Step	Failure Mode	RPN	Recommended Actions	Responsibility	Target Completion	S	O	D	Rev. RPN	Change
Rounding	Different procedures followed between IPs	**360**	Develop SOPs to standardize IP tasks and clearly define roles and responsibilities.	Upper Management	After surveillance rollout	6	4	3	96	**-73%**
	Rounding not performed daily	**240**	Develop a Roles and Responsibilities table to establish clarity and alignment.	Upper Management	End of April 2026	8	3	3	72	**-70%**
Surveillance	Surveillance prioritized over rounding in workflow	**216**	Roll out the new surveillance team and update job descriptions to reflect changes in the IP workforce.	Surveillance Team	Ongoing	4	2	4	32	**-85%**
	High redundancy in case review	**192**	Training alignment for IPs after surveillance team rollout.	Upper Management	Ongoing	4	2	4	32	**-83%**
Meetings	IP attends VA but highly redundant meetings	**96**	Streamline communication triage by daily newsletter distribution Standardize infection reporting to improve IP information sharing Implement live dashboards (Power BI/Tableau) integrated with Epic	Upper Management	End of Q3	4	4	4	64	**-33%**

TABLE V. SOLUTION PRIORITY MATRIX

Failure Area	Solution	Factor				Score	Priority
		Sustainability (35%)	Impact (35%)	Duration (10%)	Difficulty (20%)		
Rounding	SOPs	8	8	8	8	8	2
	Roles & Responsibilities Table	9	8	8	8	8.35	1
Surveillance	Surveillance team	7	9	4	5	7	4/5
	Improving training	8	8	4	5	7	4/5
Meetings	Daily Newsletter	6	5	8	9	6.45	7
	Interactive Dashboards	7	8	4	5	6.65	6
	Infection Reporting Standardization	8	9	8	6	7.95	3

Standardizing rounding procedures further support the redistribution by increasing efficiency and reducing variability among IPs, allowing for more efficient rounding.

Standardizing infection data reporting and implementing tools to streamline data preparation were the main solutions proposed to target redundancy in meetings. Additional solutions included the use of dashboarding tools to support live reporting and alternative communication methods to reduce time spent in recurring meetings. To supplement recurring meetings, the team suggested establishing a daily newsletter containing infection data reports.

Reducing redundancy in meetings and reporting creates an additional opportunity to shift time away from indirect tasks and toward value-added activities.

To prioritize these solutions, a structured evaluation was conducted using sustainability, impact, duration, and difficulty as criteria shown in Table V. Results indicated that solutions focused on standardization and role clarity provided the greatest overall benefit. The Roles and Responsibilities table ranked highest due to its strong sustainability, high impact, and ease of implementation, followed by standardized procedures. Solutions related to surveillance restructuring and training demonstrated high impact but required greater implementation effort. Improvements to reporting and meeting efficiency also showed value, particularly in reducing redundancy and improving communication.

Overall, the matrix highlighted that standardization and clear role definition offer the most effective path for improving workflow efficiency and increasing time allocated to prevention-focused activities.

D. Implementation and Control Considerations

An implementation plan seen in Table VI was created to guide the execution of the highest-rated improvement methods identified in the solution prioritization. The plan emphasized the development of a Roles and Responsibilities table, followed by the creation of updated SOPs after the rollout of the new surveillance team.

TABLE VI. IMPLEMENTATION PLAN

Key Milestone	Details	Person Responsible	Timeline
Develop Roles & Responsibilities (R&R) Table	• Identify all Infection Prevention (IP) tasks across the team • Assign clear ownership for each task to reduce redundancy and improve accountability	WVU IE Team	April 1st, 2026
Review & Approve	• Review draft with Leadership to gain feedback • Finalize R&R table.	Leadership & WVU IE Team	April 8th, 2026
Rollout R&R table	• Communicate finalized roles and responsibilities to all IP staff • Provide necessary training	IP Management	April 24th, 2026
Create New/Update Standard Operating Procedures (SOP)	• Revise SOPs to reflect the updated team structure and responsibilities • Emphasize rounding and frontline education as core priorities • Allocate dedicated time for professional development using existing training materials • Define clear guidance on infections that do not require extensive investigation (e.g., avoiding unnecessary deep dives) • Standardize information sharing through current reporting tools and other resources	Leadership	Post Surveillance Team Rollout
SOP Approval & Training	• Distribute updated SOPs to all IP staff • Conduct training sessions to reinforce expectations and clarify role changes • Communicate the shift in surveillance responsibilities to the designated team	Leadership & IP Management	Post Surveillance Team Rollout
Monitor & Adjust	• Track adherence to roles, SOP, and workflow improvements • Make adjustments as needed	IP Management	Ongoing

The first step is to develop the Roles and Responsibilities table to align IPs on their most value-added tasks and establish a clear foundation of workflow expectations. This step includes review with IP leadership to ensure alignment with leadership priorities, followed by rollout into practice with training to support proper adoption.

After the surveillance team is integrated into the workflow, updated SOPs shall be developed to reflect the revised distribution of responsibilities. These SOPs emphasize the prioritization of rounding and frontline education while reducing time spent on surveillance. The reduction in surveillance burden would allow IPs to shift focus toward prevention-focused activities and dedicate more time to professional development and use of available tools and resources.

The updated SOPs should be distributed with appropriate training to ensure consistency in application. Ongoing maintenance of these procedures would be managed by IP leadership to ensure documentation remains current and aligned with evolving workflow expectations.

The combined effect of these implementation steps is expected to reduce time spent on surveillance and administrative tasks while increasing time allocated to rounding and education. This structured redistribution aligns IP responsibilities with activities that provide the greatest impact on infection prevention outcomes.

To ensure the long-term sustainability of the proposed solutions, a control and response plan was developed to educate team members on their individual responsibilities should potential issues arise following implementation. IP leadership will be responsible for regular review of the Roles and Responsibilities table as well as SOPs. Proper maintenance and updates should be made as workflows evolve.

Infection Preventionists will be responsible for adhering to standardized procedures to ensure consistency in workflow execution. Proper training will be provided to new hires to reinforce adherence to established processes.

These control measures support continuous improvement and ensure that workflow changes remain aligned with prevention-focused objectives.

IV. Conclusion

This project evaluated Infection Preventionist workflows using the DMAIC framework to better understand how time is currently allocated and where inefficiencies exist. The baseline analysis showed that a large portion of IP time is spent on surveillance and meetings, while less time is spent on rounding and frontline education, which were consistently identified as the most value-added activities.

The root cause analysis helped explain why this imbalance exists. A lack of standardization among IPs, unclear ownership of certain tasks, redundancy in surveillance and meetings, and frequent interruptions all contributed to inconsistent workflows and reduced time available for prevention-focused work.

Based on these findings, solutions were developed to better align IP responsibilities with more value-added activities. The highest priority solutions focused on creating a Roles and Responsibilities table and standard operating procedures, as these addressed the largest sources of variation while remaining the most feasible to implement. Additional solutions targeting surveillance structure and reporting processes were also identified to reduce redundancy and administrative burden.

The implementation and control approach ensures that these changes can be sustained over time through defined ownership, ongoing updates to documentation, and continued monitoring of workflow performance. This approach provides a scalable framework for optimizing IP roles across the healthcare system, enabling the reduction of non-value-added tasks and improving workflow consistency.

Overall, this project provides a structured approach to improving IP workflows by shifting time toward prevention-focused activities, increasing consistency across IPs, and better supporting infection prevention efforts across the health system.

Acknowledgment

The authors would like to thank all who assisted in the completion of this project. This includes leadership from WVU Medicine, including Dr. Nina Huss, Dr. Matt Lokant, Chris Skaggs, and Michael Stevens. The authors would also like to thank the surveillance team for providing additional insight into Infection Preventionist workflows. A special thank you to all WVU Medicine Infection Preventionists, especially those who allowed the team to shadow their workflows during busy schedules and provided valuable feedback throughout the project.

The authors would also like to thank the Industrial and Management Systems Engineering Department at the Statler College of Engineering for support in securing funding to attend the SIEDS conference virtually. Special thanks to Dr. Makenzie Keepers for guidance in writing the paper, as well as Dr. Ashish Nimbarte, Chair of WVU IMSE, for continued support of this work and the team's efforts.

References

[1] "About WVU Medicine," WVU Medicine, 2026. [Online]. Available: https://wvumedicine.org/about/. Accessed Jan. 2026.

[2] "Infectious Diseases | Ruby Memorial Hospital," WVU Medicine, 2026. [Online]. Available: https://wvumedicine.org/ruby-memorial-hospital/services/wvu-specialty-clinics/infectious-diseases/. Accessed Jan. 2026.

[3] "Who are IPs?," APIC, 2026. [Online]. Available: https://apic.org/monthly_alerts/who-are-infection-preventionists/. Accessed Jan. 2026.