*Proceedings of the 2018 Winter Simulation Conference*
*M. Rabe, A.A. Juan, N. Mustafee, A. Skoogh, S. Jain, and B. Johansson, eds.*

# LIMITS OF DOING MORE WITH LESS: A SIMULATION STUDY OF FACILITIES MANAGEMENT WORK ORDERS IN A HEALTH SYSTEM

Shivraj Kanungo

Department of Decision Sciences
The George Washington University
Funger Hall 415, 2201 G St NW
Washington, DC 20052, USA

Nancy Ban

Vice President of the Results Management Office
Central Maine Healthcare
300 Main Street
Lewiston, ME, 04240, USA

## ABSTRACT

The facilities management department of a U.S. health system has experienced a 42.28% turnover rate within the last year. Despite the human resources team's work to mitigate turnover, insufficient attention has been given to burnout within the department. There is a need to explore alternative frameworks to investigate the issue that take into account the complexities and impact of staff burnout on the health system. This paper starts by developing an understanding of the root causes and behavior of burnout within a department and scrutinizing the complexity of how departmental decisions impact the health system as a whole. This is followed by a simulation model based on the data collected from managers at the health system. We conclude with a discussion of the insights that were derived from both causal loops as well as that from the results of the Vensim simulation. Finally, plans for future work are outlined.

## 1 INTRODUCTION

MedSys, like all health systems, faces great uncertainty about the future. In particular, today's uncertain healthcare environment includes the promise of fundamental health care reform at the national level, the unknown impact of technology and advancements in genetics, and an unresolved solution to the unhealthy aging of the population. At no other time in our history has there been a greater imperative for Health Systems to be agile – continually assessing the environment and acting both proactively and reactively as opportunities and challenges are realized.

Furthermore, at the local level, MedSys is an independent organization that includes a 250-bed medical center, two critical access hospitals, and a 90% employed physician practice group. However, with the infusion of new leadership for the first time in 30 years, staff are under pressure to evolve with the times to ensure the continued viability and effectiveness of the organization. As a result, priority strategies have been developed as it relates to strengthening the foundation.

One high priority goal that the organization recently developed to meet its "strengthen the foundation" strategy relates to operating performance. The operating performance goal developed states: "we will strengthen our operating performance to generate sufficient capital to fund our transformation for the future and to ensure its continued viability (Strategic Goals Matrix FY17). Tactics relating to this goal were also defined and include: "aggressively apply process improvement techniques and diligent management to continually improve the quality, experience, and efficiency of MedSys's services while achieving benchmark levels of staff efficiency."

As MedSys refocuses on its process improvement efforts, there has also been a shift in the health system's organizational culture from inside-out thinking of the care that they provide is the right way for patients to outside-in thinking in which leadership focuses on meeting the needs of the communities, patients and all others served. With a goal of increasing positive responses to hospital experience surveys, MedSys's leadership team requested that departmental leaders standardize approaches to providing the

community with patient experience excellence. Of particular importance to MedSys's senior leadership team was that the facilities management department re-engage in focusing on the medical center's aesthetics. As a 125-year old facility that lost significant dollars over the past few years, the medical center's bones were beginning to crumble. And because the department's leader was asked to reduce staff to the 20th percentile as compared to national benchmarks, staff believed there was not enough employees to sustain the medical center's infrastructure as well as fix non-bedside issues such as painting, landscaping, and décor.

This new mandate caused the facilities management staff stress and there was an increase in turnover within the department. As one manager put it, "This new leadership team only cares about cost – saying they care about service is a joke. If they truly cared about what this place looks like they would give us the manpower to get the job done."

## 2 LITERATURE REVIEW

The issue of employee turnover as a result of overwork and fatigue is increasing in visibility and importance as the pressure on organizations to do more with less has also increased (Lloyd et al. 2015; Parker et al. 2017). The act of an employee leaving an organization is never a simple matter. This act is often a culmination of organizational failures and mismatches at multiple levels often characterized by mismatched expectations and workloads as well as unsustainable work patterns. This sentiment is captured by Baxter and Sommerville (2011) who refer to the failure of large complex systems to meet their deadlines, costs, and stakeholder expectations and explained that these failures are not necessarily failures related to technology. Failure points emerge because the management framework does not take into account the social and organizational complexity of the context in which complex systems are deployed. As a result unstable requirements emerge that lead to inadequate systems design and resulting in inefficient and ineffective solutions.

We see this dynamic to be pervasive in healthcare (Moss et al. 2016; Sorenson et al. 2016; Dyrbye et al. 2017). In order to get in front of financial pressures due to increasing governmental regulations, health systems form numerous committees to set performance metrics, determine where to cut costs, and discuss process improvement efforts. The industry has reached a tipping point in which the internal workings of an organization are becoming more complicated due to outside forces becoming more complex. Further, as a practitioner, Kaplan believes that "American healthcare is in the danger zone (2017)." As national healthcare spending continues to rise annually through 2025, the United States still has not adopted a successful solution to a system full of inefficiency. However, there are recommendations.

One suggestion is to apply systems-engineering approaches to healthcare delivery across the nation. This is because systems approaches are holistic and have shown to improve efficiency, quality and safety in other sectors and, therefore, could be transformative for health and healthcare. Furthermore, a systems approach applies tends to be comprehensive, leading to insights that help us understand the elements that influence health outcomes and allows us to change and improve processes to produce better health at a lower cost. For example, the protocol and the process for determining whether an MRI is necessary should be the same in any hospital in any city. Less variation implies better quality and service and a lower cost.

Case in point, take a systems approach to healthcare delivery as it relates to the well-being of health care workers. Some studies (Noseworthy et al. 2017) indicate that burnout is more common in physicians that U.S. workers in other fields. Moreover, the gap between physician burnout and workers experience in other fields is increasing. In addition there is a spike in physician burnout and this spike is burnout is linked to to loss of control over work, increased performance measurement (quality, cost, patient experience), the increasing complexity of medical care, the implementation of electronic health records (EHRs), and profound inefficiencies in the practice environment. All these factors have contributed to altered work flows and patient interactions.

However, there I evidence that health care workers tend to downplay the consequences and solutions that exist within organizations. According to Montgomery et al. (2013) healthcare initiatives, changes or

regulations are mainly developed by management boards, or policy making bodies with very little input from frontline staff or patients. This can be attributed to weak bottom-up feedback mechanisms that could possibly link healthcare delivery to policy making. Consequently, the effectiveness of top-down approaches to improve health care delivery tend to be limited. Of concern is the fact that physicians responsible for delivering care tend not to be interested in contributing to design, policy or evaluation. For example, a recent American Medical Association member survey indicated that the majority of physicians do not feel responsible for reducing healthcare costs (Tilburt et al. 2013).

As burnout becomes more of an issue for health systems, leadership has an obligation to health care workers to address the components of the system that lead to burnout. Transparency and open dialogue of this issue is required as well as a review of the systems – such as healthcare reform – that lead to burnout. Montgomery et al. (2013) report that in spite of the ever-changing demands for change, changing the way things work in hospitals is difficult because of the organizational culture in hospitals. This implies that a bottom-up participatory approach is more likely to succeed than a top-down approach – which have, in fact, led to more problem. And it's not just health care workers that need to participate in these conversations. Patients and families, who have their own vision of how an organization must run, should be part of the discussion as both health care staff and patients should be considered organizational citizens. While the topic of stress, fatigue, burnout and turnover have received considerable attention for physicians and nurses, there have relatively few studies that have been conducted for facilities management employees in the healthcare sector (Ling and Wong 2016; Hashim et al. 2017).

This paper aims to contribute to the timely debate of burnout in health care organization by reviewing the plant/facilities operations department of a hospital and exploring and developing: (1) Casual loop diagrams to better understand the complexity of the underlying factors contributing to burnout in the department (2) Strategies that may be successful in improving burnout.

## 3 PROBLEM STRUCTURE

System dynamics helps stakeholders make decisions about the structure of complex systems. A system dynamics approach also "can produce patterns and trends, as well as mean values as outputs from the model. The patterns and trends resulting from simulation experimentation with different policies or strategies ("what-if" questions) can be analyzed by modelers and stakeholders to inform decision making (Marshall et al. 2015)." System dynamics allows us to incorporate the notion of feedback, levels (stocks), rates (flows), and delays. In the context of health care level variables are aggregations of entities or amounts (e.g., people, beds, and work orders). Flows represent rates; these rate variables act as faucets and drains into and out of level variables and their units are in terms of levels per time unit (e.g., patients per hour, work orders per week and dollars per year). All these concepts allow us to model non-linearity that characterizes complex systems.

### 3.1 Framing the Problem

Preliminary information related to work flow was collected from the facilities management department as well as policy documents in order to understand the current problems influencing turnover in the department. The collected data included historical trends of open/closed work orders, turnover trends, and the department's organizational structure. In addition, interviews were conducted of facilities management staff as well internal customers in order to understand the perceptions and attitudes of the department's service across the organization. Finally, interviews were conducted with patients to understand their experiences, views and attitudes as it relates to perception of the hospital's facilities.

Table 1: Sampling frame and selection.

| Category | Metric | Sampling notes |
|---|---|---|
| Abstract Heading | Heading style for Abstract | Work orders 1488 work orders, December, 2017 |
| Front-Line Facilities management Staff | Roundtable discussion 10 Staff | Staff do not have management responsibilities |
| Healthcare staff Interviews | 5 Department Managers | All clinical department managers i.e. Emergency Department, Imaging, Endoscopy, Operating Room, Oncology |
| Patient Satisfaction Survey | N/A | YTD Patient Satisfaction Scores |

Based on the data, a causal loop diagram (CLD) was developed to provide a visual of a systems-approach to the cause and effect linkages for burnout within the facilities management department. Furthermore, the CLD tool was used to transform traditional linear-thinking of burnout to circular-thinking that highlights causation in order to develop solutions. It is important to note that each circular representation that makes up the CLD can either be defined as a reinforcing loop or a balancing loop. The difference between the two is that a reinforcing loop shows a growing action where each action adds to another whereas in a balancing loop there is a variable which limits growth due to the attempt to achieve a goal. For example, the size of a cup would be considered a limiting factor for how high water can be poured in a cup; however, may solve the problem at hand. Given the study context, the CLDs were used to as communication as well as documentation tools with study participants. CLDs are most useful in the early stages of model conceptualization (Morecroft 1982) and need not necessarily be isomorphic the level and rate diagrams produced subsequently. We use CLDs below to articulate the problem before developing the simulation model presented later.

### 3.2 Workforce Changes

Hospital administrators have the arduous task of undergoing the annual hospital budgeting process. They have to produce a budget that provides the level of care that patients need while also adhering to restrictions from the government and other sources of funding. On top of that, increasing healthcare costs coupled with an ever-changing payer landscape can make this process a big challenge.

To help hospitals with this process, many use staffing benchmarks to determine how their support departments stack up against regional competitors as well as national leaders. Typically, in facility management, a metric such as square feet per person may be considered. Once the benchmark value is obtained, one can ask for benchmarks for larger facilities (which often have a higher support space than smaller ones) or for smaller facilities (which often have less support space than larger ones).

Over the past decade, in an environment of reimbursement reductions and declining revenue yields, expense reductions of 10 percent or more has been a top priority for the Health System. As a result, non-bedside care departments, such as the facilities management department, have been the first departments to undergo a reduction in its work force. By the summer of 2016, a department once staffed at the 35th percentile (as benchmarked against like facilities) had been budgeted to be staffed at the 20th percentile.

This lower level of staffing resulted primarily from consolidating specialized tradesmen (i.e. electricians, plumbers, carpenters, HVAC mechanics, painters, and locksmiths) into a plant-flexible tradesman model. In this new model, all personnel were expected to have ‘add-on’ skills in other areas of the plant to facilitate inter-trade flexibility. This model led to several facilities management personnel either exiting the organization by choice or through attrition due to the lack of ‘add-on’ knowledge of more than one trade.

Although staffing was reduced to the $20^{th}$ percentile, management’s expectations continued to increase. As seen in Figure 1, the pressure to deliver service on a timely basis had detrimental effects on the

department, including decreased morale as well as increased fatigue and employee turnover. At the end of FY17 (Jun 2016 – Jun 2017), one year after the department's latest reduction in its staffing model, the department's turnover rate was 42.28% as compared to 34.48% the previous fiscal year.

Based on a Global Benefits Attitudes survey of 22,347 employees across 12 countries including the UK and US, more than half of employees surveyed cited inadequate staffing as the biggest cause of stress in the workplace. Across the world, a minority of employers considered this to be a major problem and only 15% of senior managers acknowledged that this was a cause of stress in their organization. In the US, however, employers have agreed that inadequate staffing was the second most important cause of workplace stress following 'lack of work-life balance' (Higginbottom 2014).

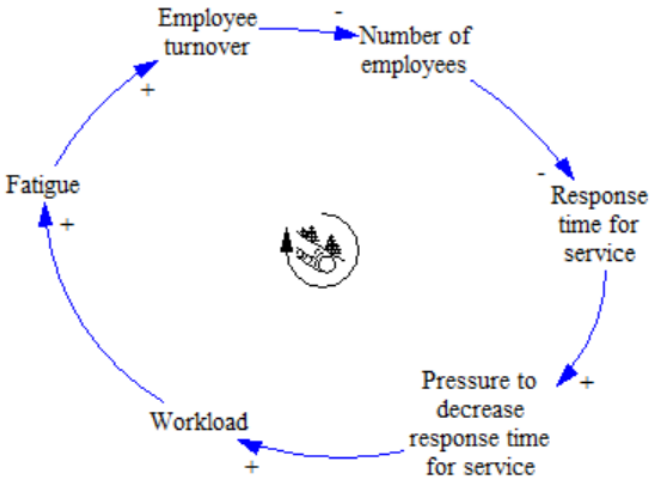


Figure 1: The reinforcing work pressure loop (R1).

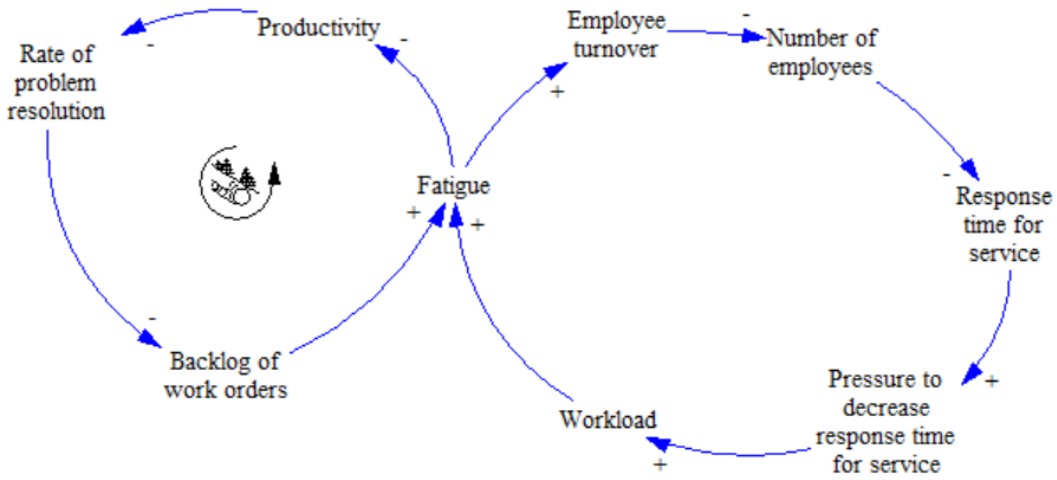


Figure 2: The reinforcing productivity Loop (R2).

Furthermore, according to the institute of work, health and organizations, stress at work can be a real problem to an organization as well as its employees. Leka et al. (2013) have reported that stress occurs in a wide range of work circumstances. However, it often feels worse in situations where employees perceive

they do not have adequate support from supervisors and colleagues and in situation where they do not have little control over their work or how their ability to cope with concomitant demands and pressures.

On top of a reduction in force, a second stressor for personnel, on which they had no control, was the anticipation of The Joint Commission's (TJC) arrival to conduct MedSys's flag-ship hospital's triennial survey. "TJC is a United States-based nonprofit tax-exempt 501(c) organization that accredits more than 21,000 US health care organizations and programs. Preparing for The Joint Commission's unannounced survey can be a challenging process. At a minimum, a hospital must be completely familiar with the current standards; examine current processes, policies, and procedures relative to the standards; and prepare to improve any areas throughout the facility that are not currently in compliance (Wikipedia 2018)."

As seen in Figure 2, a fatigued staff, trying to resolve an uptick of work orders based on the anticipation of TJC's arrival, was struggling to perform at top productivity levels. As a result, the rate at which problems were resolved decreased from 70% to 50% in the month of December, 2017 – while the backlog of work orders increased by 20%.

### 3.3 Accountability Rolls Down Hill

Multiple exogenous influences and pressures (shown in Figure 3) disallow management to lighten expectations for administrative and support employees. Protecting the safety of patients, employees and the environment is a core principle within facilities management. The department is not only responsible for providing maintenance resolution, staff must also ensure compliance of codes and standards, risk assessment principles, fire and life safety management, hazardous materials management, and medical equipment safety.

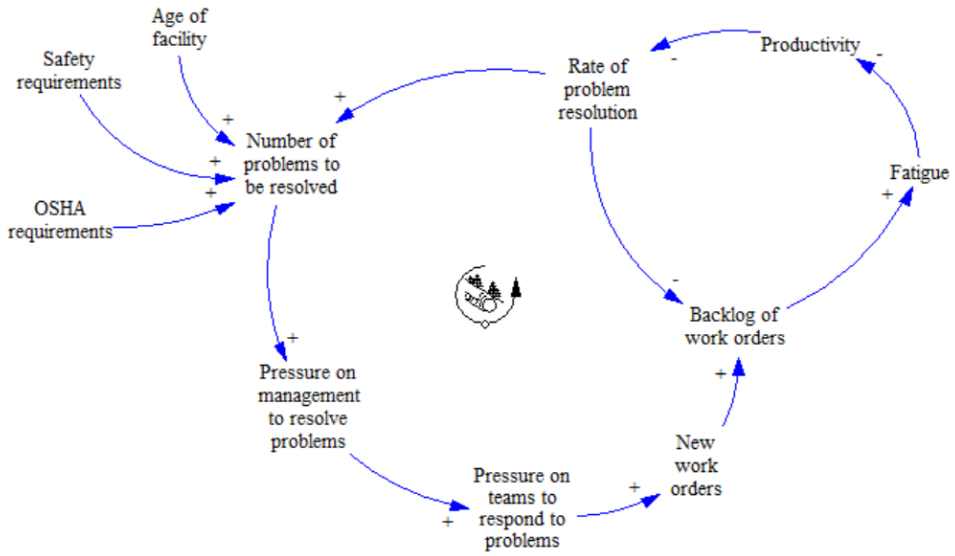


Figure 3: Top-Down Management (R3).

Furthermore, the new facilities management team inherited an over-100-year-old facility that had not had any infrastructure upgrades for the past 10 to 15 years. Due to cost pressures, the 15-year-old parking garage had never been sealed and was cracking, the twenty-year-old roof had not been replaced, the concrete walking paths to the entrance was splitting, and the wall paper on the nursing units were peeling beyond repair.

Written letters by patients were being sent to leadership sharing their dismay for the facility. One patient stated, "you're doctors are great, the nurses are even better – but the way you maintain your patient rooms

stink. For three days I looked up at stained ceiling tiles, chipped paint and worn doors. You really should take more pride in this hospital. If it wasn't for my doctor insisting I receive my care at this hospital, I would never come back".

As seen in Figure 3, anticipated TJC visits, safety requirements as well as an aging facility, increased the number of problems to be resolved. Management, working to ensure ongoing compliance with regulatory bodies as well as state codes, increased pressure on teams to respond to issues. Naturally, as additional issues were exposed, the facilities management team was pressured to respond. This constant push and pull between regulatory, safety and maintenance needs created fatigue in staff, thus, causing a loss of productivity in the workplace. This lack of performance also decreased the rate of problem resolution. Without additional staff, balancing work order management would require minimizing attention paid to root causes that lead to destabilization. This focus on temporary or quick fixes resulted in an increase in the number of work orders at the cost of investing time and resources (including capital investment) in fixing underlying systems and infrastructure. The increase in work orders combined with an increase in response time for services to negatively impact the rate of problem resolution. We call this the let-down effect.

## 4 SYSTEM DYNAMICS MODEL

System dynamics (SD) helps stakeholders make decisions about the structure of complex systems. A systems approach also provides a framework for dealing with dynamic complexity. In such complex situations cause and effect are not directly related. Moreover, SD allows us to uncover sources of policy resistance or the to account for the failure of well-intentioned interventions (Dulac et al. 2007).

### 4.1 Model Description

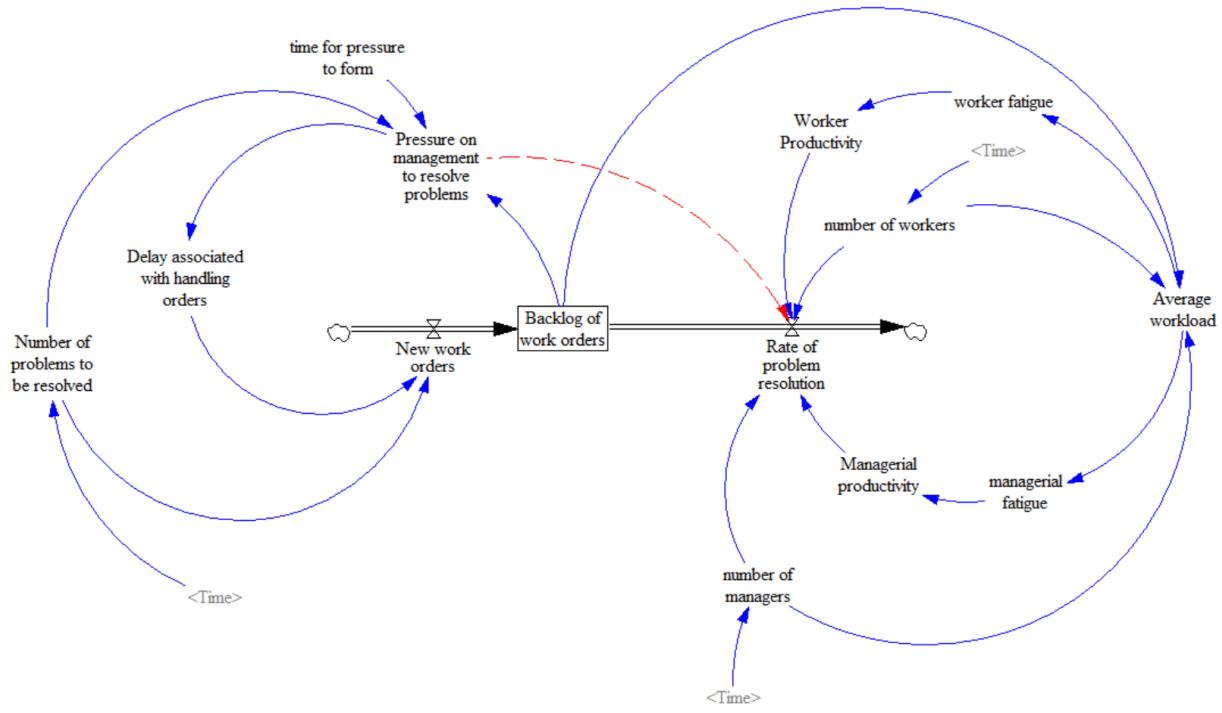


Figure 4: Base model + additional runs (shown in red).

The system dynamics model that we developed (seen in Figure 4) was created using the the three CLDs as the starting point. The model centered around the "backlog of work orders" level variable. "New work orders" is the input rate to the level variable and is fed by the exogenous source of facilities-related problems. As described in Section 3, there are three primary sources of facilities related problems which are modeled as "Number of problems to be resolved" – exogenous input data variable. The rate at which problems are recognized as work orders depends on the urgency felt by the organization at different levels – top management as well as at the facilities management levels. As the backlog builds up the pressure to respond to the backlog of problems also builds up and reduces the delay associated with recognizing problems to be addressed – thereby creating urgency and increasing the pressure to resolve problems. We also provide the actual number of managers and workers over time as input data variables.

On the resolution side, the rate at which problems are resolved is a function of how well resources (workers) are allocated to problems and how productive the workers are. In the base model the rate of problem resolution is primarily a function of average work load across managers and workers. In subsequent models, we recognize the negative effect of management pressure on the rate of problem resolution.

Since the primary goal of this data collection and modeling phase was to gain collective insight into the main problems that are being faced by facilities management and develop insights for the next modeling and analysis steps, we focused on the behavior of "backlog of work orders" and "rate of problem resolution."

### 4.2 Validation

To increase the confidence in results, verification of model structure and validation of output behavior were carried out in the development phase (Roberts 2011). Structure and behavior tests were conducted with the model as suggested by Barlas (1989) and Sterman (2000). The model structure was discussed and verified in a iterative manner to ensure its validity. The integration time step (dt) was set to one-fourth of the smallest shortest time parameter (one month) in the model that equals to one week. The historical data collected for six months was used validate the model results.

## 5 DISCUSSION

Two main variables of interest are shown in Figure 5 and Figure 6. Figure 5 shows that the backlog of problems continues to increase in the time that we studied the system and the rate of problem resolution shows an increase till it starts decreasing in month 4 onward.

Both Figures 5 and 6 show the behavior over time for three runs. The first is for the base run (shown in the legend as "base") and the next two runs are marked as FB1 (that refers to the feedback link from top management to managers in facilities management) and FB2 (that retains FB1 and incorporates a delayed effect of top management pressure on workers.)

Based on the model inputs, the change in the number of workers and managers is not significant. The number of managers and workers did not change significantly over time (the number of workers fluctuated between 10 and 12 and the number of managers fluctuated between 2 and 3). Therefore, the changes in rate of problem resolution are less a function of the actual number of employees and more a function of the inefficiencies that result from overwork and resource reallocation.

While the results are consistent with past data, it will be useful to develop a more nuanced understanding of the problem by modeling the inefficiencies as a function of the actual rate of employee turnover. This is because, although the number of employees does not change significantly over time, they are not necessarily the same people over time. Moreover, even if they are, the average workload increase over time is sure to lead to fatigue and lead to burnout – as has been reported in the literature that was reviewed and on which we based this study.

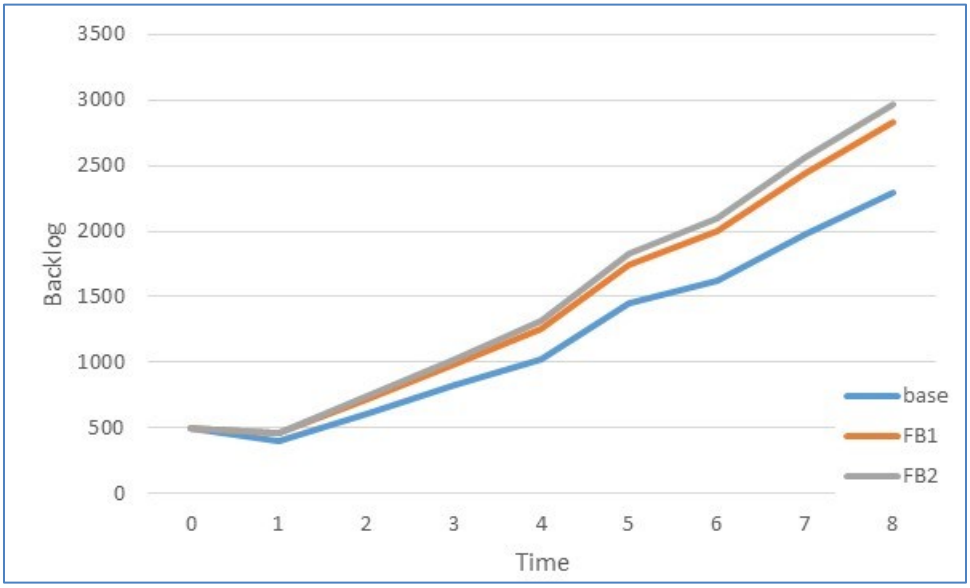


Figure 5: Behavior of backlog of work orders.

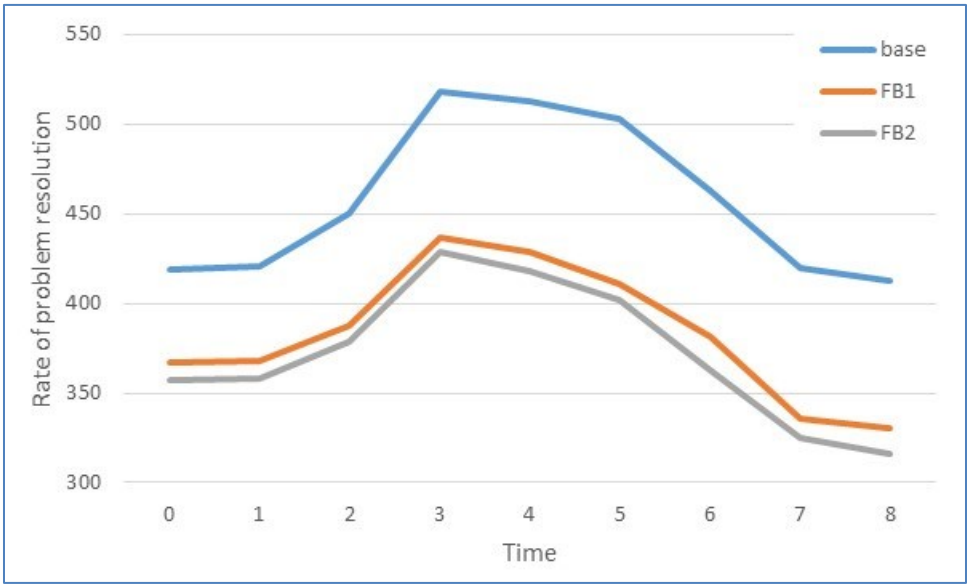


Figure 6: Rate of problem resolution (work orders per month).

These results show that management pressure (often seen as a source of solutions by management) is shown to be one of the sources of problems with respect to the rate of backlog resolution. However, as Pritchett, and Woolcock (2004) show that the solution approach is often the source of problems. This situation can also be characterized by the Icarus paradox – that shows improvement only to crash – a situation that Drummond (2008) refers to as a "destructive system." In the case of MedSys, the act of management pressure (that is done with good intentions) leads to managerial and worker fatigue. More often than not, such fatigue (a qualitative variable) is not accounted for by management and is not recognized as a legitimate decision making metric in management decision making. Our study has shown

how qualitative variables can be incorporated in process models and how they can be used as inputs for process improvement and as an argument for additional resources as and when needed.

## 6 CONCLUSION

Our system dynamics was able to provide alternative insights that has a real impact on stability – both in terms of productivity and turnover. These insights include the ability of senior leadership to develop a long-term project management vision versus an event-driven agenda so that staff (1) anticipate and counteract potential sources of fatigue through prioritization (2) develop strategies for completing work through a portfolio management process and (3) allow staff to communicate and negotiate realistic goals and problem resolution so that staff can return a department to a sense of control.

There are two main implications that arose from this research. The first was a tenable argument to provide more resources to facilities management. The second was to avoid work order peaks by spreading maintenance proactively – so that events like TJC visits do not create work load spikes. These spikes have lasting effects that impact the system long after such visits are completed.

Based on this phase of the project, we plan the following activities in the next modeling steps: (a) Calibrate worker fatigue and managerial fatigue based on additional data collection, (b) incorporate the impact of employee turnover, in addition to the number of managers and workers, on rate of problem resolution, (c) segregate work orders based on tier 1, tier 2 and tier 3 types and formalize the interactions between them to obtain a more nuanced view of the system, and (d) accounting for the inefficiencies due to rework and reassignment as a result of the mismatch between work order and worker dispatched.

## REFERENCES

Baxter, G., and I. Sommerville. 2011. "Socio-technical Systems: From Design Methods to Systems Engineering". *Interacting with Computers* 23(1):4-17.

Drummond, H. 2008. "The Icarus Paradox: An Analysis of a Totally Destructive System". *Journal of Information technology* 23(3):176-184.

Dyrbye, L. N., T. D. Shanafelt, C. A. Sinsky, P. F. Cipriano, J. Bhatt, A. Ommaya, and D. Meyers. 2017. "Burnout among Healthcare Professionals: A Call to Explore and Address this Underrecognized Threat to Safe, High-quality Care". *NAM (National Academy of Medicine) Perspective*. Washington, DC: National Academy of Medicine.

Hashim, A. E., Z. Isnin, F. Ismail, N. A. Norrihan, and R. Razali. 2017. "Occupational Stress and Behavioural Studies of Facilities Management Employees in Commercial Complex". *Journal of ASIAN Behavioural Studies* 2(5):57-64.

Kaplan, G. S. 2017. Systems Approach to Fix Healthcare. Published 15.4.2017. http://www.modernhealthcare.com/article/20170415/MAGAZINE/170419901, June 24, 2017.

Ling, F. Y. and D. M. Wong. 2016. "Redesigning Facility Mmanagement Operatives' Jobs to Increase Work Outcomes". *Journal of Facilities Management* 14(1):50-68.

Lloyd, K. J., D. Boer, J. W. Keller, and S. Voelpel. 2015. "Is My Boss Really Listening to Me? The Impact of Perceived Supervisor Listening on Emotional Exhaustion, Turnover Intention, and Organizational Citizenship Behavior". *Journal of Business Ethics* 130(3):509-524.

Marshall, D. A., L. Burgos-Liz, M. J. IJzerman, N. D. Osgood, W. V. Padula, M. K. Higashi, and W. Crown. 2015. "Applying Dynamic Simulation Modeling Methods in Healthcare Delivery Research—The Simulate Checklist: Report of the ISPOR Simulation Modeling Emerging Good Practices Task Force". *Value in Health* 18(1):5-16.

Roberts, N., D. Anderson, R. Deal, M. Garet, and W. Shaffer. 1983. *Introduction to Computer Simulation, A System Dynamics Modelling Approach*. System Dynamic Series. Portland, Oregon: Productivity Press.

Montgomery, A., K. Doulougeri, K. Georganta, and E. Panagopoulou. 2013. "Organizational Health Intervention Research in Medical Settings". In *Salutogenic Organizations and Change*, edited by G. F. Bauer and G. J. Jenny, 37-54. Dordrecht, The Netherlands: Springer.

Morecroft, J. D. 1982. "A Critical Review of Diagramming Tools for Conceptualizing Feedback System Models". *Dynamica* 8(1):20-29.

Moss, M., V. S. Good, D. Gozal, R. Kleinpell, and C. N. Sessler. 2016. "An Official Critical Care Societies Collaborative Statement—Burnout Syndrome in Critical Care Health-care Professionals: A Call for Action". *Chest* 150(1):17-26.

Noseworthy, J., J. Madara, and D. Cosgrove. 2017. "Physician Burnout is a Public Health Crisis: A Message to our Fellow Health Care CEOs". Health Affairs Blog, published 28.03.2017. http://healthaffairs.org/blog/2017/03/28/physician-burnout-is-a-public-health-crisis-a-message-to-our-fellow-health-care-ceos/, accessed June 24, 2017.

Parker, S. K., F. P. Morgeson, and G. Johns. 2017. "One Hundred Years of Work Design Research: Looking Back and Looking Forward". *Journal of Applied Psychology* 102(3):403-420.

Pritchett, L. and M. Woolcock. 2004. "Solutions when the Solution is the Problem: Arraying the Disarray in Development". *World Development* 32(2):191-212.

Sorenson, C., B. Bolick, K. Wright, and R. Hamilton. 2016. "Understanding Compassion Fatigue in Healthcare Providers: A Review of Current Literature". *Journal of Nursing Scholarship* 48(5):456-465.

Tilburt, J. C., M. K. Wynia, R. D. Sheeler, B. Thorsteinsdottir, K. M. James, J. S. Egginton, M. Liebow, S. Hurst, M. Danis, and S. D. Goold. 2013. "Views of US Physicians about Controlling Healthcare Costs". *Journal of the American Medical Association* 310(4):380-389.

Wikipedia. 2018. The Joint Commission, https://en.wikipedia.org/wiki/Joint_Commission, accessed December 30, 2017.

## AUTHOR BIOGRAPHIES

**SHIVRAJ KANUNGO** is Associate Professor of Decision Sciences and of Information systems at the George Washington University and conducts research on IT value in organizations, software process improvement, and the relationship between organizational culture and IT value using multiple approaches that include statistical modeling, system dynamics modeling and social network analysis. Journals that have published his research include System Dynamics Review, Decision Support Systems, European Journal of Information Systems, Strategic Information Systems, International Journal of Information Management, International Journal of Information Systems, Software Process: Improvement and Practice, Information Technology and People, Computers in Human Behavior, Systems Research and Behavioral Science, International Journal of Human-Computer Interaction, Journal of Information and Knowledge Management Systems and International Journal of Knowledge Management. His email address is kanungo@gwu.edu.

**NANCY BAN** is Vice President of The Results Management Office at Central Maine Healthcare in Lewiston, ME. She is responsible for driving the development and implementation of system-wide strategic initiatives to achieve the organization's strategic goals and continued operational improvements. Nancy received her B.S. in communications from Florida State University in Tallahassee, F.L., and her M.A. in corporate and strategic communications from Seton Hall University in South Orange, N.J. She's currently pursuing her Healthcare MBA from George Washington University in Washington, D.C. Her email address is banna@cmhc.org.