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Region Report

Sustainability-by-Constraints: The Covid-19 crisis

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Abstract

Healthcare crises occur occasionally and are very disruptive and resource-consuming. The Covid-19 pandemic provided an example of inefficient wasteful resource management that would be unsustainable in the long term. This paper presents a framework for sustainable crisis management that will apply to future crises. The methodology is also applicable to other pandemics, wars, multi-casualty natural disasters, industrial disasters, etc. A validated methodology to confront high-intensity crises by better-using resources is presented. Attention focuses on rapid crisis resolution such as lockdowns. Despite unprecedented investments in healthcare, lack of capacity and timeliness are still problems affecting every country, even the wealthier ones. During the Covid-19 pandemic, some healthcare systems around the world collapsed. For example, Brazil, Spain, Italy, and more. This is due to the lack of a clear methodology for handling such crises.

This paper presents a resource-based methodology to cope with healthcare crises considering three scenarios: "Peace", "War" and "Tsunami". The paper outlines a methodology for identifying the system bottlenecks for coping with the crisis in each scenario by using established simple tools. These tools assure significant resource frugality that will enhance sustainability. The paper also analyses where the system constraint should be and prescribes how to prepare for such scenarios. A large medical center case study demonstrates our approach. During "Peace" times, evolutionary strategies should be used exclusively. During "War" times, a hybrid–evolutionary/disruptive (revolutionary) strategy should be employed. During the "Tsunami" scenario, one should rely only on the disruptive (revolutionary) strategy. This methodology can be extended to other scenarios and other lines of research.

Keywords: Sustainability, Environment, Social, Governance, Covid-19, healthcare crisis, constraint management, disruptive methods

Introduction

The American Hospital Association (AHA) defines sustainability in healthcare, as "the integration of environmental stewardship, social equity, and fiduciary responsibility to support healthy, equitable, and resilient environments and communities over time" [https://www.aha.org/sustainability]. Despite unprecedented investments in healthcare, lack of capacity and timeliness are still problems affecting every country, even the wealthier ones [1]. Leadership in many countries believes that a lockdown (full or partial) is the only way to prevent the collapse of the healthcare system during drastic increases in Covid-19 pathology. The argument states that such an event will flood hospitals with patient volumes that they cannot handle. Indeed, in some countries, the lockdown was the case: China, India, Brazil, Spain, Italy, parts of the U.S., and others.

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This paper presents a resource-based approach to the problem using the Theory of Constraints (TOC). The TOC's focus on effective and efficient resource utilization goes hand in hand with the objective to reduce the hospital's ecological footprint. Section 2 provides a literature review of Covid-19 management and policy. Section 3 presents the TOC and its application in healthcare management. Section 4 defines three potential hospital load scenarios. Section 5 presents a case study that will accompany the application of the various scenarios. Section 6 presents the evolutionary methodologies to cope with these scenarios Section 7 presents the disruptive (revolutionary) methodology; Section 8 concludes the analysis and provides effective tools for the management of future pandemics and suggestions for future research. This paper presents an innovative sustainable managerial methodology in health crisis management.

Covid-19 Management Strategies and Policies

Several studies in recent years related to various management strategies and policies regarding Covid-19. Atabekova [2] explores university discourse as a conceptual-communicative macrostructure that verbally represents international organizations and university policies and activities to support youth's sustainable development amidst Covid-19. Ferrannini et al. [3] argue that a turning point in the connection among industrial policy, sustainability and development has been reached, highlighting the need to rethink its theoretical foundations as well as its governance and implementation processes for a new role in our post-Covid-19 societies. Boretti [4] analyzes Covid-19 fatalities across Europe and shows that strict lock-down strategies were not more effective and advocates to return to strategies before the lockdown period, with full compliance with preventive health instructions and social divergence, and care to protect the highest-risk groups from infection, especially for the elderly and those with chronic and respiratory diseases. Begum et al. [5] explain and describe the potential ways to control Covid-19′s impact on the environment and what controllable strategies and anticipations emerge from rethinking sustainable production. In a review article, Abubakar et al. [6] focus on the indirect effects of various measures taken to combat Covid-19, towards a sustainable environment. Arora and Mishra [7] also discuss the impact of Covid-19 on environmental sustainability. Jin and Jakovljevic [8] talk about how China controls the Covid-19 epidemic through public health expenditure and policy. Lin and Tsai [9], in an editorial, discuss new thoughts on real estate from a special lens of public health economics and interdisciplinary health sciences and relate to the relation to Covid-19 pandemic. Jin and Qian [10] discuss items of the Chinese public health expenditure and evaluate the Chinese government's performance, to help the government perform better in public health. None of these papers discuss strategies to deal with masses of patients in different scenarios. Our study looks at ways to cope with situations with mass casualties as was the situation in various countries during the height of the Covid-19 pandemic.

Theory-of-Constraints and its application in health-care management.

TOC is a managerial approach developed by Goldratt and Cox, [11] that was applied successfully in hundreds of organizations, many of which in healthcare systems, leading to rapid and significant improvements. TOC was conceived in manufacturing settings, and from there it moved to project management [12] and to service organizations. In the last twenty years, TOC has been applied in complex healthcare systems around the world [13-19]. TOC focuses the organization's attention on the few resources – Bottlenecks - that prevent the organization from reaching its goal. Gustavo et. al. [1] analyzed 42 TOC implementations (15 full-text articles, 12 video proceedings, and 2 theses/dissertations) from major scientific electronic databases and TOC International Certification Organization Conferences. All implementations reported positive outcomes, both tangible and intangible. The two main improvements reported by the authors were productivity (98%; n = 41) – more patients treated, and the timeliness of care (83%; n = 35). Furthermore, the selected studies reported dramatic improvements: 50% reductions in mean patient waiting times; a 38% reduction in patient length of stay; a 43% mean increase in operating room productivity, and a 34% mean increase in throughput. TOC implementations attained positive results at all levels of the health and social care chain. Most TOC recommendations and changes showed almost immediate results and required little or no additional costs to implement. Evidence supports TOC as a promising solution for the chronic healthcare problem, improving quality and timeliness, both necessary conditions for providing effective healthcare. One of TOC's most effective tools is hereby presented in the "Seven Focusing Steps". Orderly application of these seven steps results in significant improvement in throughput and response-time reduction while at the same time improving clinical and service qualities. TOC's seven steps are based on Operations Research tools such as Linear Programming [20]. TOC was adapted to healthcare management as outlined hereby. TOC methodology uses the Satisficer approach as it produces sufficiently acceptable solutions that result in significant improvement of the organization's performance and are achieved in a relatively short period. Gustavo et. al. [1], Mabin et. al. [21], and Mabin and Balderstone [22] provide the more successful application of TOC in healthcare.

The Seven focusing steps

The seven steps of TOC's application in healthcare are presented in Figure 1.

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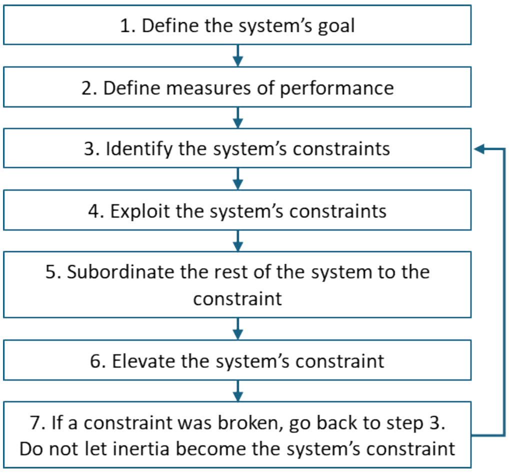

Figure 1: The seven focusing steps of TOC

1. Define the system's goal(s):

When defining the system's goal, one must identify the system being analyzed. In the case of the Covid-19 pandemic, we analyze the national healthcare system and its economic arena. Thus, the goals are to treat Covid-19 patients as best as possible, prevent contamination, and provide continuous treatment to the entire patient population, while monitoring the cost to the economy. During crises, there is a tendency to skip the definition of the goal, as it seems obvious, and to move straight to problem solutions. Defining the Goal is of great importance, particularly in not-for-profit organizations.

2. Define measures of performance:

A system behaves according to its Key Performance Indicators (KPIs). The following KPIs should be focal when confronting the Covid-19 pandemic:

a. Number of Covid-19 patients;

b. Number of new Covid-19 patients during the measurement period;

c. Average number of Covid-19 patients infected by each Covid-19 patient (Ro);

d. Number of relevant medical teams (defined later);

e. Number of carriers identified by tests;

f. Covid-19 death toll;

g. Amount of waste generated by the system;

h. Increase in Carbon emissions;

i. Response time measures: time from contamination to identification; and from identification to patient release;

j. Number of patients on ventilators.

The role of the KPIs is to help decision-making by providing decision-makers with feedback to identify successes and failures in system management. In most cases, the system must compete with itself and perform continuous improvement in a Satisficer approach by setting challenging, achievable objectives. The common approach of setting challenging benchmarks derived from other countries or organizations does not lead to the coveted result. Setting objectives should take into account the system's condition on one hand and the medical requirements on the other.

3. Identify the system constraints:

A constraint is defined as a resource in shortage preventing the system from achieving a better performance level relative to the goal [13]. A process flow chart of the system should be drawn [13] (48), to better analyze and understand the patient treatment flow.

There are four constraint types:

a. Resource constraint – Bottleneck. A resource constraint is the most loaded resource so it cannot perform all tasks assigned to it. This is the resource that constrains the performance of the whole system. The bottleneck is usually the most expensive and scarce resource. During "Peaceful times" habitually, the bottlenecks in surgery are anesthetists, and in Emergency Departments (EDs) ED experts are the bottleneck. In imaging institutions, we often identify the constraint as MRI machines or imaging analysts. During "War times", as is the case today as we fight Covid-19, internal medicine experts, anesthetists, intensive care (ICU) nurses, and ED surgeons (hereby defined as medical teams) constitute the system's bottleneck. The number of medical teams keeps shrinking due to the contamination of medical teams by the virus and the need for quarantine. Other resources must not become bottlenecks: test kits, laboratories, ventilators, and personal protective equipment. It is highly probable that in future crises, medical teams will likewise constitute the system's bottleneck.

b. Market constraint (excess capacity). A market constraint occurs when the system has extra capacity and can treat additional patients.

c. Dummy constraint. A dummy constraint is a case when the system's bottleneck is an extremely inexpensive resource relative to the other resources in the system. This is a situation where the system's capacity is constrained by a resource of negligible cost. For example, a shortage of janitors or operating room patient transporters, or a shortage in Covid-19 testing swabs. Shortages in testing kits and personal protection equipment are defined as dummy constraints since they are relatively inexpensive resources that are meant to be in excess. Dummy constraints must be resolved in haste.

d. Policy constraint. A policy constraint is the adoption

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of an inappropriate policy constraining the system's performance and achievement of the goal, and at times operates dramatically against the organization's goals. This is a situation where inappropriate policy is the system constraint. Policy, as a rule, is a positive element. Every organization must set policies on a range of important issues. However, a policy that was excellent in the past (as well as in "Peaceful times"), may become a policy constraint once environmental changes occur ("War times"). The Covid-19 system is afflicted by multiple policy constraints. Most policy constraints emanate from the application of a uniform policy in all conditions and from inappropriate KPIs. For example, applying the "number of tests performed" as a performance indicator will result in a loss of focus on the test targets, which are to perform sampling testing on one hand, and identifying virus carriers on the other. This is therefore a measure that should not be maximized or minimized. The "number of tests" is a measure of input rather than a measure of the system's output. Appropriate throughput measures are the number of new patients and the number of severely ill patients. Another policy constraint is the failure to test all suspected patients and the failure to train enough teams and labs to perform tests. Labs must work three shifts per day, if required, to establish protective capacity. Protective capacity takes into account fluctuations in the process. These are disturbances, mishaps, and uncertainty hindering performance. An excellent example of a policy constraint is the Ministry of Health's insistence on performing all tests in the ministry's labs rather than using dozens of other labs. At many hospitals around the world, ventilators are a bottleneck, and efforts are made to increase their quantity. It is of utmost importance to identify the constraints of complex health systems on the one hand and where the constraint should be, on the other. Focusing on the bottlenecks of complex systems frees managerial attention to important issues and the promotion of the goal.

4. Exploit the system's constraint:

Once a bottleneck is identified it should be exploited in two modes:

a. Efficiency – ascertaining that the bottleneck is fully utilized;

b. Effectiveness- ascertaining that the bottleneck is assigned tasks or a patient mix that maximizes the performance measures.

"Medical teams" are a bottleneck, and they are the expensive resource that management attention should be dedicated to. To achieve healthcare effectiveness, two treatment entities must be established: one for Covid-19 patients hospitalized in separate wards and the other for the rest of the routine patients. A minimal number of bottleneck physicians will be dedicated to serious Covid-19 cases. Most medical teams would be assigned to the treatment of "regular" patients. To ascertain that the bottleneck functions with efficiency and safety, a demonstrated procedure is to prevent staff from one shift from overlapping with other shifts. To minimize exposure, physicians will be selected from the hospital's regular staff and will support Covid-19 departments as consultants, as is the practice with the ICU or the ED. Only a small percentage of Covid-19 patients require the attention of a physician, and most of them require a nurse or paramedic trained to treat them. Since medical teams are susceptible to Covid-19 infection, particular attention should be devoted to their protection through routine tests and protective gear. Medical teams mustn't deteriorate to fatigue or exhaustion. Shortage of people and testing swabs is a "policy constraint". It happens in complex health systems where the focus is lost in an attempt to simultaneously maximize the utilization of all resources. We advise creating an excess (protective redundancy) of all resources and striving to reach a situation of a single bottleneck – physicians, which can be managed effectively and safely.

5. Subordinate the rest of the system to the constraint (the bottleneck):

All non-bottleneck resources (other physicians, nurses, physician assistants, technicians, paramedics, logistic decisions, patient prioritization, etc.) are subordinated to the medical teams. The "Covid-19 wards" will be subordinated to the hospital's routine management. In case of conflict, treatment should be prioritized according to the medical condition and bottleneck availability. Subordination should be performed according to the Pareto methodology. Many are familiar with the Pareto rule (the 20/80 principle) and the Pareto methodology is a practical extension of this rule [13]:

a. Classification;

b. Differentiation;

c. Resource allocation.

Classification will break patients into two groups:

a. High-risk Covid-19 patients, and elderly, non-Covid-19 patients with background afflictions. These patients constitute about 10% of the Covid-19 population and consume 90% of the bottleneck resources. This population includes patients in geographic regions with high local contamination rates; and

b. Low-risk patients who constitute 90% of the Covid-19 patients and consume merely 10% of bottleneck resources.

The significance of the differentiation is in forming a different treatment policy for each group. Group A will be

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treated by expert internal medicine doctors, anesthetists, and ICU physicians. Group B will be treated mainly by non-bottleneck doctors and nurses.

6. Elevate the system's constraint:

Offloading implies the creation of additional medical resources by transferring some of the bottleneck tasks to other resources:

a. Define "Covid-19 supporters" who are not bottlenecks: medical assistants, paramedics, military medical teams, and medical students;

b. Transfer medical tasks from hospital physicians to" Covid-19 supporters";

c. Prepare for home quarantine of Covid-19 patients through telemedicine and self-test kits;

d. Transfer those exposed to patients to home quarantine;

e. Train non-Covid-19 professional physicians to perform some "medical team" duties.

The Offload mechanism encapsulates significant potential to elevate bottleneck resources. The application of remote monitoring reduces the burden on hospitals. Patients receive equipment that reports their medical status via the web, and they are treated remotely as long as their condition is sound. Experience shows that during "peaceful times", offloading physician duties to nurses constitutes a win/win solution for both: decreasing the burden on doctors and professional empowerment to nurses.

The offloading mechanism must also be applied in decisions about the purchase of critical equipment. Simple, available equipment can be used for light patients, thus freeing sophisticated equipment for patients requiring it.

The offloading mechanism should also be applied in decision-making processes. During the current crisis, most decisions were made by excessively senior ranks, both in "peaceful times" and "war times". For example, exit from lockdown characterization was determined by the Covid-19 regulator. Decision-makers should delegate authority to lower professional cadres. Otherwise, the decision-making process itself will become the bottleneck paralyzing the whole system.

7. If the constraint is broken, return to step 3:

Identifying the new constraint, do not let inertia become the next constraint: once medical teams cease being bottlenecks, there is a new resource that takes their place. In the Covid-19 crisis, we have observed a decline in the number of afflicted, thus turning bottlenecks (medical teams) into resources with protective capacity. In such situations, the number of medical teams dedicated to the treatment of Covid-19 patients should be reduced and they should be freed to treat routine patients. During the crisis, 80%-90% of medical personnel should be allocated to the treatment of regular patients and only 10%-20% to Covid-19 patients. Many policymakers made the opposite decision: release regular patients and convert more and more wards to Covid-19 wards. If the above-mentioned differentiation between A-type patients (severe Covid-19 patients) and B-type patients (light Covid-19 patients) is maintained, there is no need to establish more and more Covid-19 wards and there is no need to allocate bottlenecks to the treatment of patients in these wards.

Resource load scenarios

Figure 2 presents the three load/capacity scenarios for hospitals: "Peace", "War" and "Tsunami". An increase in resource load/capacity results in a corresponding increase in environmental footprint. Resources operating beyond their capacity generate significantly greater amounts of waste and harmful environmental impact. The "Peace" time scenario is the normal overload situation in a hospital.

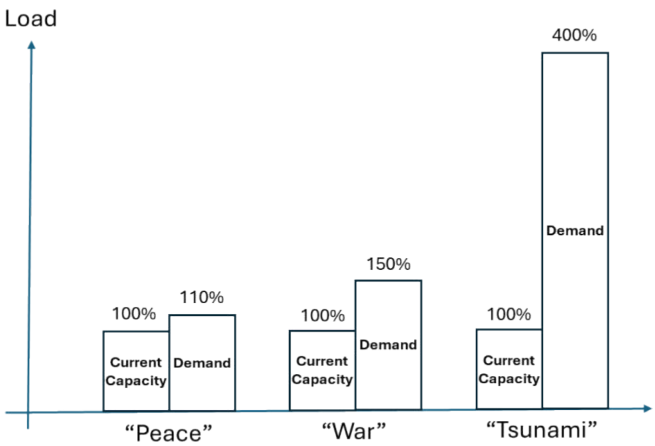

Figure 2: Peace, War, and Tsunami scenarios

During "Peace" times, hospitals are usually 10%-20% short in resources. To overcome bottlenecks, managers apply evolutionary methods such as constraint management, the complete kit concept, etc. This is the normal condition in hospitals where there are fluctuations in supply and demand. Bottlenecks in this situation are typically medical crews: senior physicians and experienced nurses. During "War" times, such as during the Covid-19 pandemic, the need for resources exceeds capacity by over 50%. To overcome this shortage, managers use the above-mentioned evolutionary methods but must also apply revolutionary methods. Here too, system bottlenecks are typically the medical crews. The first step is to create a protective capacity by rapid deployment of auxiliary hospitals. Converting internal medicine wards to Covid-19 wards, postponing elective surgeries, etc. Medical crews work significantly harder, and effort must be made to offload them through nurses, paramedics, physician assistants, etc. "War" scenarios require a hybrid application of evolutionary and revolutionary actions.

During "Tsunami" times, thousands of patients storm hospital emergency departments. In this scenario, revolutionary methods must be applied. Since the bottlenecks remain in medical crews, the policy should be to hospitalize a minimum number of patients and send the majority back to their communities. Evolutionary steps in the "Tsunami" scenario are a waste of managerial energy as they focus on double-digit improvement rather than on an "order of magnitude" increase. Anyway, for "Peace" and "War" scenarios, the Theory of Constraints (TOC) can serve as an effective tool to increase capacity. During "Peace" times, evolutionary strategies handle the excess demand peaks. During "War" times, a hybrid evolutionary/disruptive (revolutionary) strategy should be applied. During "Tsunami" times, a disruptive (revolutionary) strategy should be applied exclusively.

TOC has proved an effective tool for increasing capacity in crises. Woepple [23] was hired by BP to fight the oil spill in the Gulf of Mexico. Some other supplies were the constraint. He had a couple of TOC experts go to suppliers around the globe and increase their capacity (of an already engineered production system) by up to 400% in a matter of days.

A Case study

Medical Center X is a large Israeli university medical center consisting of over 1,000 beds. Each year, patients from the area and beyond entrust their health to the Medical Center's dedicated team of medical professionals. Annually the medical center treats 400,000 patients, performs 36,000 surgeries, and accepts 1.8 million patient visits, 220,000 ED visits, and 12,000 births. The management team was knowledgeable of the TOC methodology either from their studies at the university's Healthcare Management program or through dedicated workshops given at the hospital. During the Covid-19 pandemic, three additional workshops were conducted specifically for this purpose. The campus spans over 2.7 million square feet (250,000 square meters). The Medical Center features a General Hospital, a Hospitalization Tower, a Children's Hospital, a Heart and Brain Building, and a Maternity and Women's Hospital. The following is based on our close acquaintance with the medical center before and during the Covid-19 pandemic. During "Peace" times, some of the units handle 100%-120% loads. During the Covid-19 "War" lockdown, demand exceeded the hospital capacity by about 50%. The medical center has prepared itself for the "Tsunami" scenario but did not encounter it.

Evolutionary Methodologies

There are several tools to cope with each scenario. These tools fall into one of two categories: Evolutionary and Disruptive (revolutionary) change. Evolutionary change or "hill climbing" optimizes performance within given processes. Such evolutionary tools include the Theory of Constraints (TOC) seven-step methodology and the Compete Kit concept. The disruptive (revolutionary) change consists of radical changes to processes (even up to cancellation) that will bring significant results. The "Disruptive Methodology" is a tool used to achieve revolutionary change.

In the Theory of Constraints Covid-19 applications in healthcare systems, we often face resource constraints – bottlenecks. Expensive resources or temporary loads during peak times create resource constraints in the system. A market constraint is a case when the system has excess capacity. Dummy constraints are extremely cheap bottlenecks that must be quickly eliminated. Policy constraints result from erroneous policies and rules set by the organization (usually out-of-date ones) that hinder performance. Bottleneck identification is achieved by exploring the work areas, interviewing people, and using process flow diagrams, and load analysis.

Ronen et al. [13] provide many examples of successful applications of these methods in healthcare systems. They all result in significant improvements in throughput, reduction of response times, increase in patient and worker satisfaction, and quality improvements. The use of TOC is very productive in "Peace" and "War" times. During "Peace" times, the load is typically between 100%-120% and is concentrated in the Emergency Department (ED), internal medicine wards, and imaging services. Using TOC, the bottlenecks were identified: experts and interns in emergency medicine in the ED, internal medicine experts and interns, and senior and experienced nurses. In the imaging services, the CT equipment was the bottleneck. During "Peace" times these three bottlenecks can be overcome by offloading the physician load to experienced nurses, paramedics, etc.

During "War" time, as was the case during the recent lockdowns, the bottlenecks were medical teams (emergency medicine experts, internal medicine experts, experienced nurses, intensive care experts, and anesthesiologists). All other resources could cope with their load. The number of Covid-19 patients in critical condition determined the overall hospital load. The total number of hospitalized Covid-19 patients reached 1,200. Healthcare leaders feared the occurrence of a "Tsunami" scenario as was experienced in Italy and Spain. As a result, the lockdown in the country was determined by the total number of serious and critical patients. Even such a large and complex crisis can be simplified by TOC's focusing mechanism. By increasing the capacity of small and well-defined resources, lockdown decisions can be reconsidered when compared with their dramatic impact on the economy.

The Complete Kit Concept

The Complete Kit (CK) concept and its theoretical background are easy to understand and not too difficult to implement. This managerial tool has been implemented in various organizations with a high success rate. It is easy to adapt to every environment and situation, providing many benefits in a relatively short time. We present here the concept of the CK and show how it can be implemented in the health care system and demonstrate successful accomplishments in numerous medical processes such as emergency departments, operating rooms, and imaging departments. It is relatively easy to adapt in the healthcare environment and provides many benefits to healthcare organizations in a relatively short period, as in other industries today [14, 20]. This section discusses the complete kit concept and its implications for better healthcare management [24]. A complete kit in health care is the set of components and materials, medical documents, medical materials, laboratory results, and other information needed to complete a given medical procedure, process, or task. To properly implement the complete kit concept, one must train and educate executives, managers, physicians, nurses, and other paramedical staff. The complete kit concept was applied at Medical Center X in the ED when calling on expert consultants. During "Peace" and "War" times, the complete kit halved waiting times for CT results, which is crucial for patient treatment decisions.

Disruptive (Revolutionary) Methodology

To deal with the "Tsunami" scenario, we need revolutionary tools such as the disruptive seven steps [25]. We will demonstrate the application of the seven-step methodology by using it in a "Tsunami" scenario. Figure 3 presents the seven steps of the disruptive methodology.

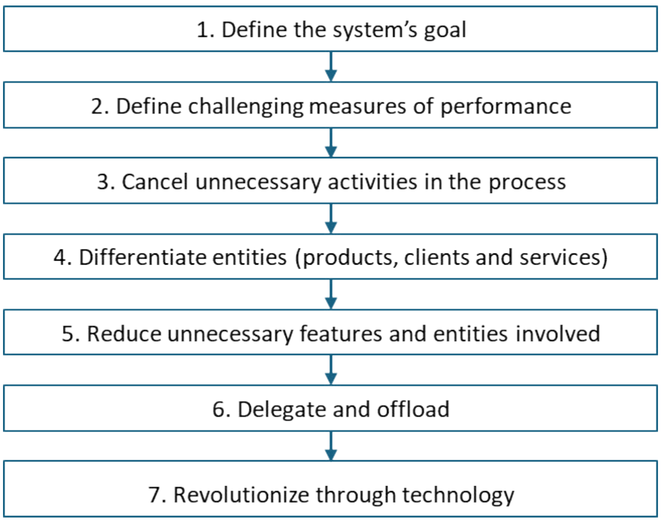

Figure 3: The seven steps of the disruptive methodology in healthcare

1. Define the system's goal

Organizational processes are created to increase the organization's value. Value enhancement consists of more throughput, less operating expenses, and better quality. We should carefully define each process goal.

2. Define challenging performance measures

Goals must be challenging yet achievable. A challenging goal forces executives to think outside the box and realize that the goals are unachievable in the current paradigm. In many cases, we should challenge the set of proper performance measures and the definition of individual performance measures. For example, a hospital measured the efficiency of use of its operating rooms (OR) as the percentage of time that the room was utilized. This resulted in surgeons extending patient stays in the ORs rather than canceling unnecessary activities in the process, reducing interpatient setup times or other throughput-increasing actions.

In addition, many processes are complex and involve several service units. Measurement should include the entire process, even though each service/business unit is responsible for only part of it. Enforcing a single service level agreement (SLA) motivates cooperation to achieve the required one.

3. Cancel unnecessary activities in the process

Canceling unnecessary activities is accomplished in two ways: using a process flowchart to analyze current activities and aggressively eliminating redundant activities; or, more effectively, building a new process from scratch. In some cases, the best way to improve a process is to cancel it altogether.

4. Differentiate entities (products, clients, and services)

One size does not fit all. The Pareto methodology consists of three steps: classification, differentiation, and resource allocation. Classification means to classify products, clients, and services into three groups:

1. The A group comprises 20% of products, clients, or services that contribute 80% of the value. These are the vital few entities that generate most of the value.
2. The B group comprises 30% of products, clients, or services that account for 10% of the value.
3. The C group comprises 50% of products, clients, or services that account for 10% of the value.

Differentiation means different policies for each group. Resource allocation implies that more resources are allocated to the A group, fewer to the B group, and even less to the C group.

5. Reduce unnecessary content and entities involved

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The 25/25 principle states that 25% of projects should be eliminated or canceled. The remaining 75% must be tapered, and 25% of the content should be removed [20]. For example, the admission office in one hospital was dealing with both admission and discharge of patients. After analyzing the process using the disruptive methodology, they concluded that in 85% of the cases, patients do not need to go through the admission office again.

6. Delegate and offload

A significant part of the activities should be offloaded to other members of the team. Many processes can be delegated to the customer for self-service. This already is the case with digitalization, where many activities are available via mobile devices with no intervention by professionals.

7. Revolutionize through technology

After following the first six steps, it is time to turn to technology for revolutionary impact. The dilemma is between the best-of-breed strategy, where optimal solutions are selected resulting in expensive and awkward integration, or the best-of-suite, where solutions are less revolutionary but operate together seamlessly.

Discussion

The contribution of this paper is managerial innovation focused on sustainability. We refute the belief that “overdoing” improves the system’s throughput. Overdoing dramatically increases the system’s environmental footprint, thus hurting sustainability. The “Peace” scenario was the routine condition in which medical centers were operating before the Covid-19 pandemic – hospital demand slightly exceeded the available resource capacity. In this scenario, hospitals confronted known bottlenecks: the primarily continuous shortage of medical teams and experienced nurses. Hospitals have been confronting this situation throughout the year, including during the flu epidemic, using established bottleneck management techniques and the application of the complete kit concept. The “War” scenario was the situation experienced when rising numbers of Covid-19 patients led to the first two lockdowns in Israel. During “War” scenarios, Medical Center X encountered peaks when demand exceeded capacity by 50% to 150%. Here the medical center implemented disruptive (revolutionary) strategies such as converting internal medicine wards into Covid-19 wards and opening provisional “field hospitals” in parking lots. During the “War” scenarios, the bottlenecks were still medical crews and experienced nurses. The medical center passed these difficult times without collapsing thanks to focused management of the bottlenecks and laudable devotion, leadership, and tenacity vis-à-vis formidable individual and systemic loads. Experience gained during the pandemic demonstrates that the agility of the human resources in the healthcare system is impressive and throughput increased dramatically without experiencing a collapse of medical crews. A synthesis of authority and duty delegation from physicians to nurses and from nurses to assistants accompanied by resource pooling significantly increases capacity without medical crew attrition.

The real concern arises from the “Tsunami” scenario where demand grows by hundreds of percent and the system faces the threat of collapse – as was the situation in Italy and Spain. In the “Tsunami” scenario, the system must switch to crisis mode and apply a disruptive (revolutionary) strategy: establishing a broad home-care system, creating emergency medical services, postponing elective surgeries, increasing the capacity of alternative hostels, and national initiatives to accelerate rapid discharge, etc. Some of these strategies were successfully applied during the lockdown periods and demonstrated that the systems did not reach a point of collapse. This paper deals with healthcare crisis management during pandemic times. The leaders must diagnose the condition the organization is in and act accordingly. The concept is applicable in other “code brown” crisis management scenarios such as chemical or nuclear massive accidents, natural disasters, etc. Many leaders respond intuitively to such crises. By establishing a resource management methodology, we strive to facilitate a dialogue within the team and also among teams that have not worked together in the past. Please note that the methodology requires minimal managerial training and team practice. This methodology is not for routine application but rather for deep crises.

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