Using Health Systems Research and Improvement Science to Improve and Protect the Healthcare Workforce

Healthcare Workforce Stress, Burnout, and Resiliency Panel
HRSA

June 17, 2022

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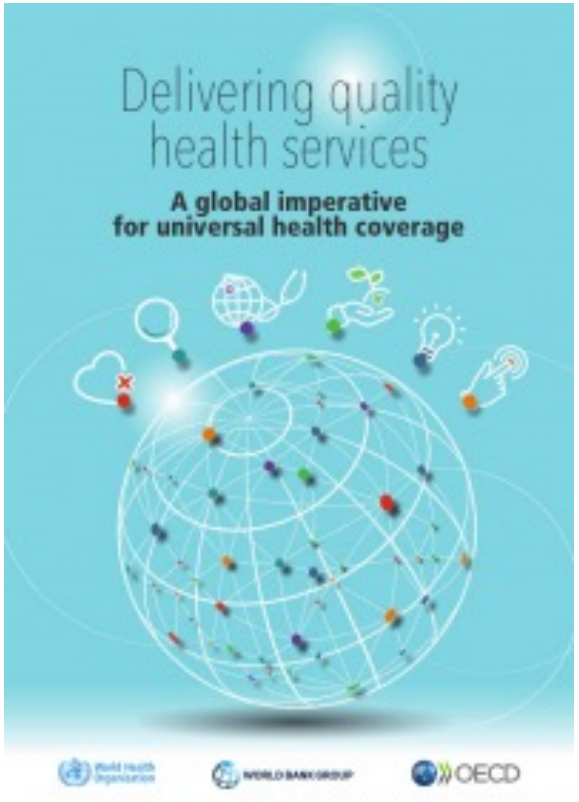
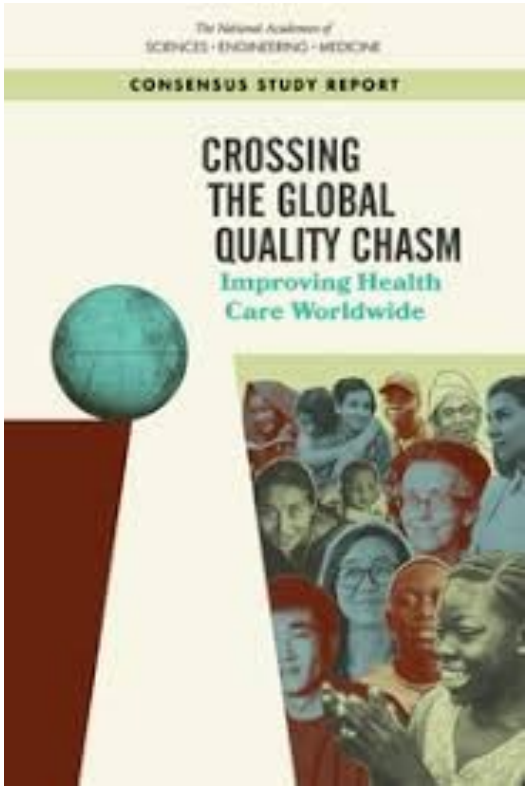
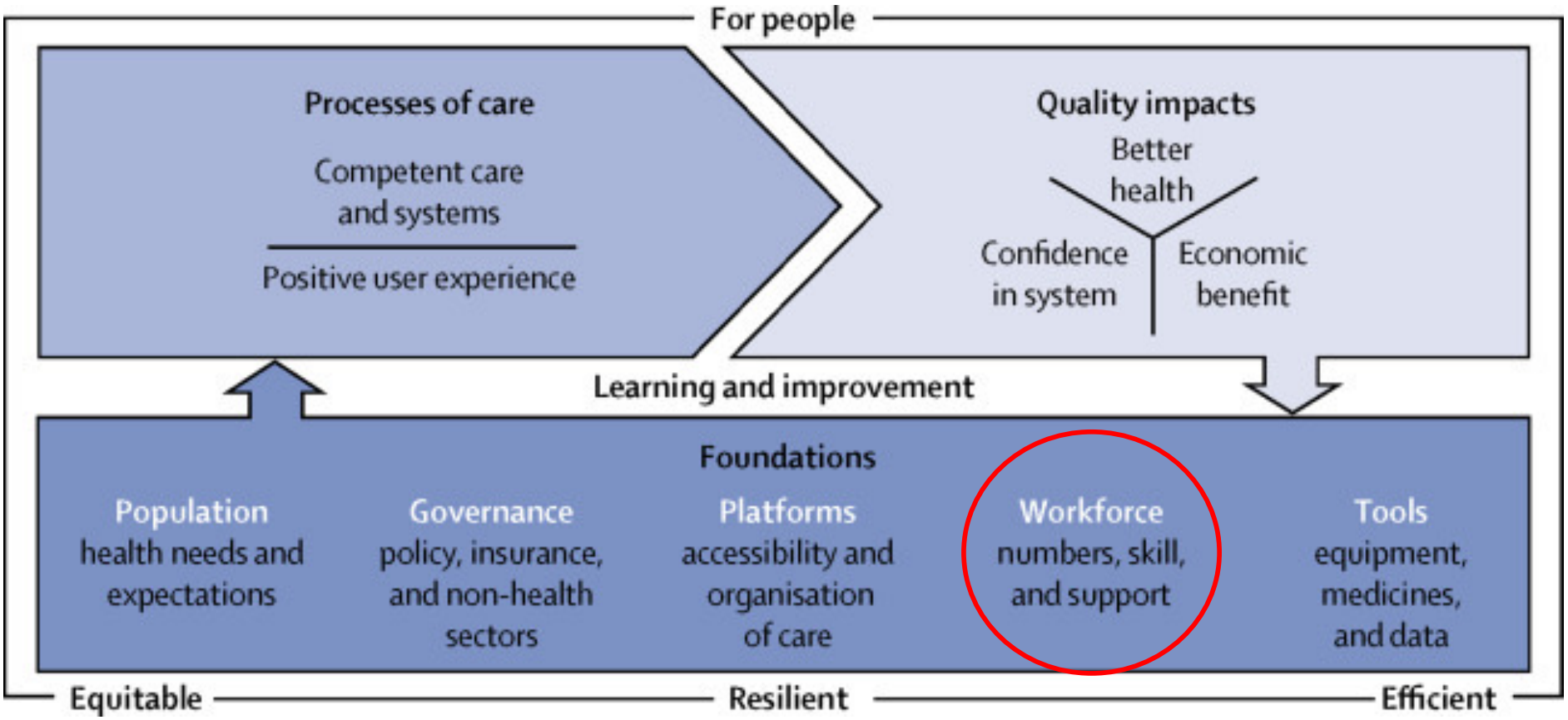
Global Health Quality – Recent Reports





High Quality Health System Framework

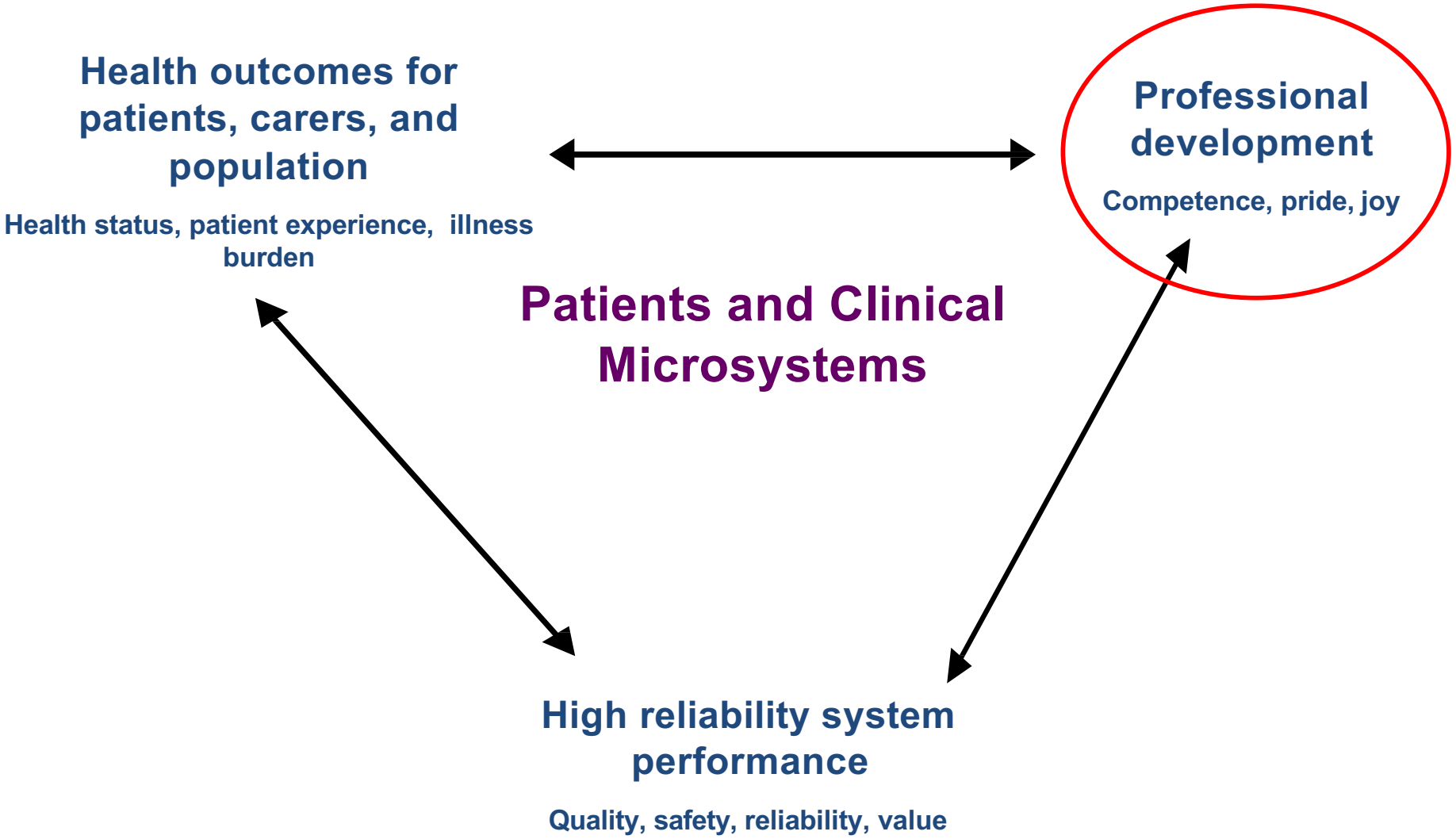


HQSS

The Lancet Global Health Commission on **High Quality Health Systems** in the **SDG Era**

Lancet, 2018

Aims in Redesigning the Healthcare Delivery(Learning) Systems



Adapted from Batalden, PB; Davidoff, F. What is "quality improvement" and how can it transform health care?" Qual Saf Health Care 16(1): 2-3, 2007

WHAT IS IMPLEMENTATION SCIENCE

- ***Implementation Science*** *is the study of factors that influence the full and effective use of innovations in practice.*
- ***Implementation*** *is specified set of activities designed to put into practice an activity or program of known dimensions.*

Source: National Implementation Research Network (2015)

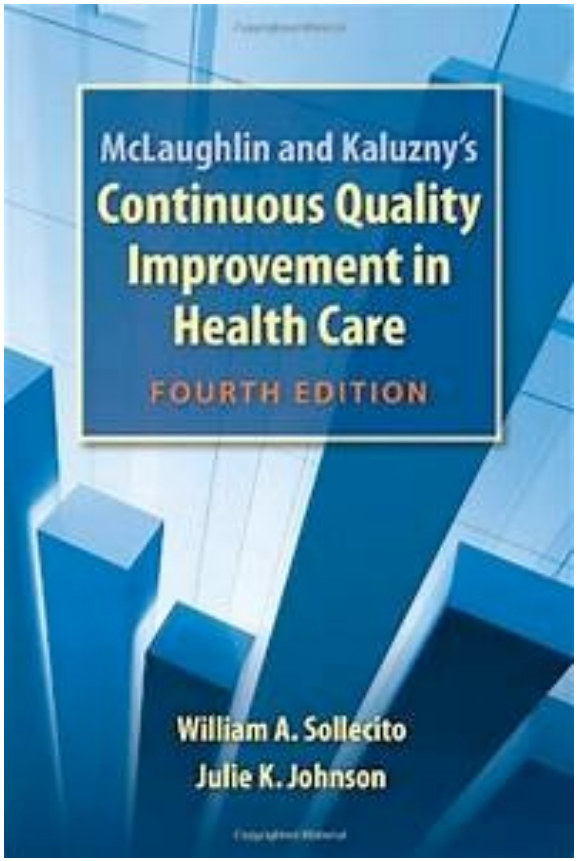
MODEL FOR IMPROVEMENT AND IMPLEMENTATION

Improvement Questions

- What are we trying to accomplish?
- How do we know that a change is an improvement?
- What change can we make that will result in improvement ?

Implementation Questions

- What implementation outcomes are critical to implementing the change ?
- What factors impede the achievement of these outcomes ?
- What implementation strategies are the most appropriate to address these factors?



The Quadruple Aim
Cornerstone of Health Workforce Resiliency

Article

AMERICAN COLLEGE OF Medical Quality

Supporting the Quadruple Aim Using Simulation and Human Factors During COVID-19 Care

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Abstract

The health care sector has made radical changes to hospital operations and care delivery in response to the coronavirus disease (COVID-19) pandemic. This article examines pragmatic applications of simulation and human factors to support the Quadruple Aim of health system performance during the COVID-19 era. First, patient safety is enhanced through development and testing of new technologies, equipment, and protocols using laboratory-based and in situ simulation. Second, population health is strengthened through virtual platforms that deliver telehealth and remote simulation that ensure readiness for personnel to deploy to new clinical units. Third, prevention of lost revenue occurs through usability testing of equipment and computer-based simulations to predict system performance and resilience. Finally, simulation supports health worker wellness and satisfaction by identifying optimal work conditions that maximize productivity while protecting staff through preparedness training. Leveraging simulation and human factors will support a resilient and sustainable response to the pandemic in a transformed health care landscape.

Keywords

health care simulation, patient safety, Quadruple Aim, COVID-19, system preparedness

Introduction

Coronavirus disease 2019 (COVID-19) has uniquely stressed health care systems, policy makers, and health care workers throughout the world as they face the worst health and economic crises of our lifetimes. Administrators are rapidly navigating their institutions through uncertain times, providing leadership and strategic plans to manage numerous evolving systems threats. Many of these plans run counter to the accepted mantra in modern times, including intentional cancelations of profitable elective procedures and layoffs or furloughs of dedicated medical staff during the pandemic.[1]

The Triple Aim of health system reform addresses ongoing and future challenges faced by the health care sector,[2] with recent calls for expansion to a Quadruple Aim[3] to include considerations and protection for staff. These 4 interdependent goals consist of (1) enhancing patient experience and safety, (2) improving population health, (3) reducing costs and preventing loss of revenue, and (4) improving wellness and satisfaction of health care workers. The fourth Aim incorporates the increasing understanding that excellent health care is not possible without a physically and psychologically safe and healthy workforce. COVID-19 has created unique threats and unanswered challenges to each element of the Quadruple Aim (Table 1).

Human factors[4] is a scientific discipline that addresses the complex interwoven variables that affect health care workers' ability to deliver safe,

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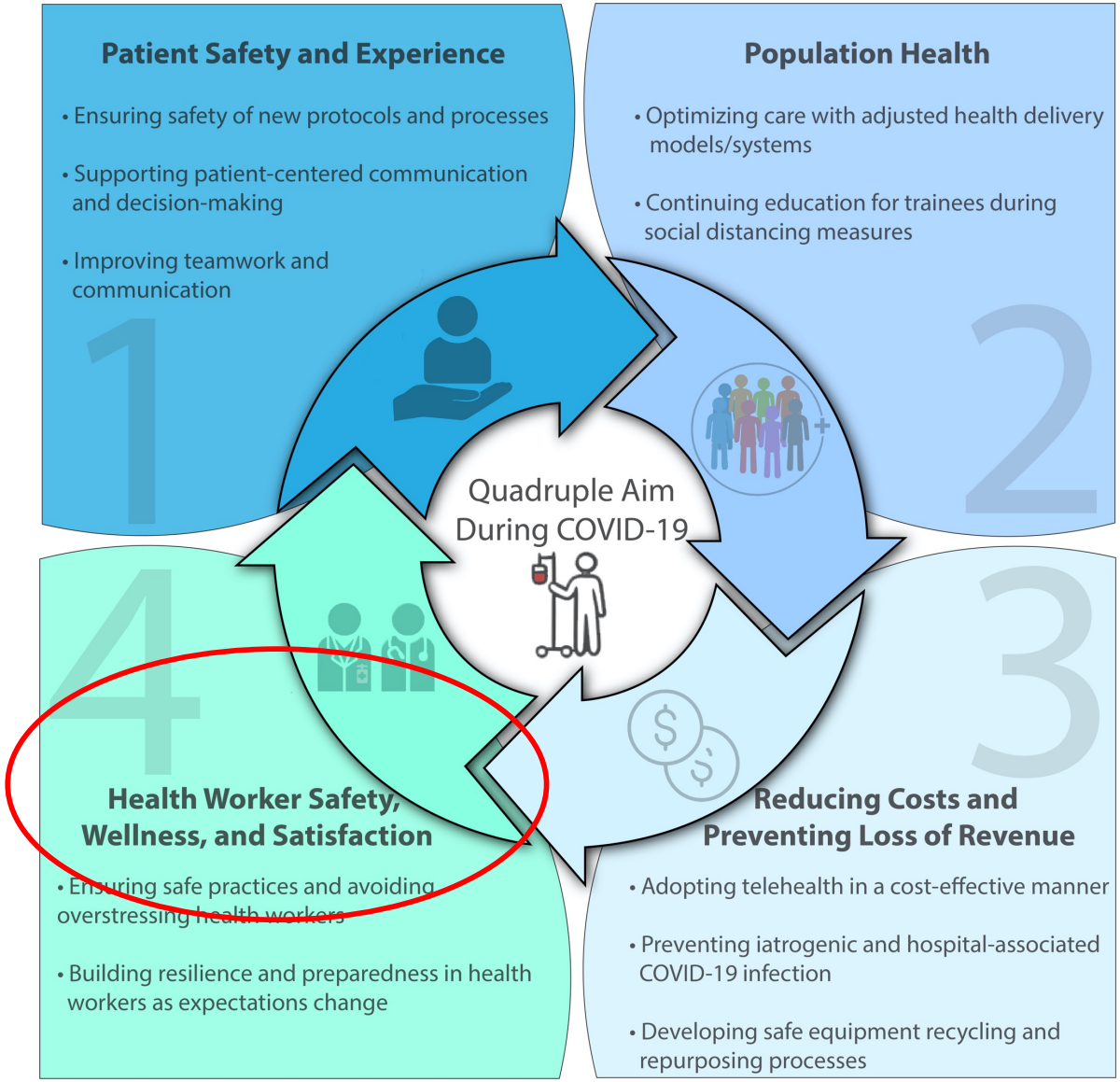


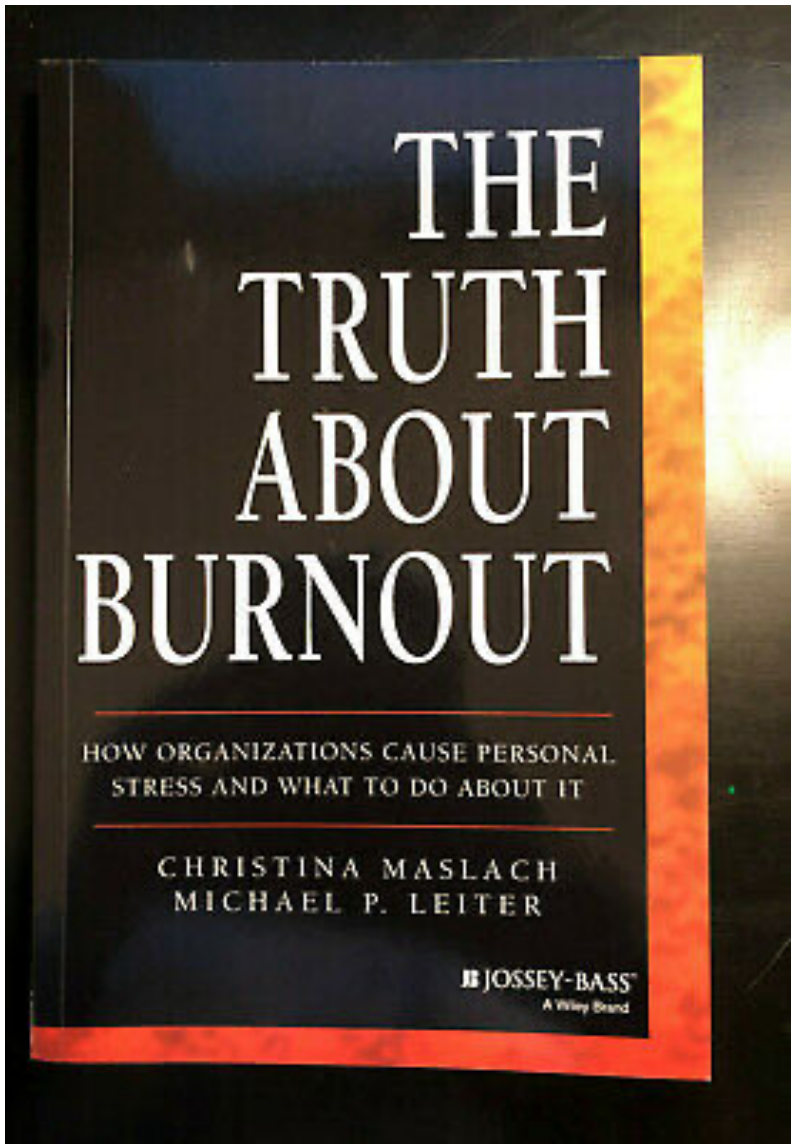
Key Health Services Research Milestones

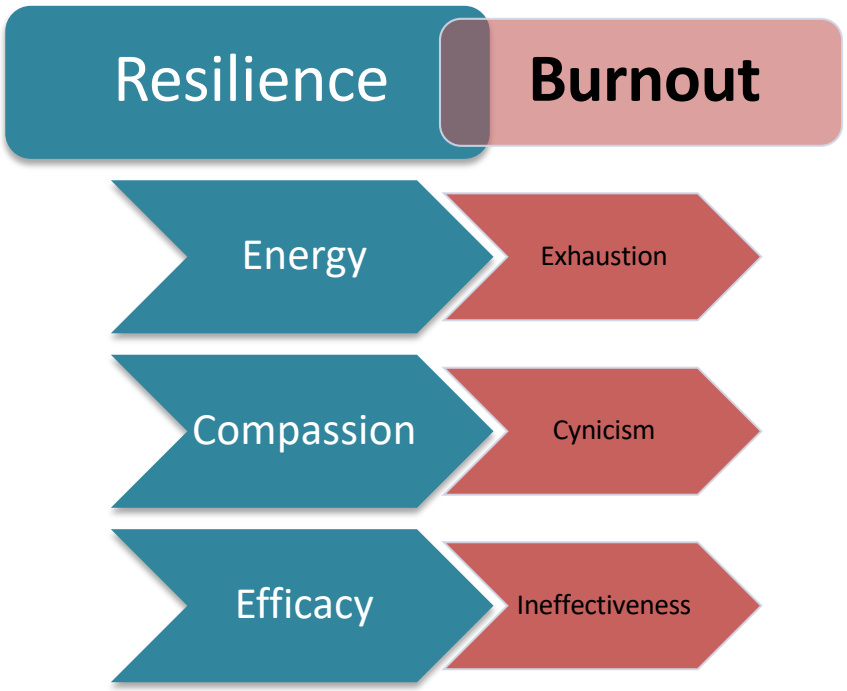
Year	Researcher	Event
1966	Donabedian	**Quality of services** is directly related to **work satisfaction**
1970	McGrath	Defined the term "**work stress**"
1974	Freudenberger	Talks of "**work disease**" and "**burnout syndrome**" which he found more frequent in healing professionals
1982	Maslach	Defined "**burnout syndrome**" by 3 characteristics—known as the Maslach Burnout Inventory (MBI) and is considered the gold standard: • **Emotional exhaustion** • **Depersonalization** • **Lack of personal fulfillment**

From: Constance Ange. Clinician burnout in Contemporary Medicine

Burnout Defined

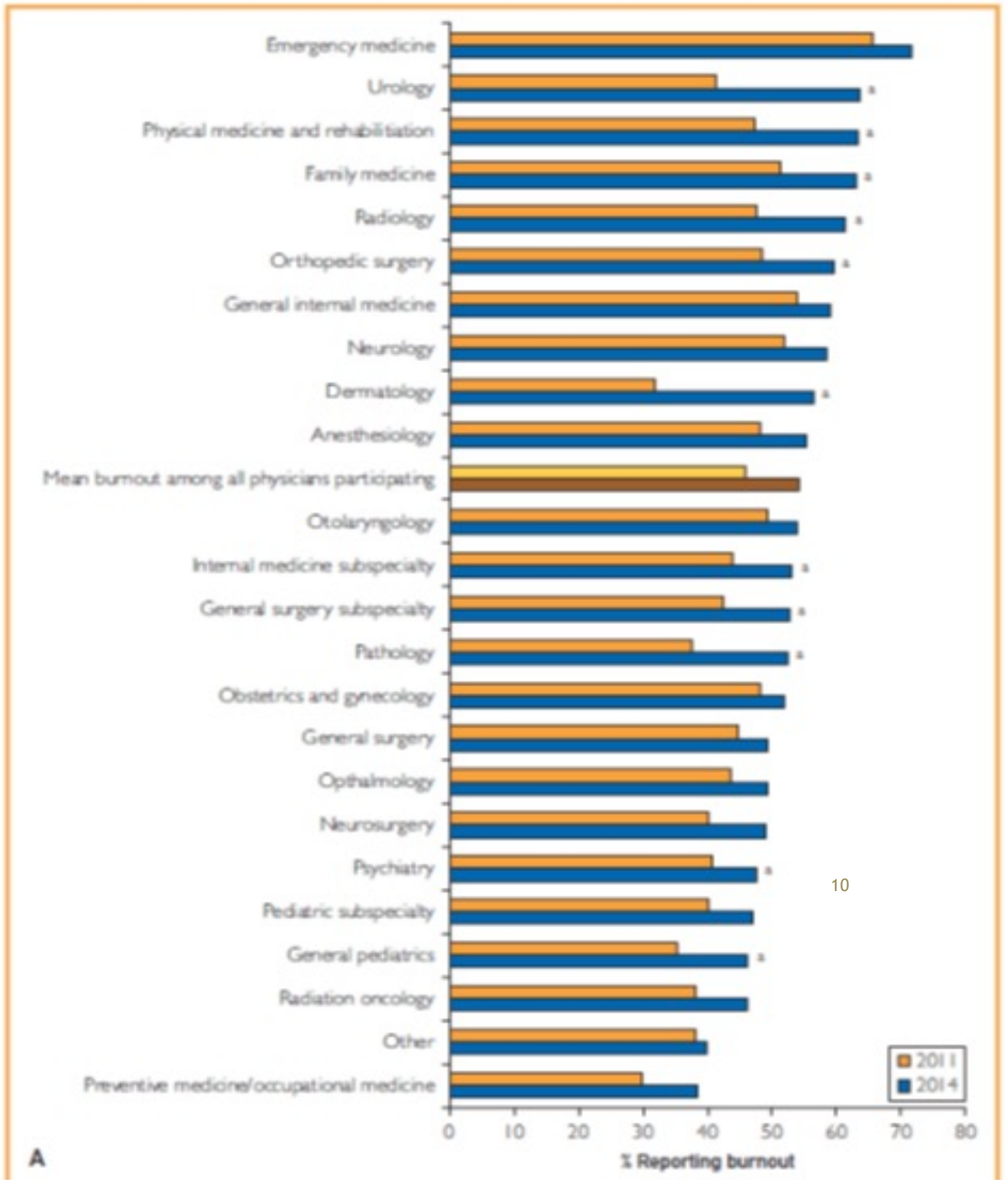
"An erosion of the soul caused by a deterioration of one's values, dignity, spirit, and will."*





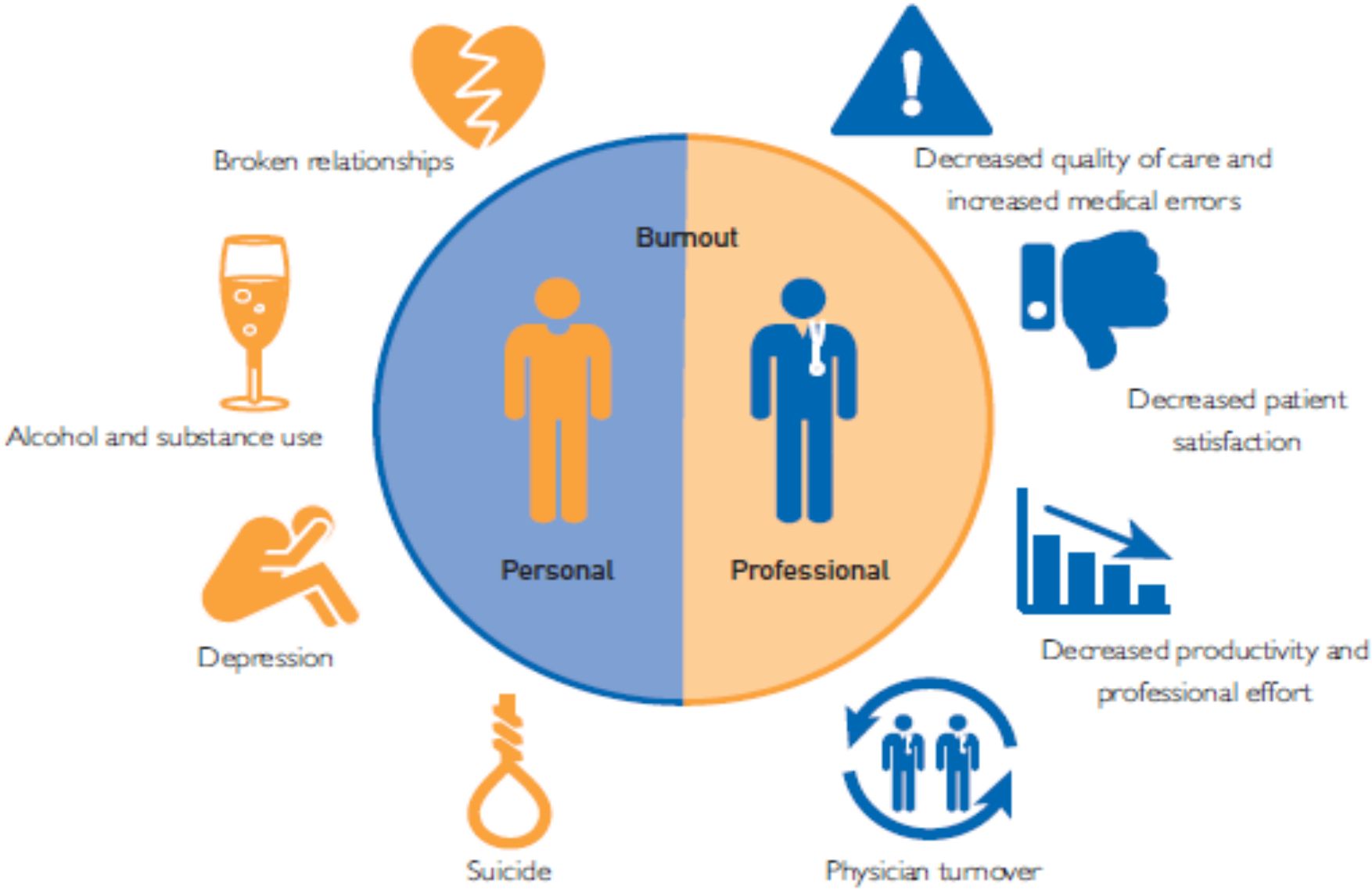
*Maslach C, Leiter MP. The Truth About Burnout: How Organizations Cause Personal Stress and What to Do About It. San Francisco: Jossey-Bass; 1997.

Burnout by specialty: 2011 and 2014 Data



Shanafelt, Mayo Clinic Proceedings; 2015

Consequences of Burnout



Shanafelt, Mayo Clinic Proceedings 2016
Drummond D. Fam Pract Manag. 2015 Sep-Oct;22(5):42-47

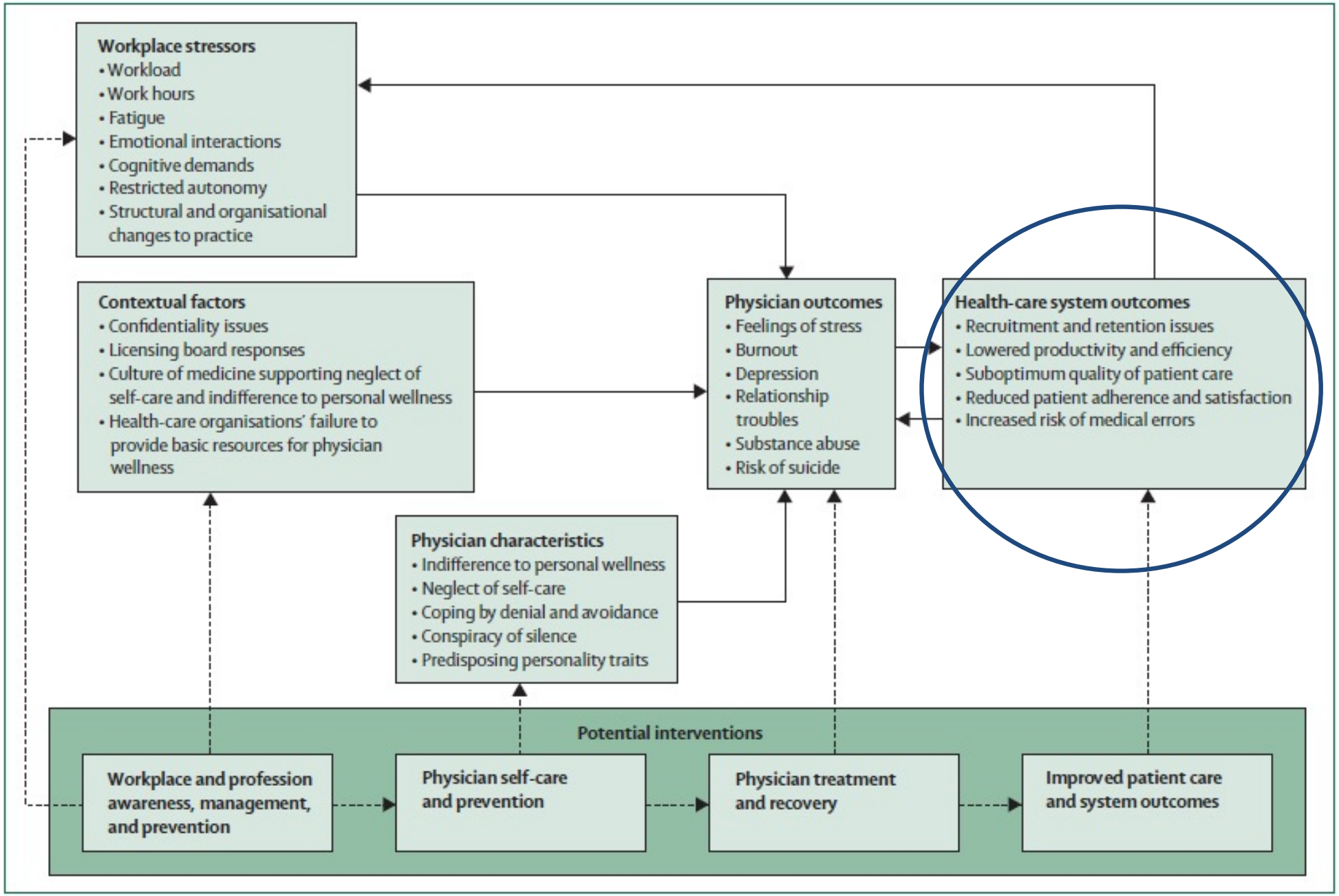


Figure: **A model of physician ill health and the links with health-care system outcomes, and potential interventions to improve physician and system outcomes**
Solid lines are empirically supported; broken lines are potential links.

Impact of COVID on HCW Lives and Wellness

- 120,000 HCW dead
- 2,000,000 long covid
- Millions quitting

*World Health Organization. (2021). The impact of COVID-19 on health and care workers: a closer look at deaths. World Health Organization.

Worker Safety and Wellness in the time of COVID

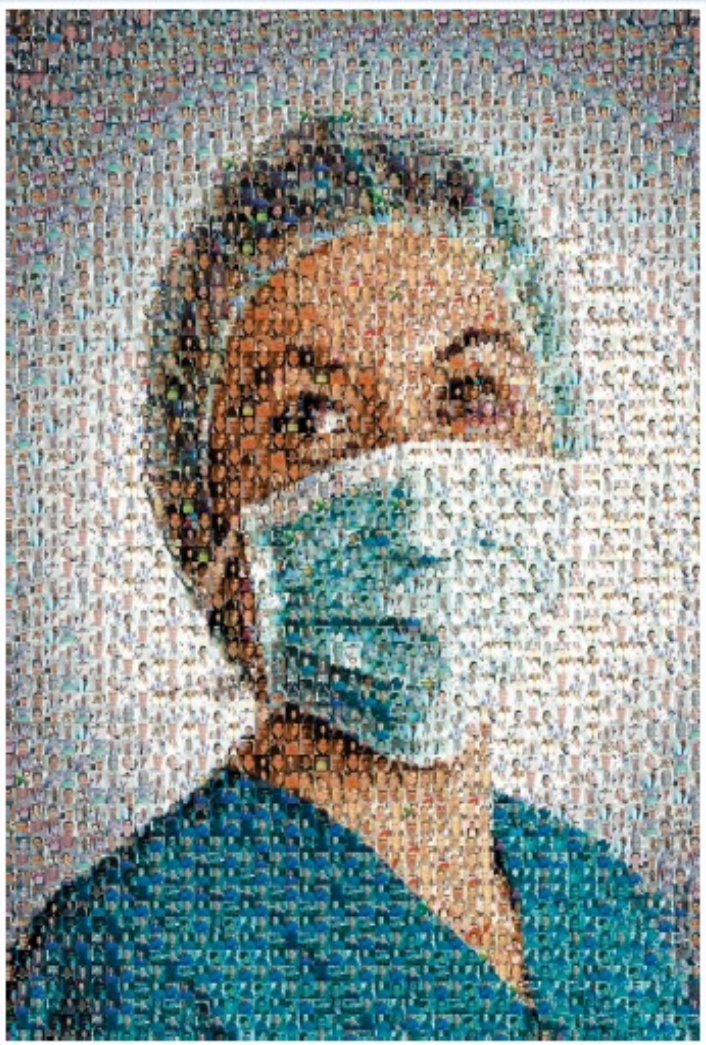
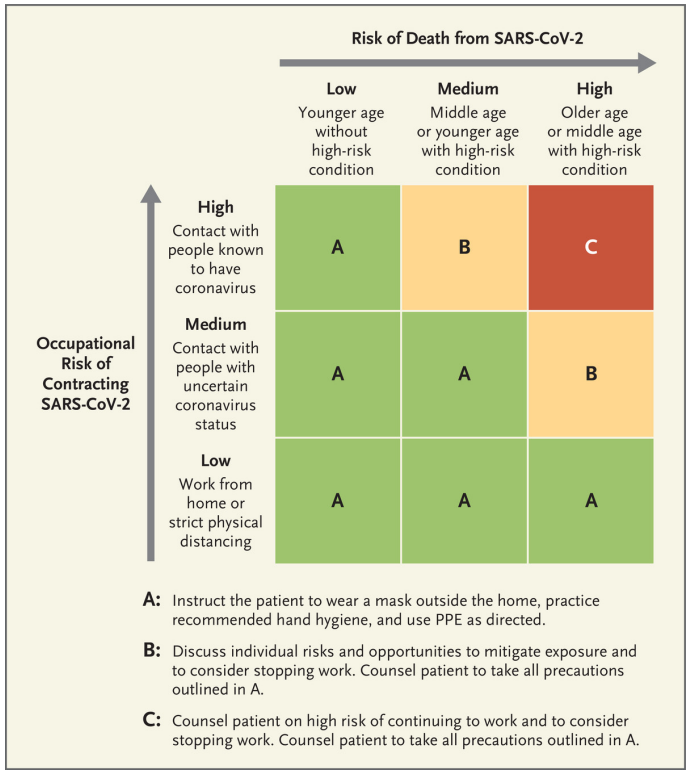


Fig 2. Collection of 198 photographs of healthcare workers who died in Mexico as a result of COVID-19 (Courtesy of MILENIO. Author: Arturo Black Fonseca).



MR Larochelle. N Engl J Med 2020. DOI: 10.1056/NEJMp2013413

BJA

British Journal of Anaesthesia, xxx (xxx): xxx (xxxx)

doi: 10.1016/j.bja.2020.09.004
Advance Access Publication Date: xxx
Editorial

EDITORIAL

Revisiting safe airway management and patient care by anaesthetists during the COVID-19 pandemic

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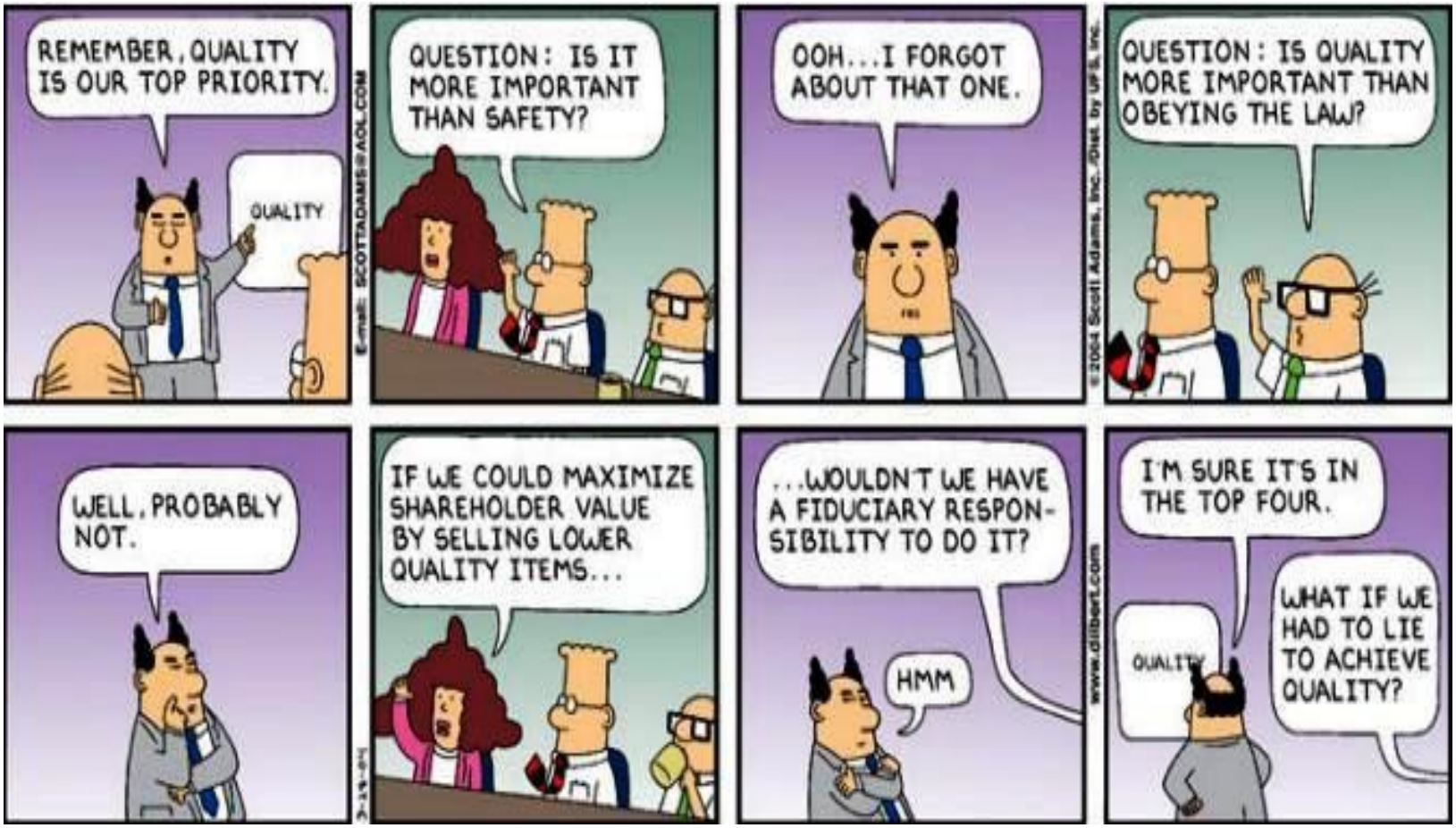
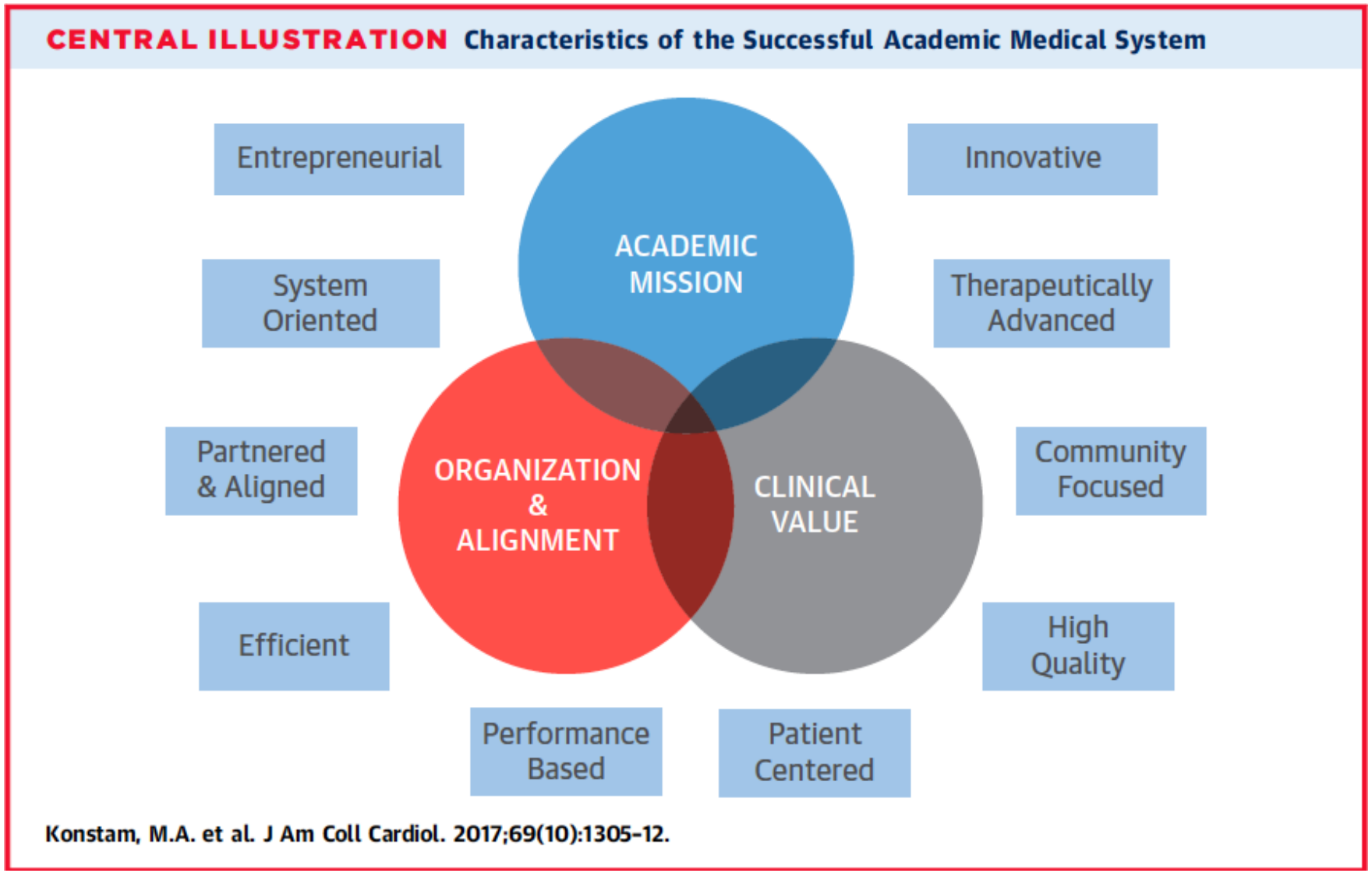
Competing Organizational and Financial Priorities



The Ideal Future Medical Center- What is missing???



SPECIAL ARTICLE

WHAT SETS THE GOALS OF PUBLIC HEALTH?*

SIR GEOFFREY VICKERS, V.C.

LONDON, ENGLAND

I AM deeply grateful to those who have honored me by this invitation; the more so, because I am a layman, unqualified in the sciences of your field. I comfort myself with the reflection that we are all laymen for most of our time, especially in a field so close as yours is to problems of decision and action. And further, that it is as laymen, not as academics, that we make our most daring speculations. The scientist with a reputation to lose may not speculate too far beyond the evidence, at least in public, but the layman with a job to do must make whatever assumptions are needed for decision, and he is content if he can reduce by even a little the random element in his behavior. So it is not inappropriate that it should be a layman who invites you to pursue a speculation that will take us beyond the boundaries of the known, even beyond the scope of our present conceptual apparatus, but never beyond the challenges of practical life.

I ask what sets the goals of public health. I do not ask how we choose them, for manifestly our choice is only one element in a manifold process. When we open our eyes to the scene around us, we find goals already set. Policies are being implemented; institutions are in action with all the historical momentum of buildings and establishments. Men are in mid-career. Budgets, even budget headings, have acquired prescriptive rights. This dynamic configuration is resistant to sudden change. So the most obvious answer to my question springs to mind at once. History sets the goals of public health. We influence them no more and no less than we influence the course of history.

The process of interaction and mutual adaptation that we call history is an obscure though familiar mystery. Looking into the future we see a widening vista of possibilities. Tomorrow is almost committed, but next year, ten, twenty years hence, what might not be possible? Yet, when we look into the past, the vista seems to narrow from past to present. We see a thin line of actualities detaching itself from all that might have been, and those who will someday look back over what is now the uncommitted future will see the same. Of all that competes for realization, only a tiny fraction is realized and in the process excludes a host of alternatives. The eternal enigma of history is: "Why from all these possibilities did these

*Presented at a public-health forum at Harvard School of Public Health, Boston, November 26, 1957. Published simultaneously in the *Lancet* (March 22, 1958) by special arrangement.

Vickers suggests that in many respects that redefining is core to our very function as public health scientists and policy makers:

"For public health has a unique opportunity, as well as a duty, to clarify our understanding of health and disease, and hence our attitude towards it."

So how do we make the healthcare workforce resiliency central to **ALL** health reform and health systems strengthening?

What is ‘Vision Zero?’

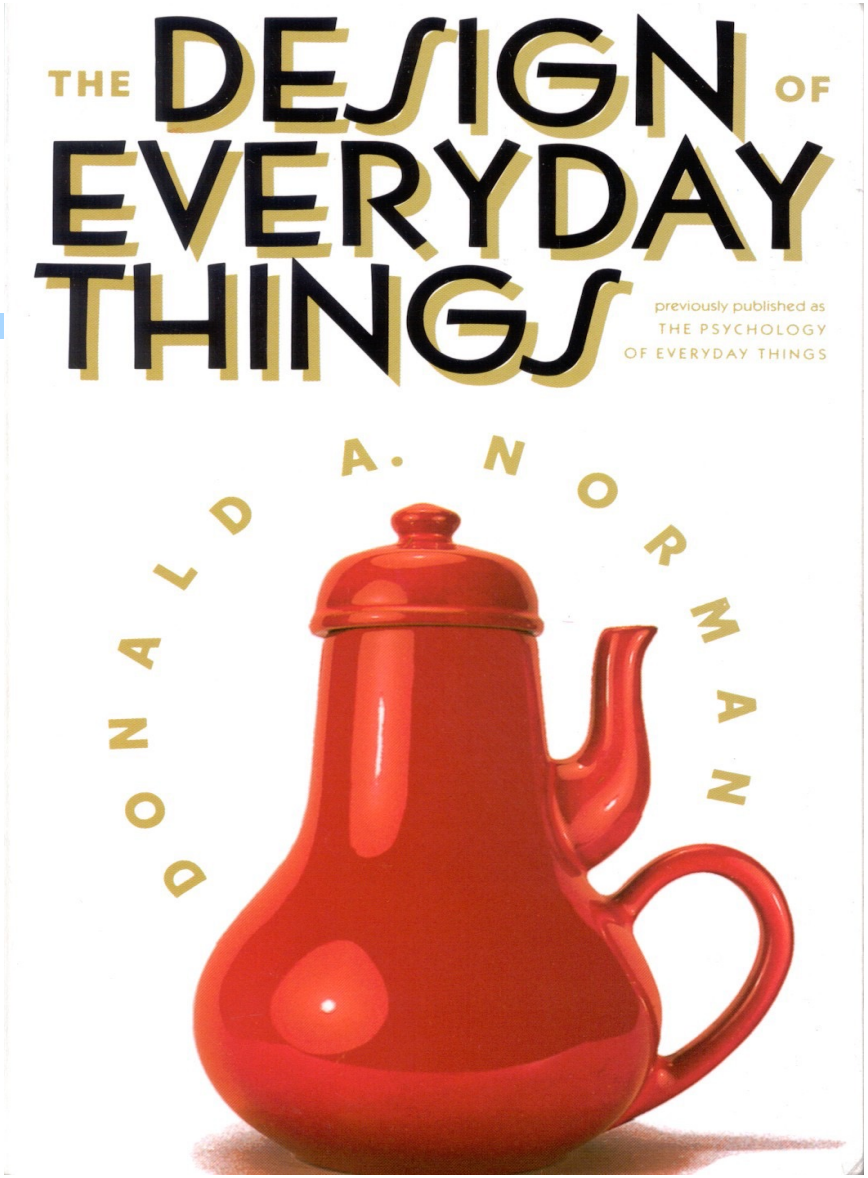
- Vision Zero is a strategy to eliminate all traffic fatalities and severe injuries, while increasing safe, healthy, equitable mobility for all.

<u>Applied to healthcare workforce resiliency</u>

- Strengthening Vision Zero plans to support health workforce physical and emotional injury reductions and health improvements

How does Vision Zero differ from traditional Healthcare Workforce approaches?

1. Reframing HCW burnout as preventable
2. Focusing on systems failure, workflow redesign
3. Reducing the impact of known stressors
4. Adopting a Safe Systems approach
5. Data-driven decision-making
6. HCW wellness as a social equity issue



Systems Science

"If an error is possible, someone will make it. The designer must assume that all possible errors will occur and design so as to minimize the chance of the error in the first place, or its effects once it gets made"

Norman, The Design of Everyday Things, 2001

A Social-Technical Model to Improve Staff Wellness

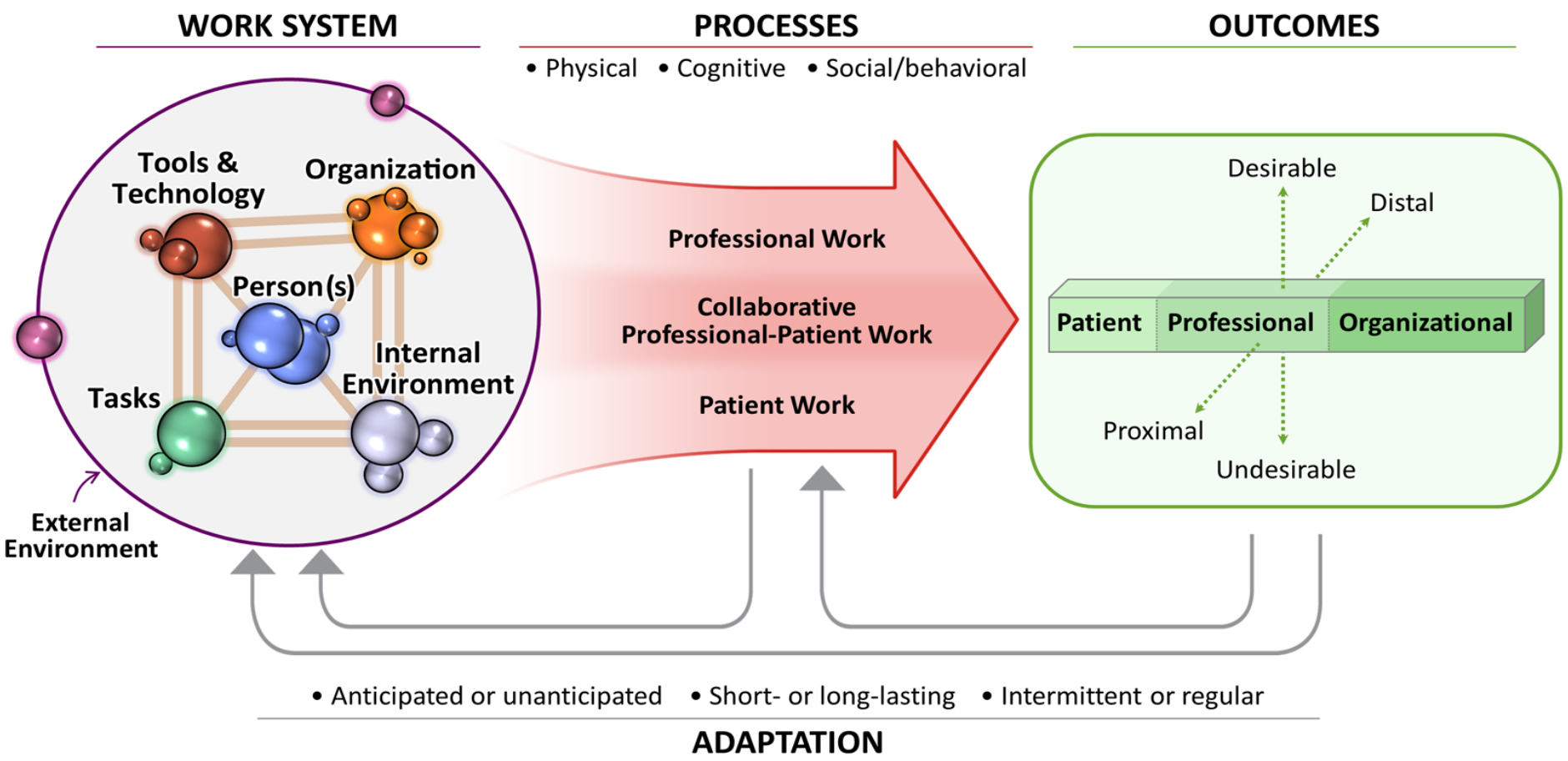
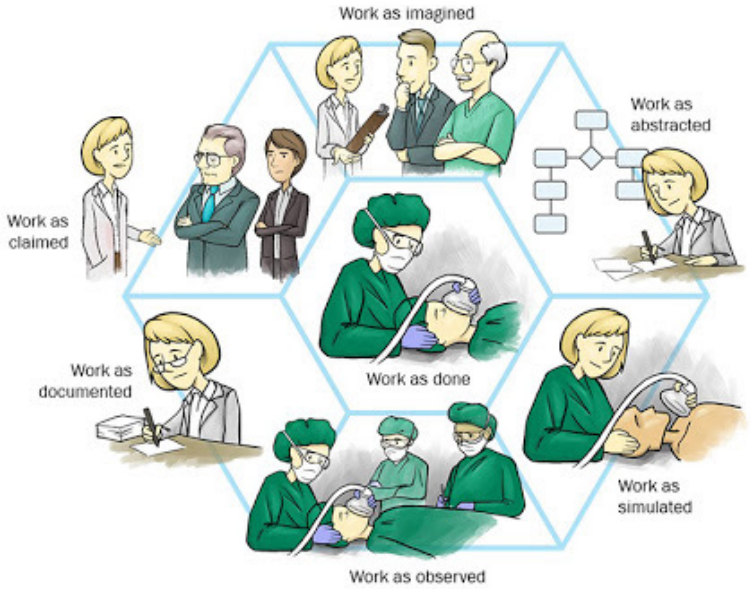
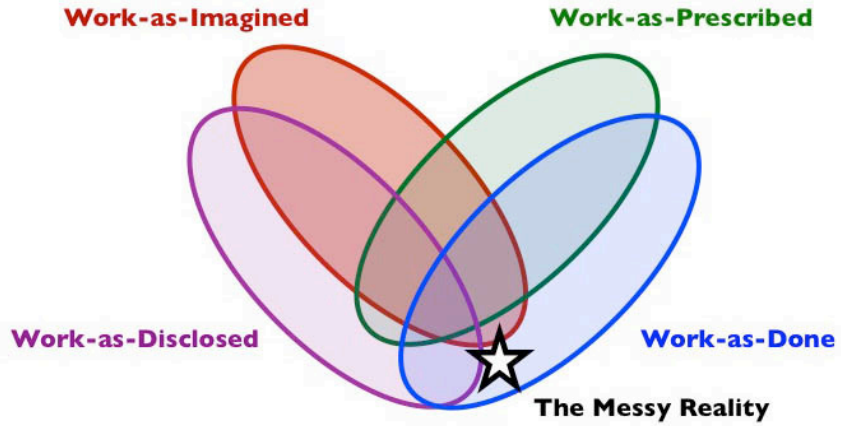


Figure 1.
SEIPS 2.0 model.

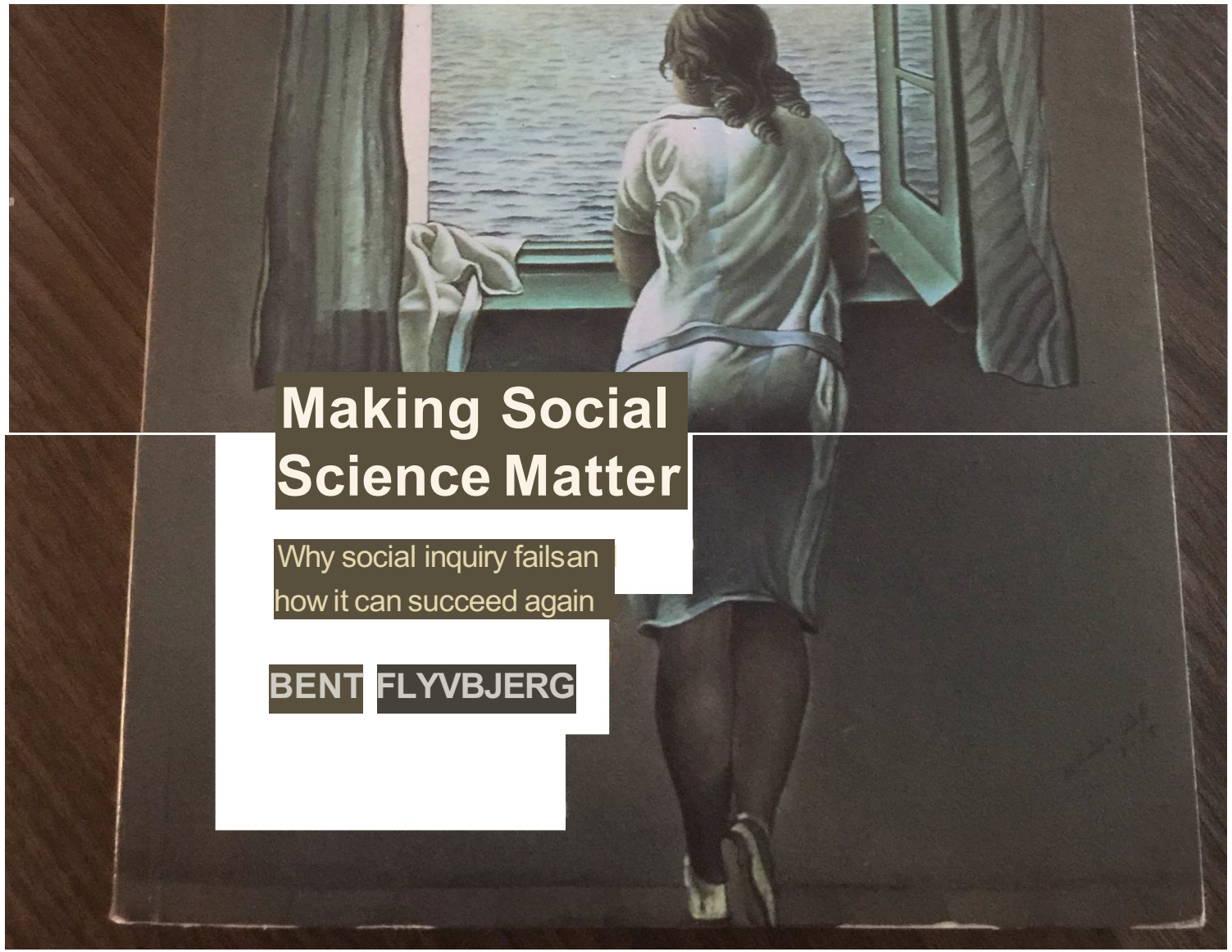
Adapted from Carayon et al.

Workflow Redesign: Work as done vs Work as imagined

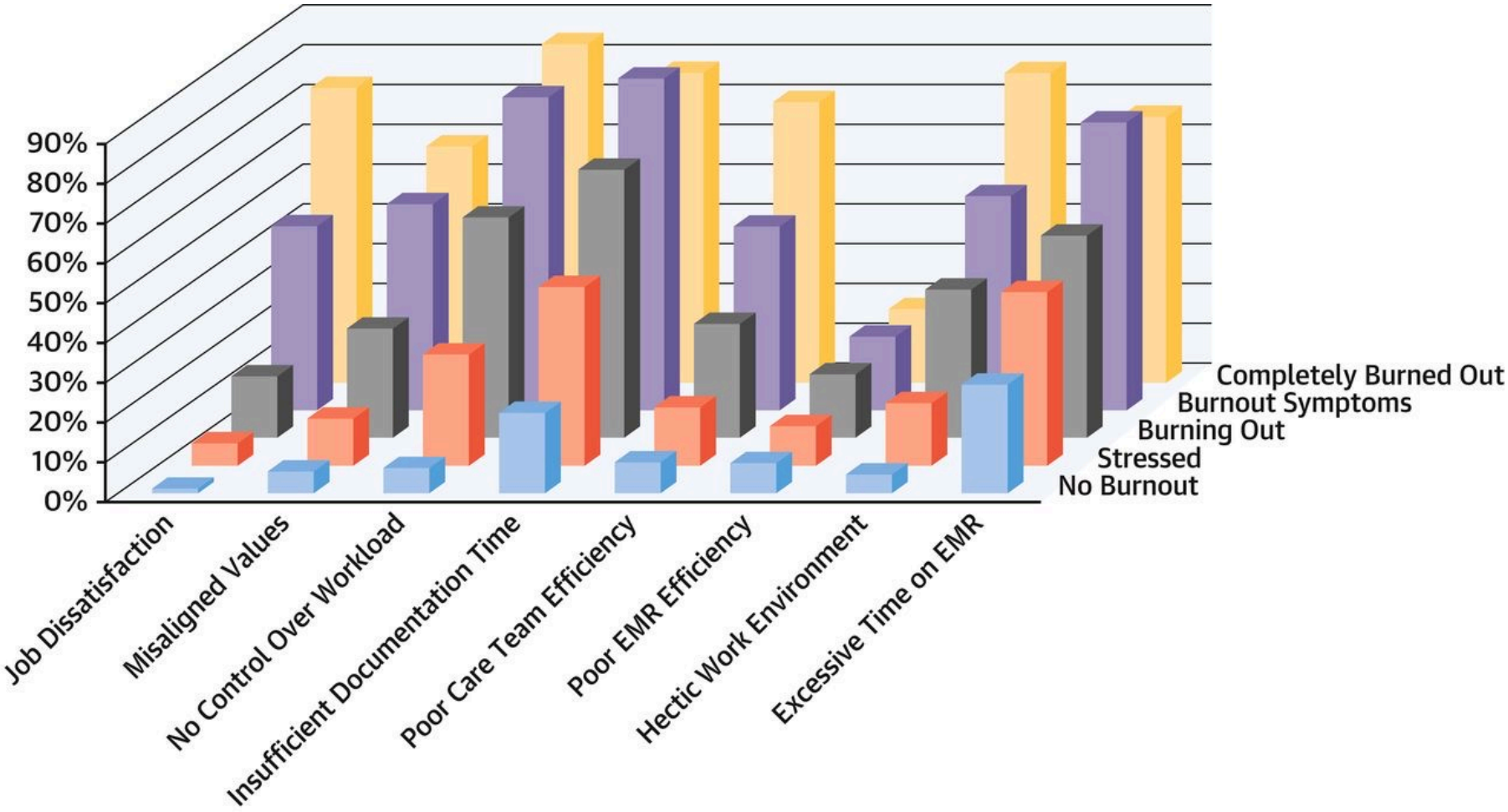




The Key Roles of Social Sciences in Helping to Improve HCW Wellness



Work Environment is Key Driver of Burnout



Laxmi S. Mehta et al. JACC 2019;73:3345-3348

MAYO CLINIC

COVID-19 and Medical Education: A Four-Part Model to Assess Risks, Benefits, and Institutional Obligations During a Global Pandemic

Paul Barach, MD, MPH; Rami Ahmed, DO, MHPE; Eric S. Nadel, MD; Frederic Hafferty, PhD; and Ingrid Philibert, PhD, MA, MBA

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The coronavirus has brought unprecedented changes to health care and medical education in the United States. The coronavirus disease 2019 (COVID-19) pandemic is emerging as nothing less than an "existential crisis" that is threatening to reshape American society. By mid-December more than 74 million cases of COVID-19 have been confirmed throughout the world with more than 1.6 million deaths. In the months since the first US case of COVID-19 was diagnosed in February 2020, the disease has resulted in nearly 17 million individuals infected and more than 300,000 deaths.[1] In March 2020, during the peak of the pandemic in New York City, the Association of American Medical Colleges (AAMC) and the Liaison Committee on Medical Education issued guidance that medical students should not be involved in the care of patients with COVID-19 or persons under investigation,[2] and many medical schools near the early epicenter of the pandemic discontinued clinical rotations. Concurrently, several medical schools and a few US states initiated plans for senior medical students to graduate early and support the growing clinical demands due to COVID-19.[3] Medical students removed from clinical settings initiated novel efforts for voluntary contributions to assist with the health care crisis, such as at the COVID-19 Student Service Corps at Columbia University Irving Medical Center.[4] Residents and fellows in a range of acute care settings continued to triage patients with symptoms that could be COVID-related and provided care for COVID-19–positive patients.

The practice of medicine carries inherent risks, especially during outbreaks of highly contagious diseases such as Ebola, H1N1, tuberculosis, and COVID-19. Exposure risks remain and extend to medical students and resident/fellows functioning in clinical settings and create ethical dilemmas around service vs potential risks of illness. At the time of an unprecedented crisis in the US health care system, institutional leaders and medical educators are tasked with meeting patient care demands and ensuring the health and well-being of learners across the medical education continuum while preventing stagnation in their education and promoting medical students and residents' professional growth. The 1980's HIV/AIDS epidemic was the first major infectious disease outbreak during which residents' exposure to a contagious disease was analyzed with an emphasis on physicians' "duty to treat" in spite of personal fears and perceived risks.[5] The debate about exposing learners to a dangerous infectious disease reemerged during the 2003 to 2004 severe acute respiratory syndrome (SARS) outbreak.[6] When patients with the Ebola virus entered the US health care system, the leaders of several institutions that received these patients decided that medical students and residents would not be involved in their care.[7] Given the spread of the virus and its lingering presence, key considerations going forward include whether and to what extent medical students and residents/fellows should be involved in caring for patients with COVID-19, how this will affect their learning

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JACEP OPEN

WILEY

ORIGINAL RESEARCH

Infectious Disease

An international survey of healthcare workers use of personal protective equipment during the early stages of the COVID-19 pandemic

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Abstract

Objective: Little is known regarding the specific ways personal protective equipment (PPE) has been used and reused during the coronavirus disease 2019 (COVID-19) pandemic. The objective of this study was to evaluate the patterns of PPE use and the impact of PPE availability on the attitudes and well-being of an international population of healthcare workers.

Methods: This was an online, cross-sectional survey of healthcare workers. The survey was disseminated internationally using social media, specialty society list-serves, and email augmented by snowball sampling to healthcare workers who provided direct care to patients with suspected or confirmed COVID-19. The survey was conducted between April 13 and May 1, 2020. The primary outcome was self-reported PPE use during aerosol-generating medical procedures. Other outcomes included PPE use during care for respiratory patients in general, PPE reuse, PPE decontamination, and healthcare worker impressions related to their work and the pandemic.

Supervising Editor: Steven G. Rothrock, MD.

- Overall, 1783 (80.1%) of providers reported general reuse of PPE, which was similar across US regions but less common in Canada, Italy, and Spain.
- The most commonly reused item of PPE was the N95 respirator, with the majority of respondents who reused PPE reporting N95 reuse (n = 1157, 64.9%). Of the 1050 individuals who wore an N95 mask while performing an aerosol-generating medical procedure, 756 (72%) reported re-using an N95, and 344 (45.5%) reported reuse for >3 days.
- Qualitative results identified several common themes, including (1) lack of availability of PPE, (2) **fear and anxiety as a result of inadequate PPE,** (3) potential exposure to family members, and (4) concerns regarding workload and pay.

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0736-4679/$ - see front matter

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ELSEVIER

Brief Report

Reuse of Personal Protective Equipment: Results of a Human Factors Study Using Fluorescence to Identify Self-Contamination During Donning and Doffing

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□ **Abstract—Background: . At least 115,000 health and care workers (HCWs) are estimated to have lost their lives to COVID-19, according to the the chief of the World Health Organization (WHO). Personal protective equipment (PPE) is the first line of defense for HCWs against infectious diseases. At the height of the pandemic, PPE supplies became scarce, necessitating reuse, which increased the occupational COVID-19 risks to HCWs. Currently, there are few robust studies addressing PPE reuse and practice variability, leaving HCWs vulnerable to accidental contamination and harm. Objective: The objective of this study was to assess potential HCW contamination during PPE donning, doffing, and reuse. Methods: The study included 28 active acute care physicians, nurses, and nurse practitioners that evaluated 5 simulated patients with COVID-like symptoms while donning and doffing PPE between each patient encounter. An N95 mask was contaminated with a transparent fluorescent gel applied to the outside of the N95 mask to simulate contamination that might occur during reuse. Participants were evaluated after PPE doffing for each encounter using a black light to assess for face and body contamination. Results: All participants had multiple sites of contamination, predominantly on their head and neck. None of the participants were able to don and doff PPE without contaminating themselves during five consecutive simulation cycles. Conclusions: The current Centers for Disease Control and Prevention PPE guidelines for donning and doffing fall short in protecting HCWs. They do not adequately protect HCWs from contamination. There is an urgent need for PPE and workflow redesign. © 2021 Published by Elsevier Inc.**

□ **Keywords—personal protective equipment; PPE; donning; doffing; PPE reuse; occupational risks**

Introduction

COVID-19 has shone a bright light on the physical and emotional safety burdens that frontline health care workers (HCWs)around the world face. Unsafe working conditions and a lack of personal protective equipment (PPE) remain major challenges for HCWs throughout the recurrent waves of the pandemic and reflect on our society's failings.

PPE offers a critical barrier for preventing disease transmission in health care settings, but its widespread use during the COVID-19 pandemic has changed the experience of care delivery. In the United States, an estimated 3600 HCWs perished from COVID-19, which was most likely contracted during work (1). Centers for Disease Control and Prevention (CDC) guidelines and PPE availability were unable to keep HCWs safe from harm. HCWs in low-income countries have been particularly affected due to limited protective equipment and delayed vaccinations (2). Globally, the Director-General of the World Health Organization has o documented

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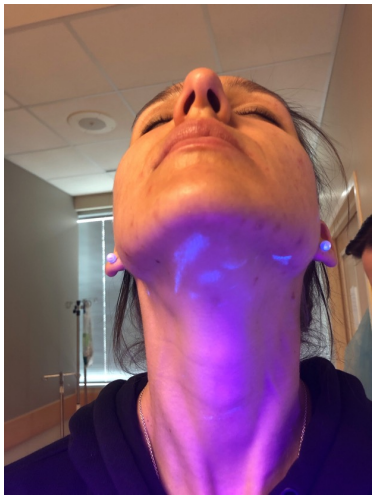
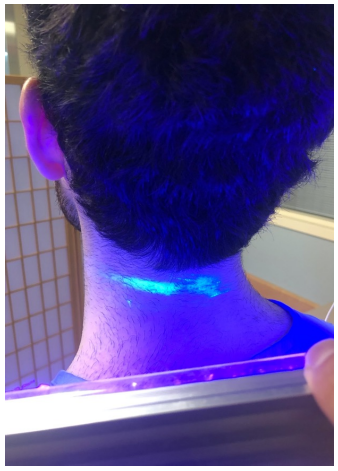
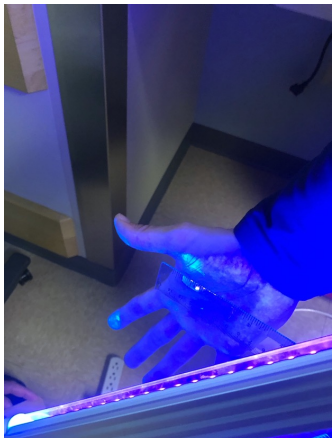






EMERGENCY NURSES ASSOCIATION

Workplace Violence in Emergency Departments

Prevalence of Workplace Violence in Health Care/Emergency Departments

Workers in the **health care** sector make up about

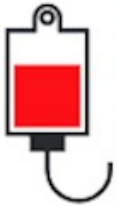
50%

of all victims of workplace assault.[1]

From 2002–2013, serious incidents of **workplace violence** were

4x

more common for workers in the **health care** sector than for all other workers in the U.S.



Studies show that **emergency nurses** and other personnel in the ED experience a **violent event** about

once every 2 months.[2]

ED workers are exposed to **significant rates** of **physical** and **verbal abuse**. Under-reporting of workplace violence in the ED is common and contributes to the difficulty in accurately tracking violence.[5, 6]

100%

of emergency nurses reported **verbal assault** and

82%

reported **physical assault** in the past year.

Emergency nurses have the **highest rate of physical assaults** of all nurses.[3, 4]

Impact of Workplace Violence on Nurses, Patients and U.S. Health Care System

JAMA Network Open

Workforce Violence Crisis

Original Investigation | Occupational Health

Physicians' Experiences With Mistreatment and Discrimination by Patients, Families, and Visitors and Association With Burnout

Liselotte N. Dyrbye, MD, MHPE; Colin P. West, MD, PhD; Christine A. Sinsky, MD; Mickey Trockel, MD, PhD; Michael Tutty, PhD; Daniel Satele, BA; Lindsey Carlasare, MBA; Tait Shanafelt, MD

Abstract

IMPORTANCE Burnout is common among physicians and is associated with suboptimal patient outcomes. Little is known about how experiences with patients, families, and visitors differ by physician characteristics or contribute to the risk of burnout.

OBJECTIVE To examine the occurrence of mistreatment and discrimination by patients, families, and visitors by physician characteristics and the association between such interactions and experiencing burnout.

DESIGN, SETTING, AND PARTICIPANTS This cross-sectional survey was conducted from November 20, 2020, to March 23, 2021, among US physicians.

EXPOSURES Mistreatment and discrimination were measured using items adapted from the Association of American Medical College's Graduation Questionnaire with an additional item querying respondents about refusal of care because of the physicians' personal attributes; higher score indicated greater exposure to mistreatment and discrimination.

MAIN OUTCOMES AND MEASURES Burnout as measured by the Maslach Burnout Inventory.

RESULTS Of 6512 responding physicians, 2450 (39.4%) were female, and 369 (7.2%) were Hispanic; 681 (13.3%) were non-Hispanic Asian, Native Hawaiian, or Pacific Islander; and 3633 (70.5%) were non-Hispanic White individuals. Being subjected to racially or ethnically offensive remarks (1849 [29.4%]), offensive sexist remarks (1810 [28.7%]), or unwanted sexual advances (1291 [20.5%]) by patients, families, or visitors at least once in the previous year were common experiences. Approximately 1 in 5 physicians (1359 [21.6%]) had experienced a patient or their family refusing to allow them to provide care because of the physician's personal attributes at least once in the previous year. On multivariable analyses, female physicians (OR, 2.33; 95% CI, 2.02-2.69) and ethnic and racial minority physicians (eg, Black or African American: OR, 1.59; 95% CI, 1.13-2.23) were more likely to report mistreatment or discrimination in the previous year. Experience of mistreatment or discrimination was independently associated with higher odds of burnout (vs score of 0 [no mistreatment], score of 1: OR, 1.27; 95% CI, 1.04-1.55; score of 2: OR, 1.70; 95% CI, 1.38-2.08; score of 3: OR, 2.20; 95% CI, 1.89-2.57). There was no difference in the odds of burnout by gender after controlling for experiencing mistreatment and discrimination score and other demographic factors, specialty, practice setting, work hours, and frequency of overnight call.

CONCLUSIONS AND RELEVANCE In this study, mistreatment and discrimination by patients, families, and visitors were common, especially for female and racial and ethnic minority physicians,

(continued)

Key Points

Question How frequently do physicians experience mistreatment and discrimination by patients, their families, and visitors; how does this vary by physician characteristics; and what is the association between having such interactions and experiencing burnout?

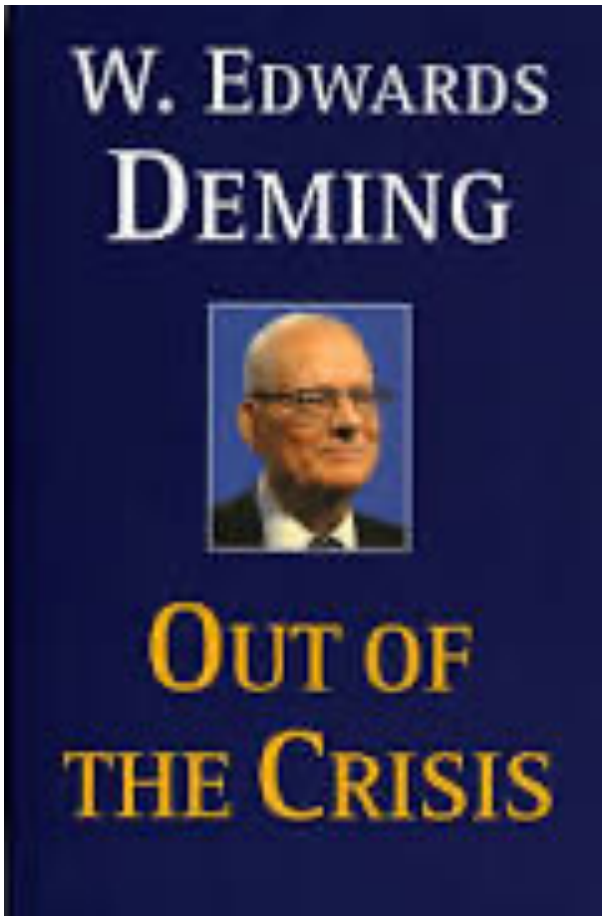
Findings In this cross-sectional study of 6512 US physicians, mistreatment and discriminatory behaviors by patients, families, and visitors within the previous year were common, especially for female and racial and ethnic minority physicians, and associated with higher burnout rates.

Meaning The findings suggest that efforts to mitigate risk of physician burnout and improve the work experience of female and racial and ethnic minority physicians should include strategies that promote patient, family, and visitor civility.

+ Supplemental content

Author affiliations and article information are listed at the end of this article.

“Fear is toxic to both safety and improvement”



Edward Deming, 1993

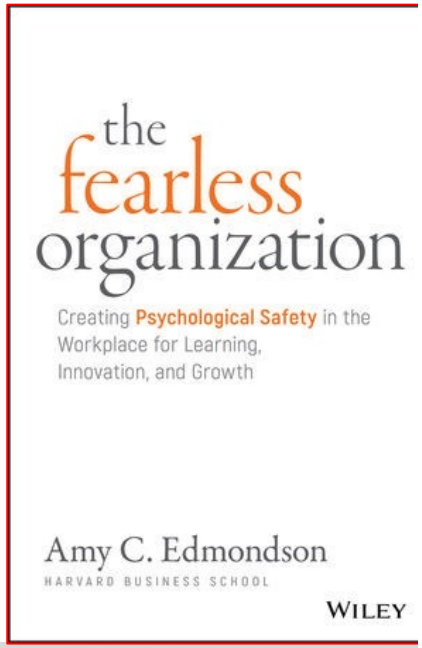
The Role of Psychological Safety—20 year gap

Psychological safety and learning behavior in work teams
Amy Edmondson
Administrative Science Quarterly; Jun 1999; 44, 2; ABI/INFORM Global
pg. 350

Psychological Safety and Learning Behavior in Work Teams

Amy Edmondson
Harvard University

This paper presents a model of team learning and tests it in a multimethod field study. It introduces the construct of team psychological safety—a shared belief held by members of a team that the team is safe for interpersonal risk taking—and models the effects of team psychological safety and team efficacy together on learning and performance in organizational work teams. Results of a study of 51 work teams in a manufacturing company, measuring antecedent, process, and outcome variables, show that team psychological safety is associated with learning behavior, but team efficacy is not, when controlling for team psychological safety. As predicted, learning behavior mediates between team psychological safety and team performance. The results support an integrative perspective in which both team structures, such as context support and team leader coaching, and shared beliefs shape team outcomes.



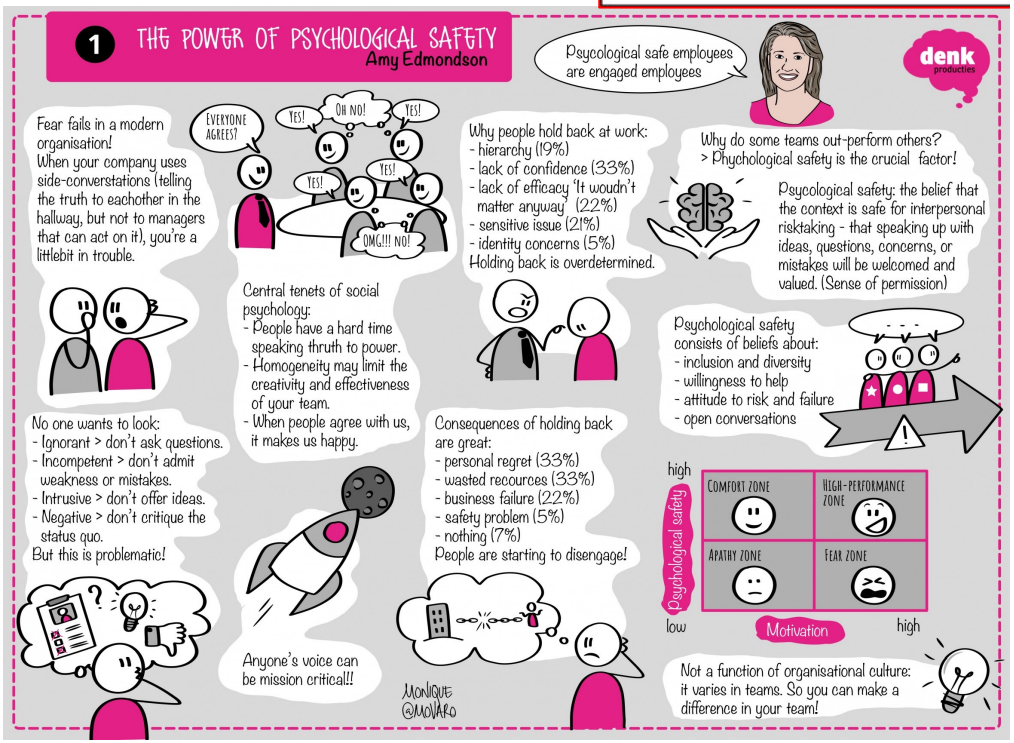
The NEW ENGLAND JOURNAL of MEDICINE

MEDICINE AND SOCIETY

TEAMWORK — PART 2
Debra Malina, Ph.D., *Editor*

Cursed by Knowledge — Building a Culture of Psychological Safety

Lisa Rosenbaum, M.D.



The Impact and Power of Staff Courage to Speak up

Open access Original research

BMJ Open

Associations between work satisfaction, engagement and 7-day patient mortality: a cross-sectional survey

Kirsten Brubakk ,[1] Martin Veel Svendsen,[2] Dag Hofoss,[3] Tonya Moen Hansen,[4] paul Barach ,[5] Ole Tjomsland[6]

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ABSTRACT

Objective This study examines the association between profession-specific work environments and the 7-day mortality of patients admitted to these units with acute myocardial infarction (AMI), stroke and hip fracture.

Design A cross-sectional study combining patient mortality data extracted from the South-Eastern Norway Health Region, and the work environment scores at the hospital ward levels. A case-mix adjustment model was developed for the comparison between hospital wards.

Setting Fifty-six patient wards in 20 hospitals administered by the South-Eastern Norway Regional Health Authority.

Participants In total, 46 026 patients admitted to hospitals with AMI, stroke and hip fracture, and supported by 8800 survey responses from physicians, nurses and managers over a 3-year period (2010–2012).

Primary and secondary outcome measures The primary outcome measures were the associations between the relative mortality rate for patients admitted with AMI, stroke and hip fractures and the profession-specific (ie, nurses, physicians, middle managers) mean scores on the 19 organisational factors in a validated cross sectional, staff survey conducted annually in Norway. The secondary outcome measures were the mean scores with SD on the organisational factors in the staff survey reported by each profession.

Results The Nurse workload (beta 0.019 (95% CI0.009–0.028)) and middle manager engagement (beta 0.024 (95% CI0.010–0.037)) levels were associated with a case-mix adjusted 7-day patient mortality rates. There was no significant association between physician work environment scores and patient mortality rates.

Conclusion 7-day mortality rates in hospital wards were negatively correlated with the nurse workload and manager engagement levels. A deeper understanding of the relationships between patient outcomes, organisational structure and their underlying cultural barriers is needed because they may provide a better understanding of the harm and death risks for patients due to organisational characteristics.

Strengths and limitations of this study

- This is the first study, to our knowledge, combining profession-specific work place survey data with patient mortality data correlated with the hospital ward levels.
- This study is strengthened by the use of ward-specific level data as hospital data can mask inter-ward differences.
- A case-mix adjustment model was developed for the comparison between hospital wards but not for the disease severity, thus it is hard to distinguish between patients who might die from the severity of their illness and less severe cases, for whom the lack of high-quality care ultimately may have reduced their chances of survival.
- Although the study included hospitals providing healthcare services to more than half of the Norwegian population, the number of wards is too small to allow the use of complex multivariate analyses.

INTRODUCTION

Hospitals are complex social–cultural organisations defined by their complexity of operations, uncertainty and interdependency.[1] A strong linkage between the organisation of care and patient outcomes has been found in several studies.[2 3] Complex organisations rely on authentic inputs and interactions while they deliver an array of clinical services. In these settings, it can be hard to determine the proximal causes of an adverse patient event such as a cardiac arrest or a medication error.[4 5] Numerous initiatives have been promoted to enhance the quality of the patient's journey when in hospital, and yet at least one in ten patients still experiences adverse events.[6] High-reliability organisational theory posits that organisational features including psychological safety,[7] leadership involvement,[8] team based care,[9] trusting support[10] and a relentless culture of quality measurement are needed to sustain reliable improvements in care.[11]

The impact of organisational culture on quality, reporting of data and safety in non-medical organisations is well documented.[12–15] Monitoring staff perceptions of their work environment and their organisational culture

PLOS ONE

RESEARCH ARTICLE

Hospital work environments affect the patient safety climate: A longitudinal follow-up using a logistic regression analysis model

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Competing interests: The authors have declared that no competing interests exist.

Abstract

Background

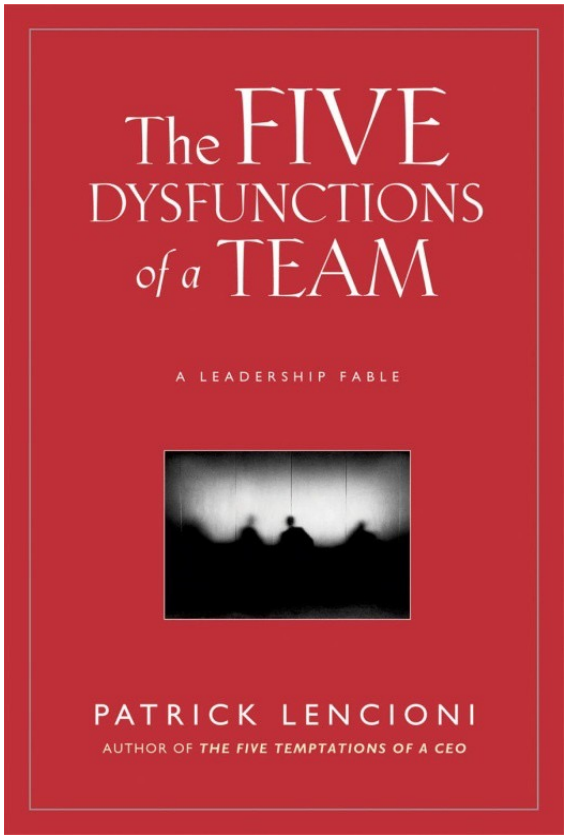
Occupational worker wellness and safety climate are key determinants of healthcare organizations' ability to reduce medical harm to patients while supporting their employees. We designed a longitudinal study to evaluate the association between work environment characteristics and the patient safety climate in hospital units.

Methods

Primary data were collected from Norwegian hospital staff from 970 clinical units in all 21 hospitals of the South-Eastern Norway Health Region using the validated Norwegian Work Environment Survey and the Norwegian version of the Safety Attitudes Questionnaire. Responses from 91,225 surveys were collected over a three year period. We calculated the factor mean score and a binary outcome to measure study outcomes. The relationship between the hospital unit characteristics and the observed changes in the safety climate was analyzed by linear and logistic regression models.

Results

A work environment conducive to safe incident reporting, innovation, and teamwork was found to be significant for positive changes in the safety climate. In addition, a work environment supportive of patient needs and staff commitment to their workplace was significant for maintaining a mature safety climate over time.



The Five Dysfunctions of Healthcare Teams

After Patrick Lencioni, 2007

The Power of the Clinical Microsystem

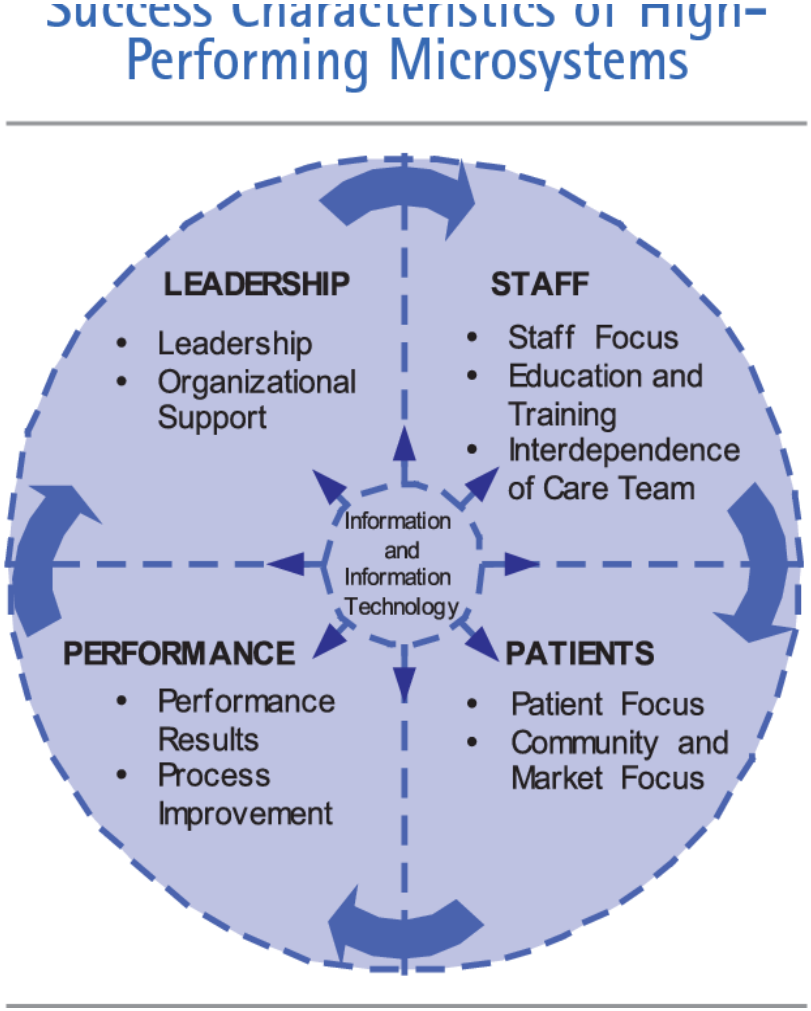
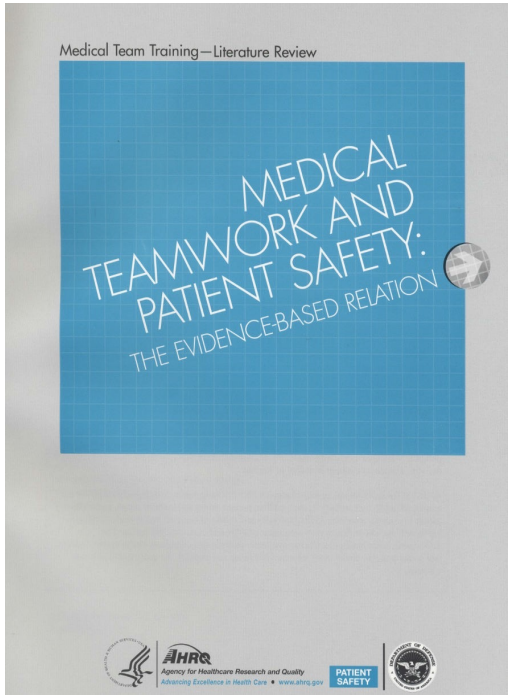


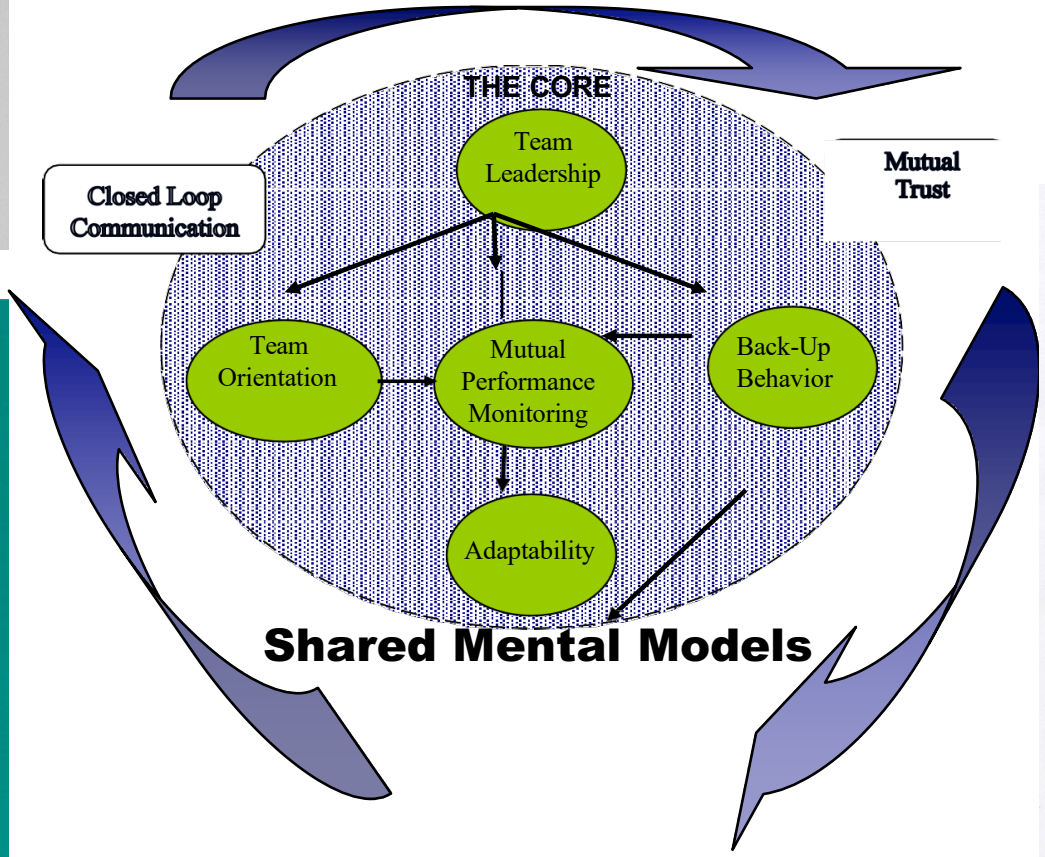
TABLE 6–1. Microsystem Dimensions and Operational Definitions

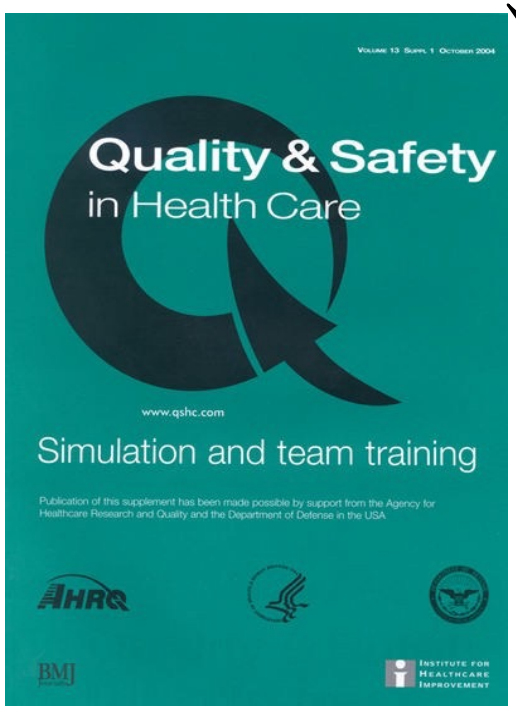
Dimension	*Operational Definition*
1. Leadership	The role of leadership is to balance setting and reaching collective goals, empower individual autonomy as well as accountability through building knowledge, respectful action, and reviewing and reflecting
2. Organizational support	The larger organization looks for ways to connect to and facilitate the work of the microsystem and coordinate the hand-offs between microsystems
3. Staff focus	There is selective hiring of the right kind of people; the orientation process is designed to fully integrate new staff into culture and work roles; expectations of staff are high regarding performance, continuing education, professional growth, and networking
4. Education and training	All clinical microsystems, regardless of whether they are part of an academic medical center, have responsibility for the ongoing education and training of staff and for aligning daily work roles with training competencies; academic clinical microsystems have the additional responsibility of training students
5. Interdependence	The interaction of staff is characterized by trust, collaboration, willingness to help each other, appreciation of complementary roles, respect and recognition that all contribute individually to a shared purpose
6. Patient focus	The primary concern is to meet all patient needs—caring, listening, educating, and responding to special requests, innovating against needs, and ensuring smooth service flow
7. Community and market focus	The microsystem is a resource for the community and the community is a resource to the microsystem; there is a focus on establishing the relationship with the community
8. Performance results	Performance focuses on patient outcomes, avoidable costs, streamlining delivery, using data feedback, promoting positive competition, and frank discussions about performance
9. Process improvement	An atmosphere for learning and redesign is supported by the continuous monitoring of care, use of benchmarking, frequent tests of change, and a staff that has been empowered to innovate
10. Information and information technology	Information is THE connector—staff to patients, staff to staff, needs with actions to meet needs; technology can facilitate effective communication and multiple formal and informal channels are used to keep everyone informed all the time, listen to everyone's ideas, and ensure that everyone is connected on important topics

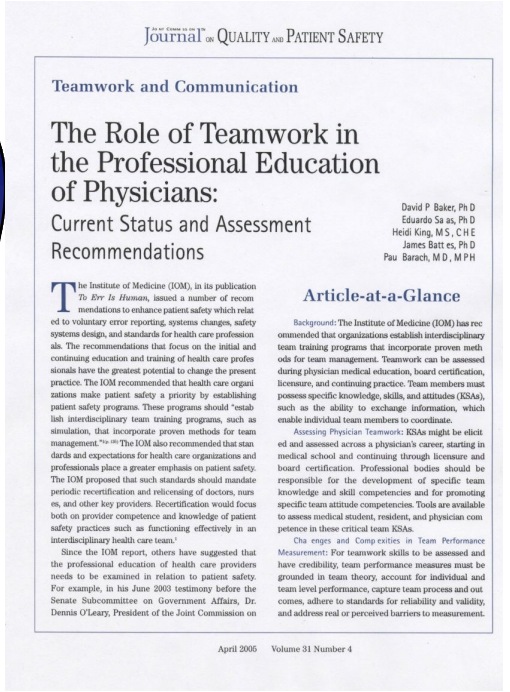
Mohr, et. al; Johnson et al; Barach et al.



TeamSTEPPS Model



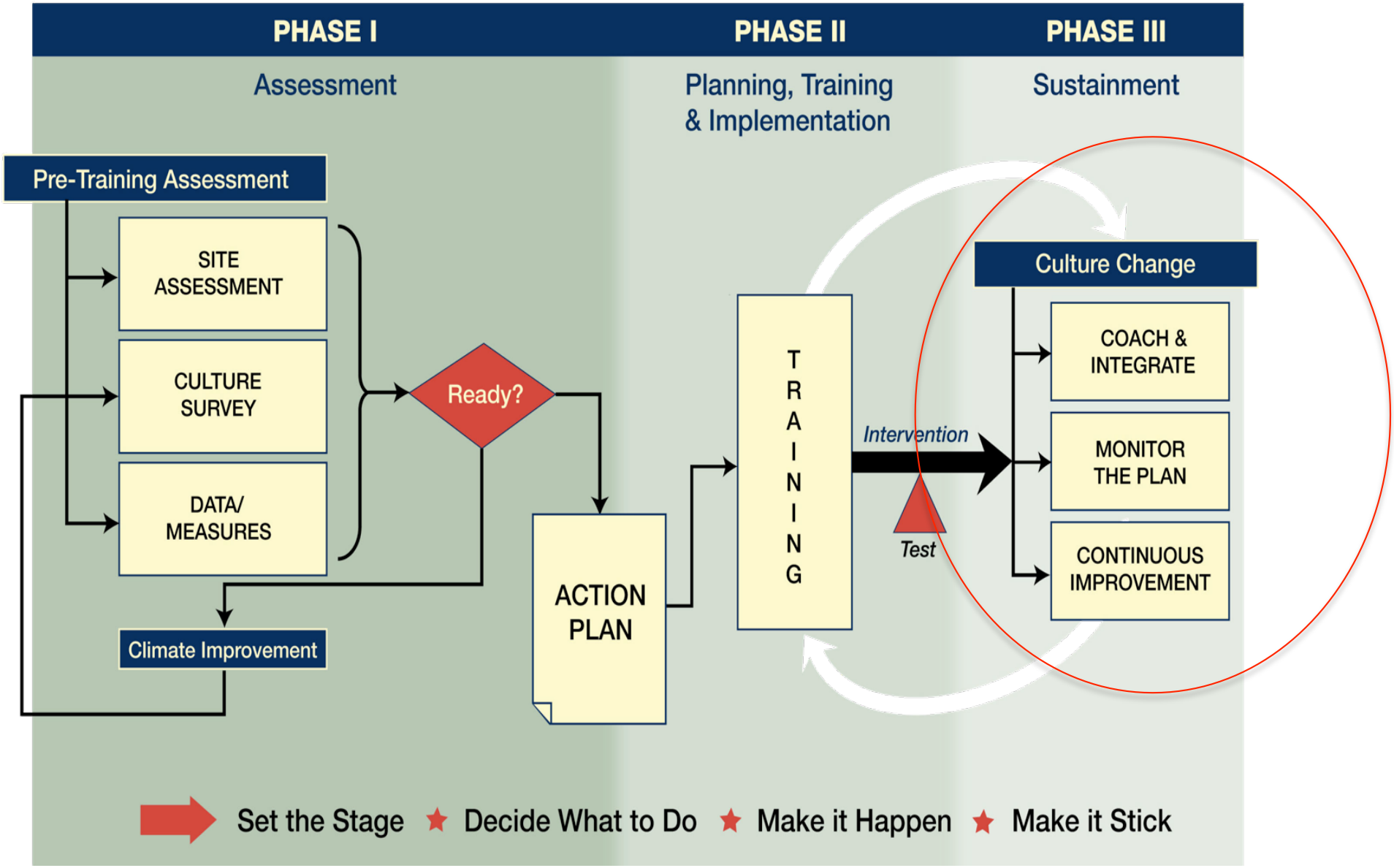




Baker, Salas, King, Battles, Barach, 2006; 2007; 2009

https://www.hrsa.gov/behavioral-health/teamstepps

Culture Change is ESSENTIAL to TeamSTEPPS Model



Association Between Implementation of a Medical Team Training Program and Surgical Mortality

Julia Neily, RN, MS, MPH
Peter D. Mills, PhD, MS
Yinong Young-Xu, ScD, MA, MS
Brian T. Carney, MD
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James P. Bagian, MD, PE

Context There is insufficient information about the effectiveness of medical team training on surgical outcomes. The Veterans Health Administration (VHA) implemented a formalized medical team training program for operating room personnel on a national level.

Objective To determine whether an association existed between the VHA Medical Team Training program and surgical outcomes.

Design, Setting, and Participants A retrospective health services study with a contemporaneous control group was conducted. Outcome data were obtained from the VHA Surgical Quality Improvement Program (VASQIP) and from structured interviews in fiscal years 2006 to 2008. The analysis included 182 409 sampled procedures from 108 VHA facilities that provided care to veterans. The VHA's nationwide training program required briefings and debriefings in the operating room and included checklists as an integral part of this process. The training included 2 months of preparation, a 1-day conference, and 1 year of quarterly coaching interviews

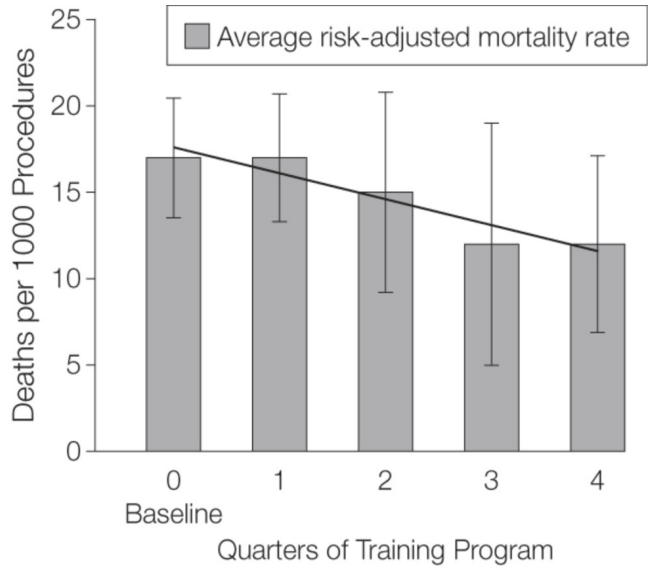
Main Outcome Measure The rate of change in the mortality rate 1 year after facilities enrolled in the training program compared with the year before and with nontraining sites.

Results The 74 facilities in the training program experienced an 18% reduction in annual mortality (rate ratio [RR], 0.82; 95% confidence interval [CI], 0.76-0.91; *P*=.01) compared with a 7% decrease among the 34 facilities that had not yet undergone training (RR, 0.93; 95% CI, 0.80-1.06; *P*=.59). The risk-adjusted mortality rates at baseline were 17 per 1000 procedures per year for the trained facilities and 15 per 1000 procedures per year for the nontrained facilities. At the end of the study, the rates were 14 per 1000 procedures per year for both groups. Propensity matching of the trained and nontrained groups demonstrated that the decline in the risk-adjusted surgical mortality rate was about 50% greater in the training group (RR,1.49; 95% CI, 1.10-2.07; *P*=.01) than in the nontraining group. A dose-response relationship for additional quarters of the training program was also demonstrated: for every quarter of the training program, a reduction of 0.5 deaths per 1000 procedures occurred (95% CI, 0.2-1.0; *P*=.001).

ADVERSE EVENTS RELATED TO surgery continue to occur despite the best efforts of clinicians.[1] Teamwork and effective communication are known determinates of surgical safety.[2-6] Previous efforts at demonstrating the efficacy of patient safety initiatives have been limited because of the inability to study a control group.[7] For example, the use of the World Health Organization Safe Surgery checklist has been evaluated, but its overall efficacy remains uncertain because no control group was studied to clearly demonstrate this instrument's effectiveness.[8]

The Veterans Health Administration (VHA) is the largest national in-

"The 74 facilities in the training program experienced an 18% reduction in annual mortality (rate ratio [RR], 0.82; 95% confidence interval [CI] 0.76-0.91; P = 01) compared with a 7% decrease among the 34 facilities that had not yet undergone training (RR, 0.93; 95% CI, 0.80-1.06; P = 59)".



Neily J et al: JAMA 304: 1693-700, 2010

THE MODEL FOR IMPROVEMENT

What do we want to achieve?

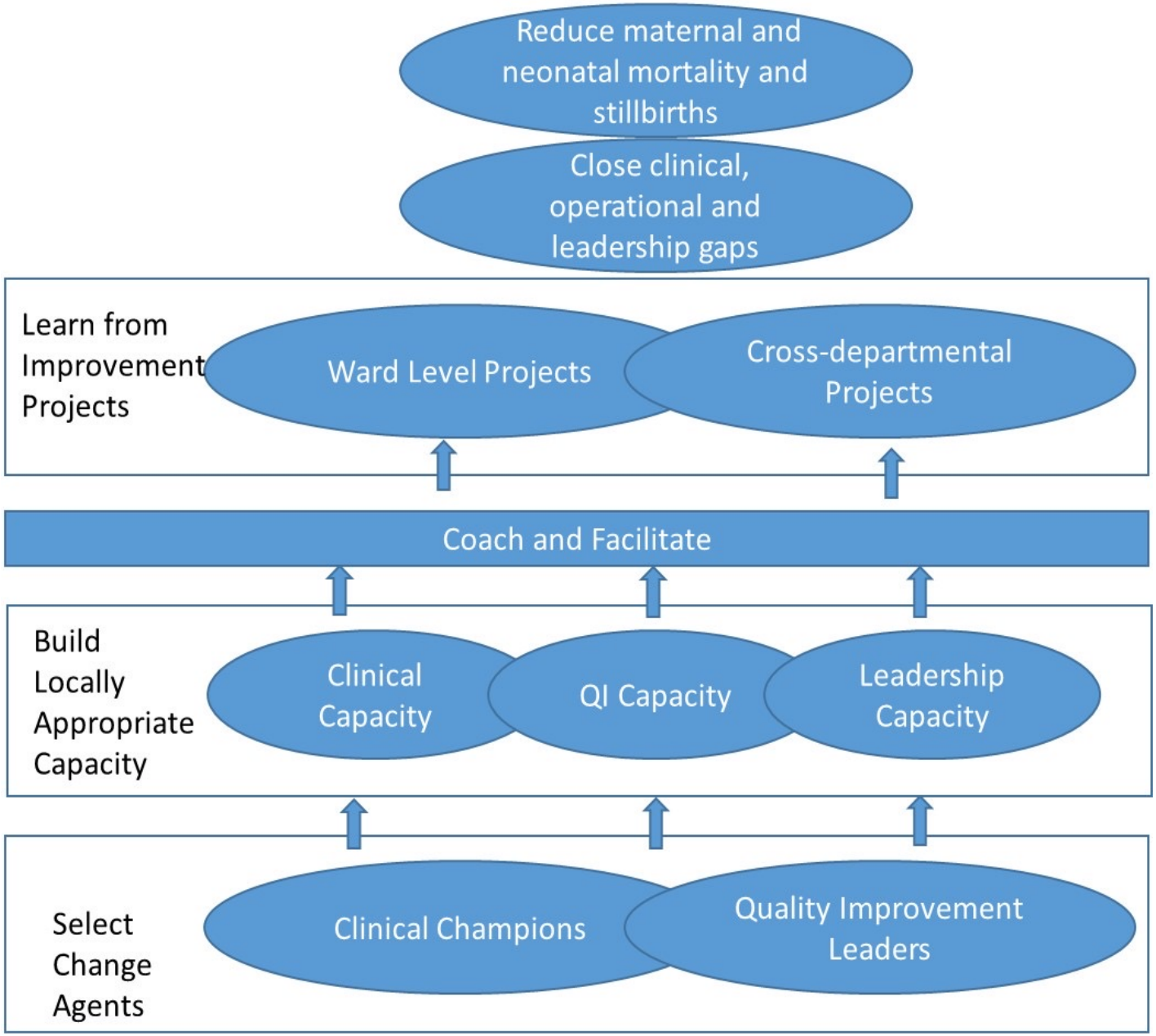
What changes will drive our progress?

How will we measure our progress?

How should we modify our latest changes?

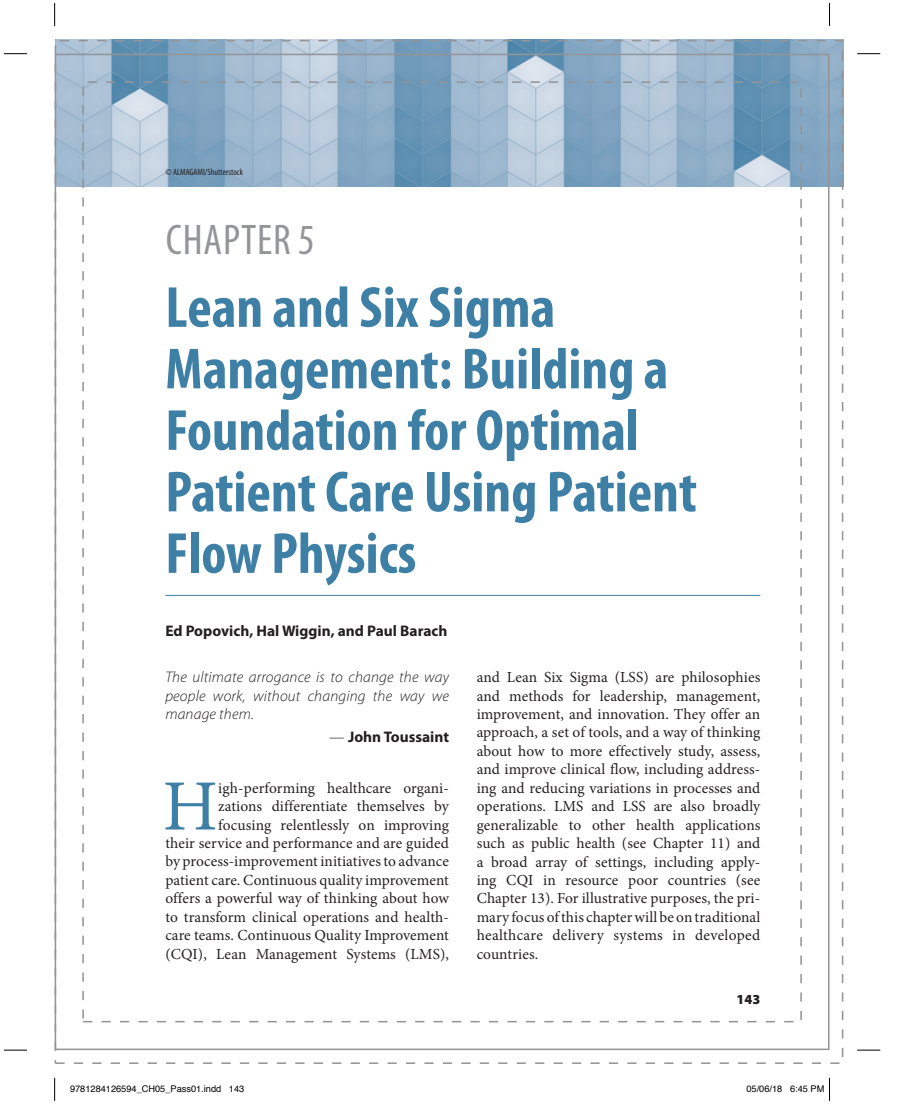
From: ***The Foundation of Improvement*** by Thomas W. Nolan *et. al*

Theory of Change



IMPROVEMENT TOOLKIT

- Flowcharts
- SIPOC
- Cause and effect diagrams (Ishikawa/fishbone)
- FMEA-Failure Mode and Effects Analysis
- Pareto charts
- Run charts



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CHAPTER 5

Lean and Six Sigma Management: Building a Foundation for Optimal Patient Care Using Patient Flow Physics

Ed Popovich, Hal Wiggin, and Paul Barach

The ultimate arrogance is to change the way people work, without changing the way we manage them.

— **John Toussaint**

High-performing healthcare organizations differentiate themselves by focusing relentlessly on improving their service and performance and are guided by process-improvement initiatives to advance patient care. Continuous quality improvement offers a powerful way of thinking about how to transform clinical operations and healthcare teams. Continuous Quality Improvement (CQI), Lean Management Systems (LMS), and Lean Six Sigma (LSS) are philosophies and methods for leadership, management, improvement, and innovation. They offer an approach, a set of tools, and a way of thinking about how to more effectively study, assess, and improve clinical flow, including addressing and reducing variations in processes and operations. LMS and LSS are also broadly generalizable to other health applications such as public health (see Chapter 11) and a broad array of settings, including applying CQI in resource poor countries (see Chapter 13). For illustrative purposes, the primary focus of this chapter will be on traditional healthcare delivery systems in developed countries.

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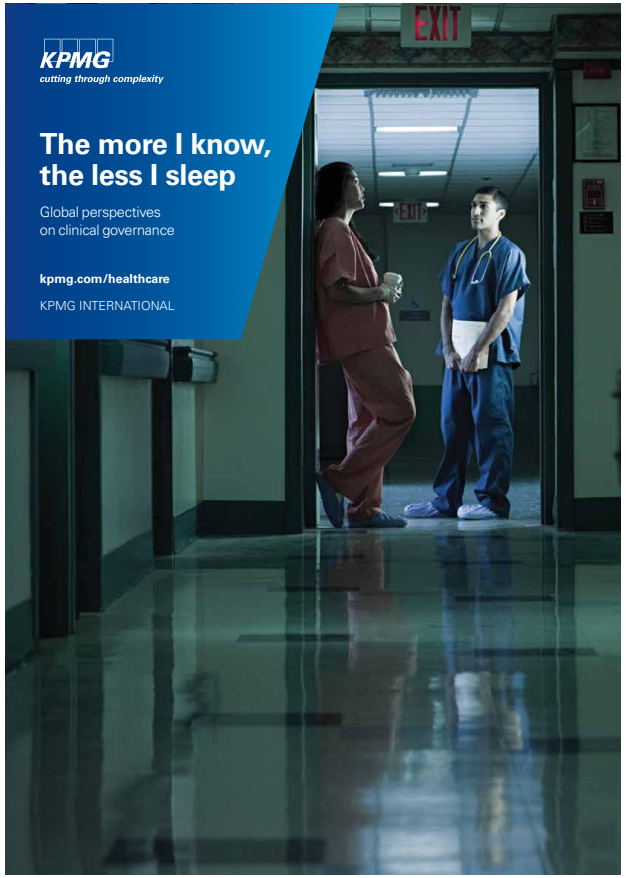
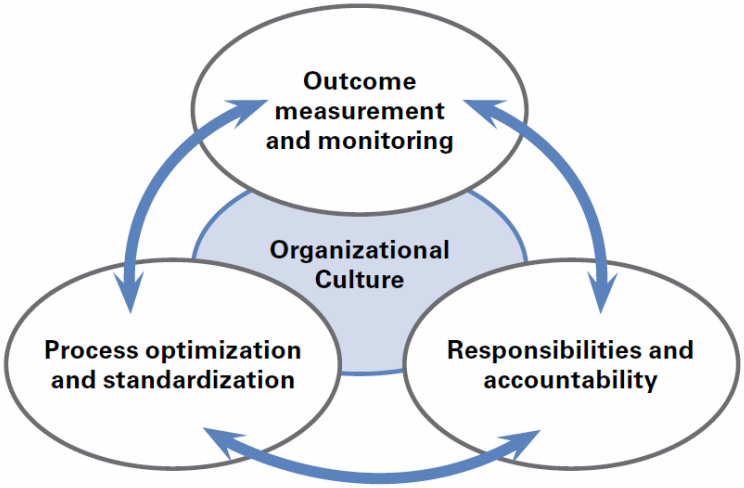
Popovich E, Wiggin H, Barach P, 2019

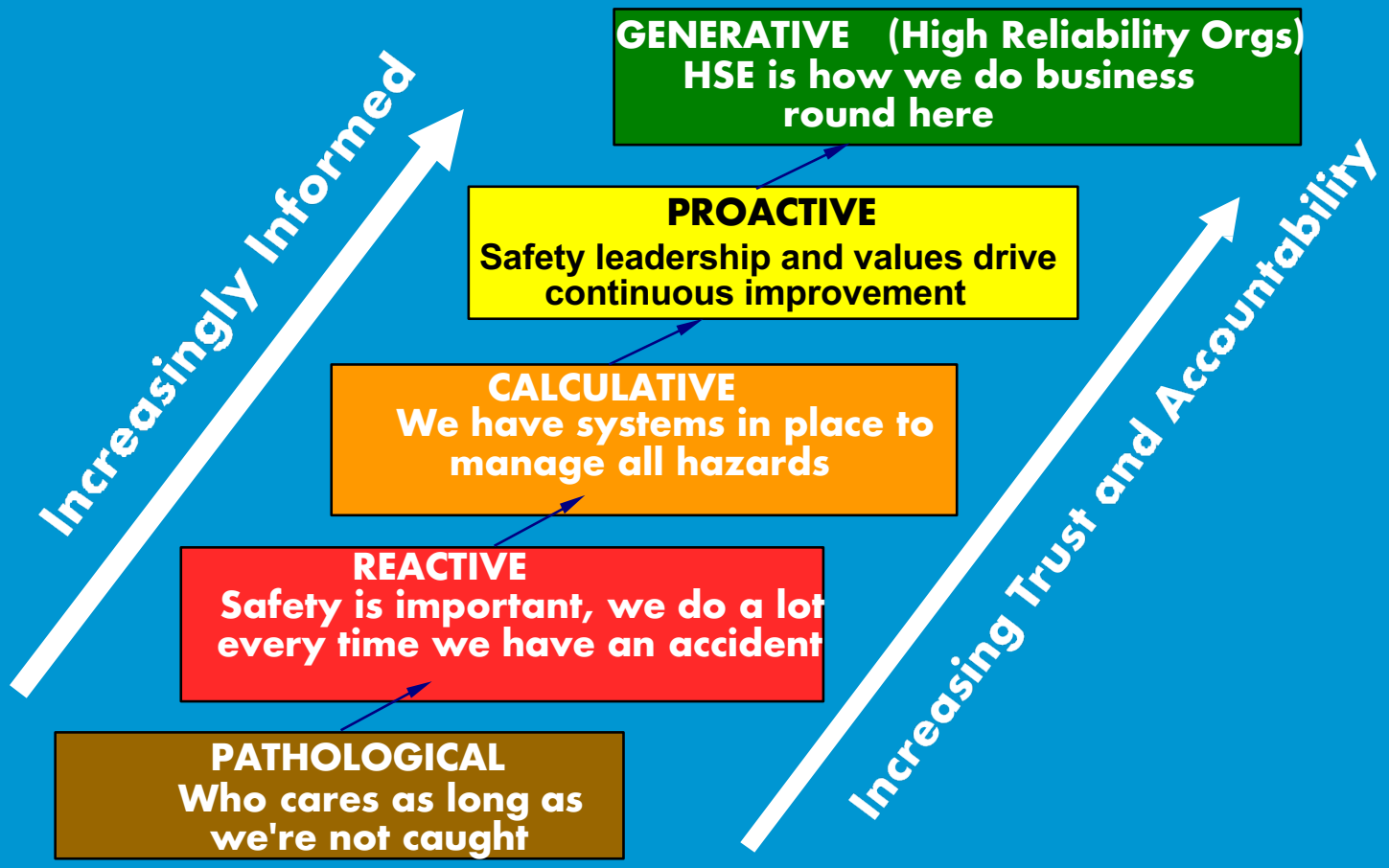
What we can learn from
High Reliability Organizations about HCW Wellness and Loyalty





- Sanchez J, Barach P. High Reliability Organizations and Surgical Microsystems: Re-engineering Surgical Care. Surgical Clinics of North America, 02/2012; 92(1):1-14DOI: 10.1016/j.suc.2011.12.005

Stages in the development of a safety culture



After Ron Westrum

Evaluating policy and service interventions: framework to guide selection and interpretation of study end points

Richard J Lilford,[1] Peter J Chilton,[1] Karla Hemming,[1] Alan J Girling,[1] Celia A Taylor,[2] Paul Barach[3]

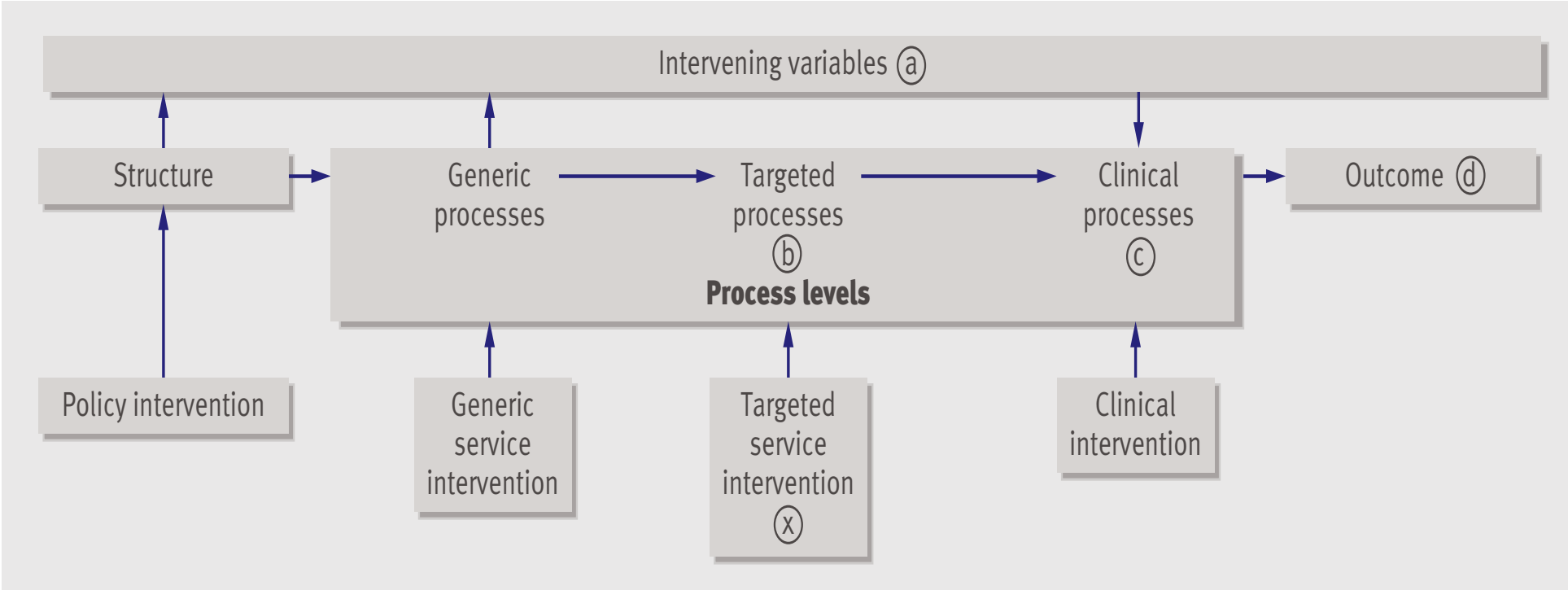


Fig 1 | Modified Donabedian causal chain. Interventions at structural (policy) and generic service level can achieve effects through intervening variables (such as motivation and staff-patient contact time) further down the chain. For example, an intervention at (x) produces effects (good or bad) downstream at (a), (b), (c), and (d)

BMJ 2010;341:c4413 doi: 10.1136/bmj.c4413

Designing HCW Welness Interventions by Focused Implementation

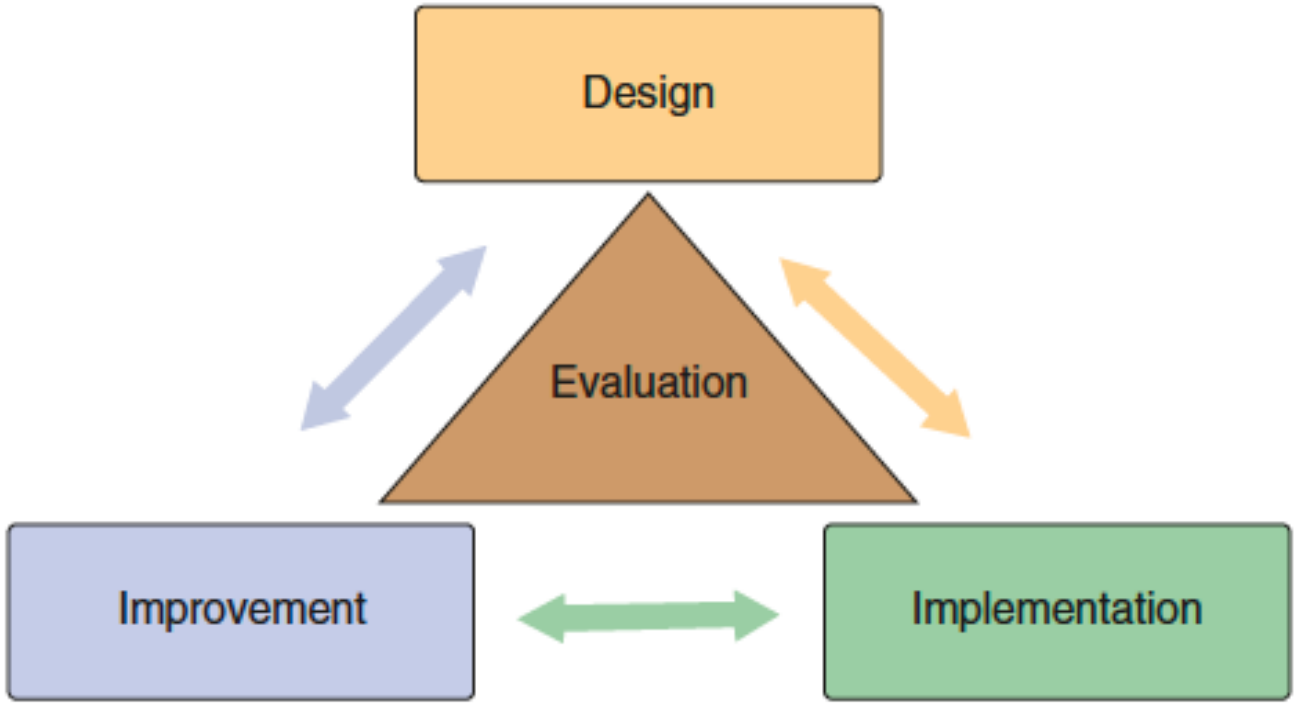


Fig. 39.2 Design Focused Implementation Framework (DFIF)

Toward a Learning System for ERAS: Embedding Implementation and Learning Evaluation

Rohit Ramaswamy and Paul Randall Barach

"The success of organizations depends on their ability to design themselves social learning systems."
– Etienne Wenger

Introduction

Contemporary colorectal surgery was often associated with long length of stay (8 days for open surgery and 5 days for laparoscopic surgery), high cost, and rates of surgical site infection approaching 20–30%. During the hospital stay for elective colorectal surgery, the incidence of perioperative nausea and vomiting (PONV) may be as high as 80% in patients with certain risk factors. After discharge from colorectal surgery, readmission rates have been noted in past to be as high as 35.4%.

The concept of a multimodal approach to recovery after surgery was initially proposed by Kehlet who explored the possible determinants of postoperative morbidity in the late 1990s [1]. He identified potential risk factors that need to be recognized and treated perioperatively to minimize the effects of surgical stress on the patient. Kehlet also championed the idea of working within an integrated multidisciplinary framework. Together these efforts have led to a series of interventions that are formulated into standardized protocols to span a patient's entire journey through the surgical process with distinct elements in the preoperative, intraoperative, and postoperative phases [2].

The outcomes of interest to patients and providers include freedom from nausea, freedom from pain at rest, early return of bowel function, improved wound healing, and early hospital discharge. The basic premise is that the impact of surgery on the metabolic and endocrine response systems are reduced, leading to earlier recovery. Successful implementation of ERAS leads to reduced length of hospital stay and earlier return to productivity. Systematic reviews of ERAS for various types of surgery have shown that the intervention has the potential to enhance patient outcomes but that consistent implementation is required [3, 4]. In this chapter, we describe how the concepts drawn from the field of implementation science can be used to improve the consistency and quality of ERAS implementation while engaging front line clinical staff [5, 6].

Management of Surgical Risk and Quality Improvement

It is widely understood today that the first step toward implementing ERAS to assure patient safety and quality of care is to address several factors that are external to the surgical process itself. Scaling up in new hospitals and countries requires attention to much more than the surgerical interventions and requires an appreciation for introducing standardized processes in complex systems and appreciation of the implementation contexts [7]. These steps involve (1) developing a standard set of activities that are needed to deliver ERAS within a health system (over and above the clinical steps themselves); (2) identifying the operational factors (e.g., political will, resources, schedules, supplies, equipment, etc.) that affect the implementation of ERAS within the system; (3) identifying the organizational factors (e.g., staff motivation, organizational culture, climate for innovation) that affect the implementation of ERAS; and (4) developing a tailored, locally appropriate and bottom-up strategies to address the organizational and operational factors based on local constraints and championship. In essence, effective hazard reduction and risk management requires a reframing of care from one that is task-oriented at the level of the

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Jefferson College of Popuation Health, Philadelphia, PA, USA

O. Ljungqvist et al. (eds.), *Enhanced Recovery After Surgery*, https://doi.org/10.1007/978-3-030-33443-7_39

Consolidated Framework for HCW Wellness Research

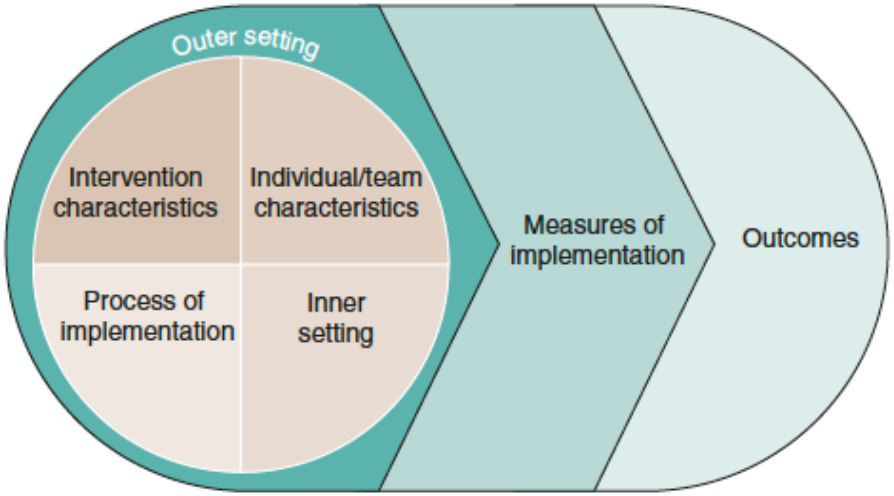


Fig. 39.4 Consolidated Framework for Implementation Research (CFIR). (Figure modified from Rojas Smith et al. [27])

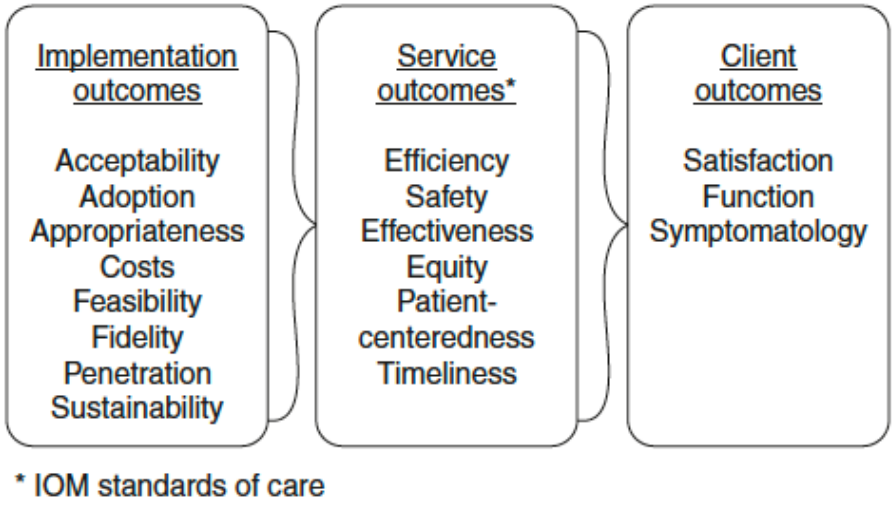
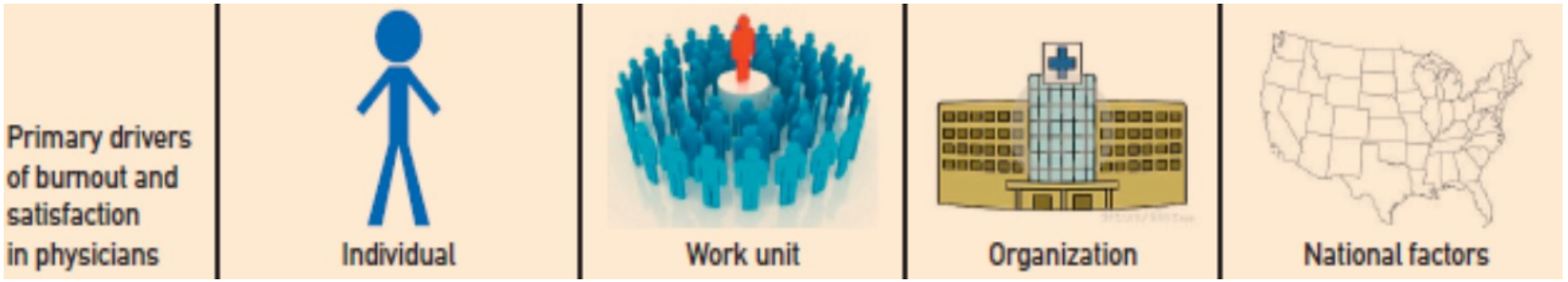
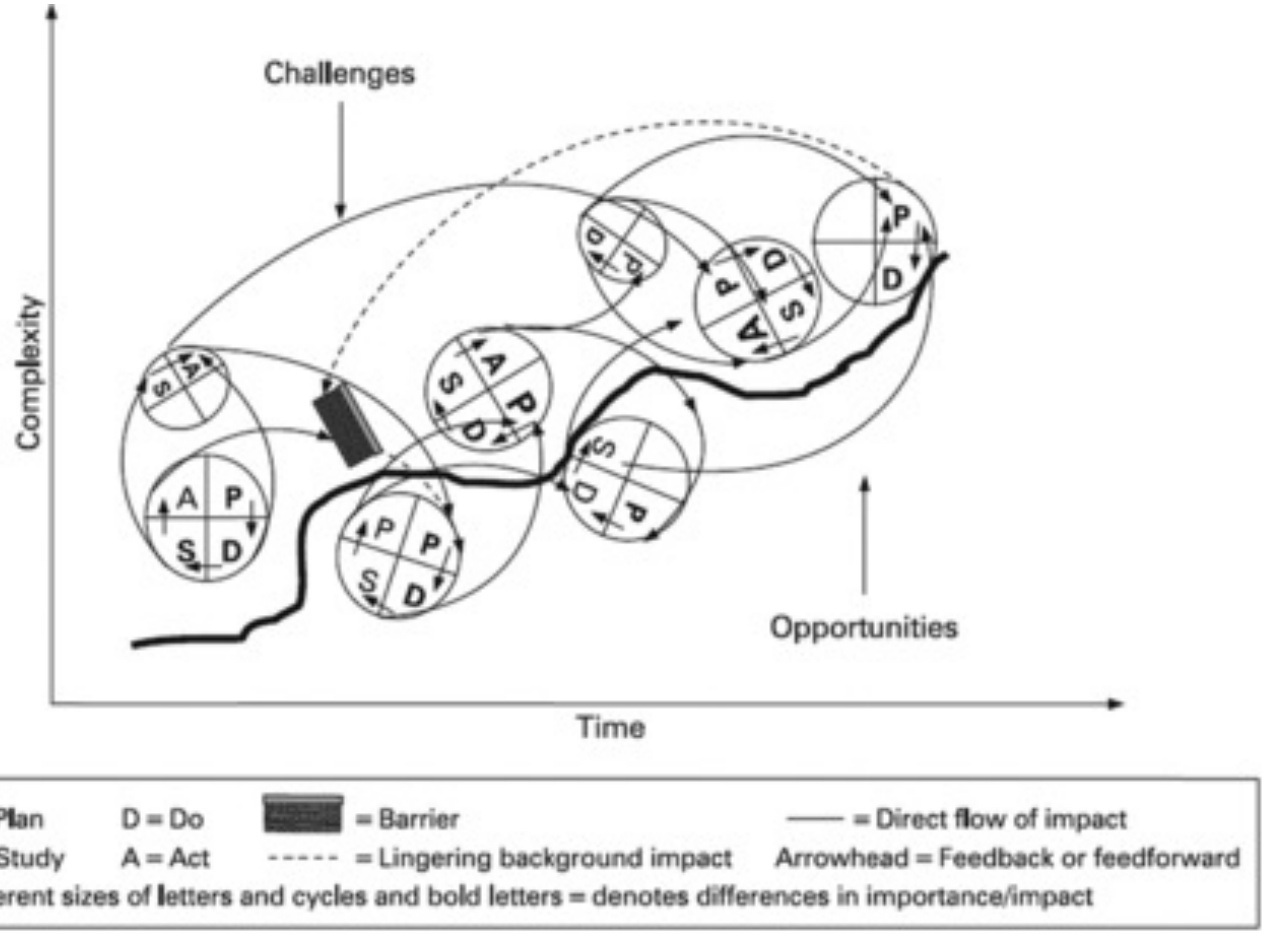


Fig. 39.5 Implementation, service, and client outcomes. (Reprinted with permission from Proctor et al. [29])

Damschroder, L.J., Aron, D.C., Keith, R.E. *et al.* Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. *Implementation Sci* **4,** 50 (2009). https://doi.org/10.1186/1748-5908-4-50

Efficiency of Practice: Measurement Challenges





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Formula for Improving HCW Wellness Interventions

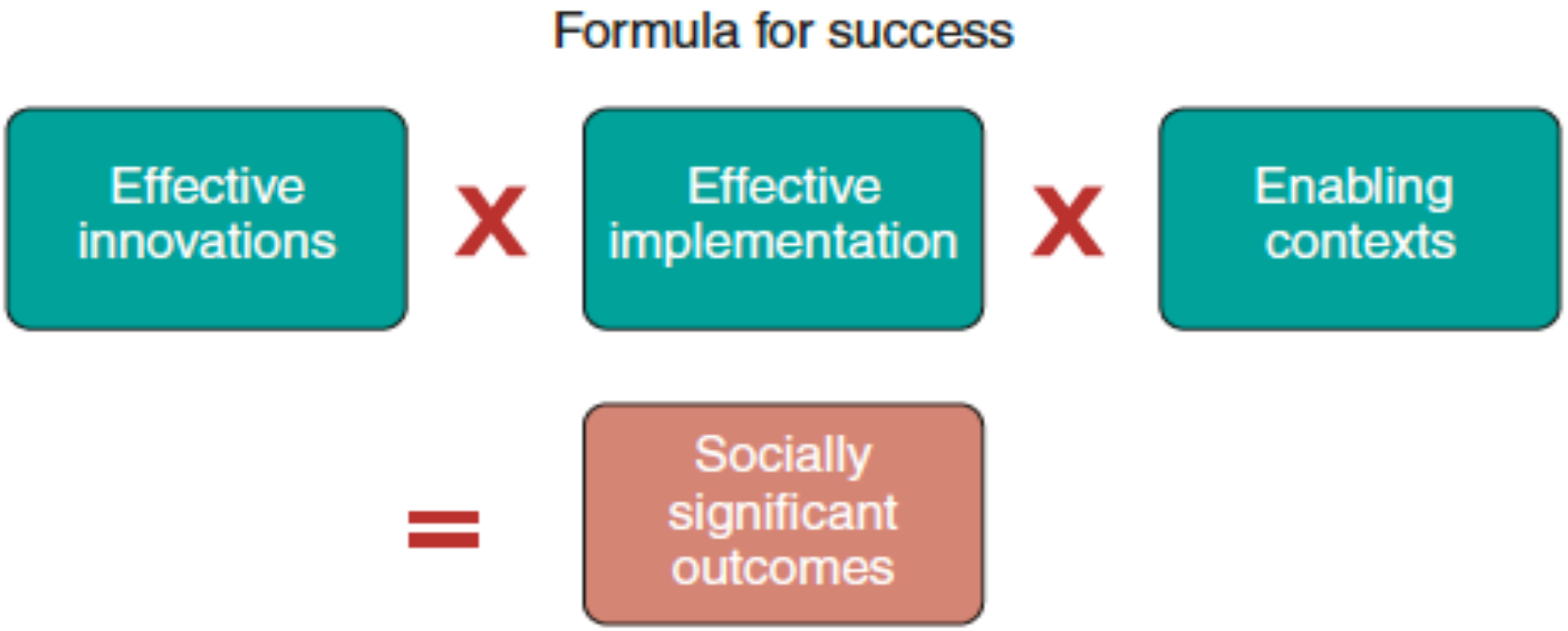
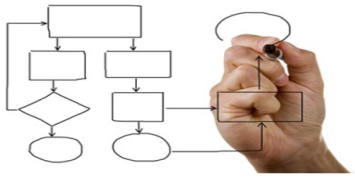


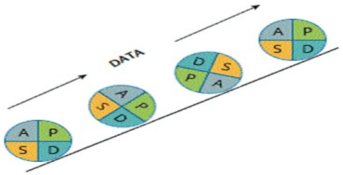
Fig. 39.7 Formula for successful implementation and update of clinical interventions [38]

Ramaswamy R, and Barach P. 2020

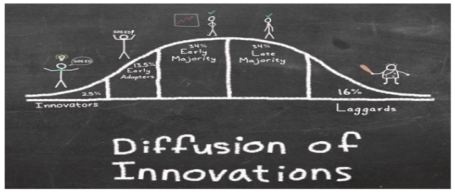
Health Workforce Wellness Redesign Roadmap 3.0



Teamwork
Human behavior
Institutional change
Understanding patients

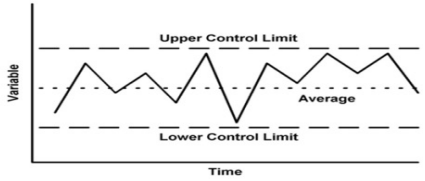


Understanding variation
Measuring change
Qualitative methods



Logic modeling
Process mapping
Systems thinking

Plan-Do-Study-Act
Serial small tests of change
Coproducing clinical encounters



Communicating results
Scale up and spread
Sustaining change

Adapted from IHI

Chapter 27
Safety 3.0 and the End of the Superstar Clinician

Chris P. Subbe and Paul Barach

'Every system is perfectly designed to get the results it gets'.
Paul Batalden

Abstract Training of clinicians in both nursing and medicine is often focused on improving their individual competencies in the hope to reduce error and patient harm rates to a negligible level. Medicine attracts the brightest students in most countries through a highly competitive selection process. Despite this, 5–10% of patients admitted to hospital continue to suffer complications with significant morbidity and mortality. Disappointingly error rates in many areas have not significantly changed for decades.

The dominant philosophies of error reduction are 'Safety 1' and 'Safety 2'. The principle of 'Safety 1' focuses on measurement and understanding of errors. 'Safety 2' is looking for resilient systems in which we seek to understand how people manage to create safety despite system weaknesses and endeavour to better appreciate successful safe working practices.

In this chapter in build on Safety 1 and 2, and introduce the concept of Safety 3.0. In contrast to the principles applied to reducing errors in hospitals, the high-reliability industries have used another approach to assure reliable, reduction of failures and to enhance safety: modular redundancy. This approach assures that safety-critical parts of technical systems exist in triplicate or quadruplicate backups and the failure of individual parts does not lead to catastrophic system failures and fatal outcomes. This might be the key to reliable safety of complex social-technical systems such as aviation, nuclear power, space travel and more.

The application of this principle is still rare in healthcare, but acceptance of the need for a robust safety management system based on redundancy of safety-critical

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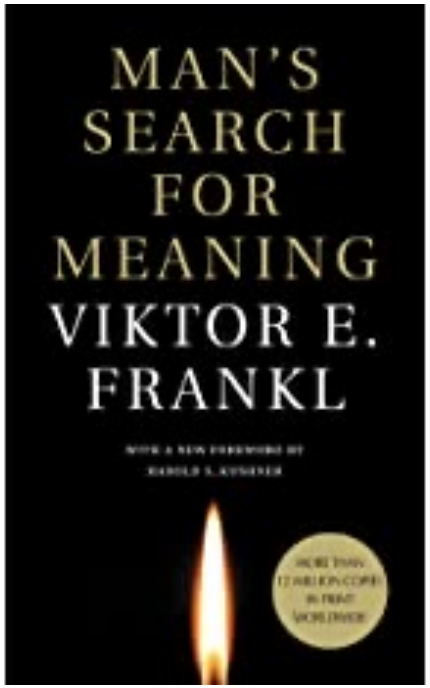
E. Vanderheiden, C.-H. Mayer (eds.), *Mistakes, Errors and Failures across Cultures*, https://doi.org/10.1007/978-3-030-35574-6_27

Meaningful Work



"Life is never made unbearable by circumstances, but only by lack of meaning and purpose."

"Between stimulus and response, there is a space. In that space is our power to choose our response. In our response lies our growth and our freedom."

For more background information
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