

# Frailty of Health Care Systems

Philip D. St. John, MD<sup>1</sup>, David B. Hogan, MD<sup>2</sup>

<sup>1</sup>Department of Medicine, Max College of Medicine and the Centre on Aging, University of Manitoba, Winnipeg, MB; <sup>2</sup>Departments of Medicine and Community Health Sciences, Cumming School of Medicine, University of Calgary, Calgary, AB

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## ABSTRACT

Frailty is a state of vulnerability to stressors which has long been a focus of Geriatric Medicine, and is gaining acceptance in other fields. The notion of frailty considers individuals, but many similarities exist between individuals and health care systems (HCS). We have drawn parallels between frail individuals and frail health care systems. We have adapted a commonly used measure of frailty—the “Frailty Phenotype”, to measure HCS which are vulnerable to acute and chronic stresses. Finally, we note the “double jeopardy” of frail older adults within frail HCS. Ensuring that HCS remain robust and unlikely to fail should be a priority for health-care policy makers.

**Key words:** frailty, health-care systems, resilience, health policy

## INTRODUCTION

Frailty in older persons is characterized by a loss of reserve capacity to deal with acute stressors and an enhanced vulnerability to system failure. It is the result of multiple complex causal pathways involving diverse and interacting risk factors operating over time. Not surprisingly, complex interventions across multiple domains are felt necessary to prevent frailty and mitigate the adverse consequences for those living with frailty.<sup>(1)</sup> Common approaches to its identification include the accumulation of deficits,<sup>(2)</sup> frailty phenotype,<sup>(3)</sup> and the updated Clinical Frailty Scale.<sup>(4)</sup> With the former, frailty arises from a build-up of multiple age-related deficits. Those with a higher ratio of deficits present to those considered are frailer than those with fewer. The frailty phenotype postulates that frailty is a geriatric syndrome characterized by the presence of three or more of the following criteria: unintentional weight loss (shrinking); self-reported fatigue (exhaustion); weakness (low grip strength); slow walking speed; and low physical activity. The updated Clinical Frailty Scale is a judgment-based instrument that assesses where an older person fits on a 9-point scale of fitness to frailty, with an additional category for those terminally ill.

Like people, health care systems (HCS) are complex entities with varying reserve capacity. While the notion of a frail HCS has been raised, its analogy to frailty as understood clinically has not been fully explored. Volpato *et al.* commented on the lack of functional reserve (specifically shortages in ICU beds and ventilators) in the Italian HCS that led to its inability to “maintain system homeostasis under stressful conditions” during the early days of the COVID-19 pandemic.<sup>(5)</sup> Doré felt the NHS in England was “crumbling” in the manner of a frail biological system. Initial coping to challenges through utilizing subsidiary pathways over time became over-matched as problems accumulated, persisted and/or worsened.<sup>(6)</sup>

Building on these contributions, we will briefly review concepts about frailty in older persons, demonstrate how they might be useful in assessing HCS position on a fitness-to-frail spectrum, discuss how the COVID-19 pandemic operated as a stress test for HCS, and explore the double jeopardy (i.e., risk or disadvantage incurred from the occurrence of two sources of risk simultaneously) frail older persons encounter when cared for by frail HCS.<sup>(7)</sup>

## Failure of Complex Systems

Complex systems are “made up of a large number of parts that interact in a non-simple way ... [where] the whole is more than the sum of the parts.”<sup>(8)</sup> They are prone to “cascading failures.” As one part of a system fails, stress is placed on related parts that, in turn, may fail, leading to a progressive series of failures.<sup>(9)</sup>

HCS failure can manifest itself in two manners: adequate steady-state performance until a precipitating event (or series of events) that the system is ill-equipped to deal with takes place (i.e., catastrophic failure), OR progressive “failing” over years manifested by deteriorating performance (i.e., progressive collapse). The underlying health care state and the precipitating event may interact. A less intense precipitant that would be tolerated by a “fit” HCS could cause a “failing” one to collapse. For example, the COVID-19 pandemic stressed HCS around the world.<sup>(5)</sup> Prior to the pandemic, certain HCS were regarded as highly functional, well resourced, and able

to respond to the routine ebb and flow of health-care needs. While these HCS were distressed by the pandemic, they remained functional throughout and recovered soon after the pandemic. “Failing” systems with little-to-no reserve capacity prior to the pandemic were more likely to fail and took longer to recover afterwards. Most HCS fell between these extremes.

Older individuals living with advanced frailty may reach what has been referred to as the “point of no return” when “the process becomes irreversible and death is imminent”,<sup>(10)</sup> and palliation may be appropriate. HCS may also face a point beyond which failure is imminent and unavoidable without external intervention. During the early days of the COVID-19 pandemic, some HCS were stressed to the point that they failed to provide core services to their clients, patients, and/or residents. Home care was hampered by staffing shortages and the restrictions of infection control measures; hospitals felt overwhelmed; long term care facilities (LTCF) were disproportionately impacted by mortality risk (in Canada residents of LTCF in mid-2020 accounted for 78.4% of all deaths);<sup>(11)</sup> and elective non-urgent surgeries could not be performed until well after the major COVID-19 waves had passed. Fundamental changes to the Canadian HCS may be needed for it to more adequately address current demographics and epidemiology of diseases and health conditions.

### Related Notions

Fried *et al.*<sup>(12)</sup> defined concepts related to frailty that are potentially relevant to HCS.

ADAPTATION is “the ability to change in structure or function in order to increase the fitness for survival.”<sup>(12)</sup> For an older individual, the inability to mount an adaptive response results in complications and breakdowns, sometimes in domains seemingly unrelated to the initial insult (e.g., COVID-19 infection presenting as a fall).<sup>(13)</sup> Similarly, HCS may adapt slowly, incompletely, or in an indirect manner (e.g., primary care and hospital inpatient care breakdowns manifesting as emergency department overcrowding).

RESERVE is “the weighted average of the maximum work capacity minus the basal work output of each physiological subsystem involved in stress response”.<sup>(12)</sup> In a resting state, maximum capacity is not needed, but the lack of sufficient reserve can have catastrophic effects when a system faces an acute increase in demand of a sufficient magnitude. Unused capacity in HCS is often viewed as wasteful, leading to calls for increased “leanness” in pursuit of greater organizational efficiency. Excessive cuts to capacity could result in insufficient reserve to deal with statistically rare events and stressors. Similarly, diverting resources to deal with overall increased demand may be necessary in extreme situations, but could also worsen pre-existing issues and lead to indirect harm. For example, to preserve access to hospitals during the COVID-19 pandemic, Alberta, like many jurisdictions, postponed non-urgent surgeries during waves of the infection. While the resulting increase in the backlog of patients waiting for surgery was expected, this action exacerbated pre-existing issues with the delivery of surgical

services in the Province, led to perceived inequities, and was associated with worsening physical and mental health issues for the patients affected.<sup>(14)</sup>

RESILIENCE is “the ability of a system to recover [in a timely manner] from a stressor of sufficiently large magnitude that the system is pushed into a state far from its original equilibrium state and ultimately retains its essential identity and function” while ROBUSTNESS is the “ability of a complex system to maintain its structure and function intact in the face of internal and external perturbations.”<sup>(12)</sup> Individuals who are resilient and robust are more likely to retain function and recover quickly and completely from acute illness. Similarly, resilient/robust HCS should rebound quickly from acute stressors. Resilient HCS require high political commitment, community-based response planning, and multi-sectorial collaboration,<sup>(15)</sup> as well as respect for health-care workers<sup>(16)</sup> sustained over time. Conversely, a lack of equitable access, system unresponsiveness, poor surveillance, and weak leadership were associated with lower resilience.<sup>(15)</sup> An example of inadequate resiliency/robustness has been the Canadian effort to catch up with COVID-related cancellations of scheduled non-urgent surgeries. Two to three years after the onset of the pandemic, nearly half of patients receiving knee or hip replacements were waiting longer than the recommended upper limit of six months.<sup>(17)</sup>

### Frail Older People in Frail Systems

Healthy people may fare reasonably well in a frail HCS. However, when frail individuals are cared for in frail HCS, they may fare particularly poorly. While a rational premise, empirical evidence that this occurs is generally lacking. A potential example is a natural experiment from the United States. To reduce hospital crowding, in certain States skilled nursing facilities were required and/or incentivized to accept COVID-19–positive patients still subject to transmission-based precautions from hospitals.<sup>(7)</sup> Even at the time there was concern about this action. When exposed facilities (i.e., those with a COVID-19–positive admission) were compared to control facilities (i.e., those without an admission), there was a 31.3% increase in the number of COVID-19 cases and a 72.4% increase in COVID-19–related deaths in exposed facilities over a subsequent 15-week period. These increases were markedly higher in exposed facilities with evidence of personal protective equipment and/or staffing shortages, which were potential markers of increased institutional vulnerability.<sup>(7)</sup>

### Measuring Frail Health Care Systems

Measuring the frailty of HCS may be useful in assessing their current state, predicting the likely response to a range of acute stressors, and determining if changes are required to achieve a desired degree of robustness. In the accompanying Table 1, we use the Frailty Phenotype as a model to assess the frailty of HCS. Frail HCS are deficient in various combinations of leadership, resources (financial, infrastructure, and/or human), culture, adaptability, reserve, resilience and/or robustness.

These can result in a low-capacity system that is under-resourced, exhausted, and slow to provide services. Frail HCS are also vulnerable to catastrophic failure when faced with an external challenge.

### Strategies for Frail HCS

HCS will always have limits placed on their abilities to respond to external stresses. At a societal level, it will be important to set feasible thresholds for the desired reserve capacity and resilience of HCS and invest in achieving them. It is also critical that HCS are structured to provide excellent care to the population that they currently serve. This is increasingly older adults with variable social supports and networks, multiple health problems, and cognitive and functional impairment. Simply devoting increasing resources to a HCS most adept at dealing with single acute issues will not be sufficient.

Interventions for frail individuals are typically complex, multidimensional, and operate over both short- and long-term time frames. Simple solutions, quick fixes or silver bullets that definitively address the multiple issues facing frail adults rarely, if ever, exist. Similarly, HCS require complex, multidimensional interventions sustained over time. While these interventions—such as age-friendly services—are fairly obvious in principle,<sup>(18)</sup> in practice they can be difficult to implement.<sup>(19)</sup> They require good data systems and administrative commitment, as well as the required infrastructure, personnel, and culture. The World Health Organization Report on Ageing<sup>(20)</sup> reinforces the need for complex interventions. While novel technical innovations

are important, in themselves they cannot fully substitute for deficiencies in leadership, the setting of clear organizational objectives, a culture of caring, attention to detail, necessary basic infrastructure, and a dedicated, competent work force.

### Accepting Complexity

In dealing with adults living with frailty, we must embrace—or at least accept—complexity. In dealing with HCS, we must do likewise. We should be skeptical of simple solutions and accept the necessity of multiple complex interventions. These interventions may offer incomplete fixes and take time to unfold. They must also be judiciously selected to balance benefits, risks, targets, and opportunity cost. Changes to HCS also require on-going monitoring to evaluate effectiveness, and identify areas requiring modification and the emergence of unintended consequences. Since these unintended consequences may occur in different sectors of the HCS, a system-wide approach is critical. At the same time, HCS must be adaptable and able to change to deal with emerging demands. Reserve capacity should not always be seen as waste to be eliminated. The overall goal is to have a HCS which is robust and resilient, and able to deal with expected and unexpected stressors.

### CONCLUSIONS

The concept of frailty may be a useful way of thinking about HCS. Identifying and grading HCS frailty, coupled with taking action to make them more robust and resilient, should be a focus for more serious study. Given an aging population

TABLE 1.  
Proposed health care frailty measure based upon the clinical Frailty Phenotype Model

<i>Criteria</i>	<i>Original Definitions at Individual Level<sup>a</sup></i>	<i>Analogous Definitions for Health Care System Level</i>
Shrinking	Unintentional weight loss of $\geq 10$ pounds in prior year or, at follow-up, of $\geq 5\%$ of body weight in prior year.	Annual funding declines after accounting for population ageing, changes in chronic illness prevalence, and inflation.
Weakness	Grip strength in the lowest 20%, adjusted for gender and body mass index.	Under-resourced system with low health care worker (e.g., physician, nurse, OT, PT, SW)/population ratios, low hospital and facility based long-term care bed/population ratios, inadequate community care capacity, and/or inadequate radiology/ laboratory/ other infrastructure resources (based on comparisons with historical, other jurisdictions and projected needs).
Exhaustion	Self-reported exhaustion, identified by two questions.	Current management, staff, and/or physicians report high levels of demoralization/ burn-out/fatigue/intent to leave, identified by staff surveys. Difficulty in recruitment to replace staff losses and deal with new demand.
Slowness	The slowest 20% on time to walk 15 feet, adjusting for gender and standing height.	Wait times for urgent and elective diagnostic procedures, surgery, cancer therapy, out-patient physician/ primary care visit, home care, mental health services, other specialist assessments, and/or long-term care admission that are longer than recommended (based on expert opinion).
Low activity level	Membership in lowest quintile of the population on physical activity based on weighted score of kilocalories expended per week, adjusting for gender.	Low utilization of evidence-based interventions (based on expert opinion), compared to other jurisdictions.

<sup>a</sup>Ref. #3: Fried *et al.* Available at <https://doi-org.ezproxy.lib.ualgary.ca/10.1093/gerona/56.3.M146>

and infrastructure, coupled with increasing numbers of frail adults, the HCS caring for them must be adaptable, robust, resilient, and designed not to fail.

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**Correspondence to:** Philip St. John, MD, GE 547 Health Science Centre, 820 Sherbrook St., Winnipeg, MB R2A 1R9  
**E-mail:** pstjohn@hsc.mb.ca