"The Art of War" in the Era of Coronavirus Disease 2019 (COVID-19)

Daniel N. Maxwell, MD[1], Trish M. Perl MD, MSc, FIDSA, FSHEA[1], James B. Cutrell, MD, FIDSA[1]

1. Division of Infectious Diseases and Geographic Medicine, Department of Medicine, University of Texas Southwestern Medical Center, Dallas, TX

Corresponding Author:
Trish M. Perl, MD, MSc
5323 Harry Hines Blvd. Dallas, TX 75390-9113
trish.perl@utsouthwestern.edu
Phone:214 648-9022
Fax:214 648-2741

Key Words: novel coronavirus, COVID-19, SARS-CoV-2, infection prevention, emerging infections

Novel coronavirus disease (COVID-19) caused by the virus SARS-CoV-2, began in Wuhan, China, and has spread worldwide, with over 101,700 cases and 3,461 deaths in more than 75 countries. With rapidly increasing cases and local community transmission in multiple countries outside of China, including the United States, the outbreak has entered a new phase, which requires a shift in primary battle strategy from a focus on containment in China to international mitigation. What will be required to fight this novel virus as it travels the globe?

The metaphor of war is often used in the infectious diseases field, with its interspecies fight for survival. Military strategies can be applied to outbreak management, and advice from one of the oldest and best-known military sages – China's own Sun Tzu discusses the importance of preparation in *The Art of War*. Sun notes that victory is achieved before any fighting begins and that those headed toward failure look for victory only after the battle has already begun[1]. So again, how do we prepare to fight COVID-19?

As cases of COVID-19 explode internationally, a strategic shift is required away from primarily containment, keeping the virus "out there", to home-based mitigation and public health responses. The task of healthcare systems is no longer screening and treating small numbers of infected returning travelers in highly specialized units with expert teams. Now, the task is bearing the burden of identifying, isolating, triaging and managing the rising number of cases, necessitating total engagement of the medical community, public health sector, governments and society as a whole. For the medical and public health communities, this enormous task requires approaches that are both rapidly scalable and sustainable. We need to use existing teams and resources efficiently and to build capacity where it is lacking. Two reports in this issue of *Clinical Infectious Diseases* shed light on possible steps forward.

First, we must learn from our own and others' battles. Marchand-Senecal et. al.[2] report on the successful management of the first hospitalized case of COVID-19 in Canada. They draw on and highlight lessons from the 2003 SARS experience in Toronto. Notably, while they utilized airborne, contact, and droplet precautions in a negative pressure room, no advanced personal protective equipment (PPE) such as powered air-purifying respirators (PAPRs) was used. The rationale was simple. Prior research demonstrates that using unfamiliar or increasingly complex PPE increases the risk of self-contamination[3]. Consequently, training for healthcare workers (HCW) focused on ensuring proper donning and doffing techniques with familiar, well-rehearsed PPE procedures. As Sun Tzu noted, "If in training soldiers' commands are habitually enforced, the army will be well-disciplined."[1] The authors also highlight improvements in infection prevention and control (IPC) infrastructure, administrative controls, and public health coordination compared to their 2003 SARS experience. Standard staffing models rather than a dedicated COVID-19 team were used safely. Strategies that focus on maintaining the workforce by requiring sufficient training for all staff offer potential for more sustainable, scalable HCW capacity in these extraordinary settings. Still, these authors note the paucity of evidence-based guidance for initial triage and discharge timing decisions in hospitalized COVID-19 patients.

Second, we must train the way we intend to fight. As illustrated by the Canadian report, the allure and novelty of PPE "maximalism" should be avoided in favor of proven strategies that HCW have practiced and conduct with a high-degree of fidelity without self-contamination. Regarding triage, Bryson-Cahn[4] and colleagues in Washington state present a novel framework for home screening and evaluation of persons under investigation (PUIs) based on prior preparation for Ebola community screening in 2014. Their experience describes nine community-based assessment visits during which teams screened PUIs in a variety of community settings after the IPC team determined a home assessment was appropriate. Detailed protocols are given for how a HCW team, with appropriate training and required supplies, can safely perform a focused assessment and collection of screening samples outside the healthcare setting.

This approach avoids unnecessary exposures and resource utilization for those who otherwise are safe to remain at home. Their explicit protocols provide a framework for other healthcare and public health systems to weigh along with cost-effectiveness and scalability. Both papers highlight the power of collaborative partnerships and communication between public health and healthcare facilities required in these events.

Finally, we must identify our weaknesses and vulnerabilities the "enemy" can exploit. As Sun Tzu exhorted, "carefully compare the opposing army with your own, so that you may know where strength is superabundant and where it is deficient."[1] We want to highlight four critical vulnerabilities at present within the United States context but with global applicability.

First, a paramount vulnerability that must be rapidly addressed is the limited diagnostic testing capacity for SARS-CoV-2 in the clinical arena. At this stage where screening must expand from narrow geographic-based criteria to syndromic surveillance, rapid and validated testing at scale must be available to help inform clinicians and public health officials for isolation, triage and care of patients. Fortunately, FDA Emergency Use Authorization regulatory requirements have been relaxed to allow more laboratory developed tests to come online even as the CDC races to expand testing capacity in the public health sector. These efforts must be given utmost priority to define the scope of current community transmission and to allow proactive, rather than reactionary, public health responses.

Second, aggressive supply chain management during periods of increased demand is critical. Public panic and fear can create or exacerbate real supply shortages, especially in an era of social media and just-in-time supply chain management. The World Health Organization and others have issued helpful guidance on the rational use of PPE for COVID-19, aimed at optimizing HCW safety while mitigating disruptions in the global PPE supply chain.[5] Rapid scalability in the supply of pharmaceuticals and PPE must be considered a public health imperative. Moreover, preventing rushes on the public market through measured risk communication with the public can help safeguard needed supplies. Finally, we must consider strategies to decrease less urgent use of PPE and identify situations where we can use different types of protection, where elements of PPE can be reused, or where the use of PPE is not supported by evidence-based practice.

Third, efforts to build and leverage margin and flexibility within healthcare staff capacity must be prioritized. Marchand-Senecal et. al. point out that specialized, dedicated teams in an outbreak, while attractive, could be quickly overwhelmed as cases increase. Moreover, longer shifts and increased work intensity may lead to HCW fatigue and lapses in PPE techniques, driving nosocomial transmission, a painful reminder from the battle with SARS. Initial reports indicate about 4% of Chinese HCW caring for COVID-19 patients were infected, with 15% classified as severe or critical disease.[6] Transmission to HCWs, a feature seen with SARS and MERS, is devastating as it simultaneously diverts resources, depletes HCW capacity, saps morale, and drives public fear. To mitigate this, healthcare systems experiencing a surge in cases should consider all measures to liberate resources and staff, including telemedicine triage, drive-thru testing, and preparations to reschedule elective medical care.

Fourth, and finally, our national and global commitments to funding for public health and epidemic preparedness must be expanded and sustained. Rather than the current "boom and bust" funding roller-coaster responsive to the latest outbreak, governments must provide expanded, stable funding levels to improve disease surveillance and response and to build technical capacity for rapid deployment of diagnostics, vaccine development, and clinical trials of pharmaceuticals for this outbreak and the

next.[7] The folly of short-sighted cuts to public health and research funding is manifest in the significant costs associated with a lack of preparedness and threatens global health and security.

As the battle against COVID-19 ramps up worldwide, it is imperative that the entire global community join together in solidarity, apply the hard-fought lessons of this and prior epidemics, and move rapidly to implement proven public health and IPC principles to turn the tide against this foe. Quoting Sun Tzu one final time, “He who knows these things, and in fighting puts his knowledge into practice, will win his battles.”

None of the authors has any conflicts of interest.

References:

1. Sun Tzu, The Art of War, circa 6th century B.C.E, translation by Lionel Giles. Accessed on 3/1/2020 at http://classics.mit.edu/Tzu/artwar.html.

2. Marchand-Senecal X, Kozak R, Mubareka S, et al. Diagnosis and Management of First Case of COVID-19 in Canada: Lessons applied from SARS. *Clinical Infectious Diseases*

3. Mumma JM, Durso FT, Casanova LM, et al. Common Behaviors and Faults When Doffing Personal Protective Equipment for Patients With Serious Communicable Diseases. *Clinical Infectious Diseases* 2019; 69 (Supplement 3): S214-S20.

4. Bryson-Cahn C, Duchin J, Makarewicz VA, et al. A Novel Approach for a Novel Pathogen: using a home assessment team to evaluate patients for 2019 novel coronavirus (COVID-19). *Clinical Infectious Diseases*

5. WHO. Rational use of personal protective equipment for coronavirus disease 2019 (COVID-19): interim guidance. 27 February 2020. Accessed on 3/1/2020 at *https://apps.who.int/iris/bitstream/handle/10665/331215/WHO-2019-nCov-IPCPPE_use-2020.1-eng.pdf*

6. Wu Z, McGoogan JM. Characteristics of and Important Lessons from the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72314 Cases from the Chinese Center for Disease Control and Prevention. JAMA Published online February 24, 2020. Doi:10.1001/jama.2020.2648. Accessed on 3/1/2020.

7. Gates B. Responding to COVID-19—A Once-in-a-Century Pandemic? N Engl J Med. February 28, 2020. Doi:10.1056/NEJMp2003762. Accessed on 3/1/2020.