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Special Article

Brave New Lungs: Aging in the Shadow of COVID-19

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Abstract

As the COVID-19 pandemic continues to affect communities worldwide, this novel disease is leaving many survivors with severe lung damage. Among older patients, advanced lung damage is more likely. Survivors of all ages who have extensive lung impacts are likely to be new to managing those issues. Supporting healthy aging for these patients will require both gathering data about their unique experiences and using the existing evidence basis about adapting to managing obstructive lung disease. This article outlines key priorities for research with COVID-19 survivors aging with permanent lung damage and highlights unique considerations for people older at age of onset. It also outlines the relevance of findings from this research for clinical care supporting people newly aging with advanced lung disease from COVID-19. In the process, it summarizes lessons from established patient populations aging with progressive lung disease—using cystic fibrosis as a prominent example from the author's lived experience—that may enhance the experiences of older COVID-19 survivors.

Keywords: Aging, COVID-19, Health care, Illness management, Pulmonary fibrosis

As the COVID-19 pandemic continues to ravage communities worldwide, much attention is appropriately given to the many lives being lost to the disease. From a population aging perspective, it seems equally important to focus on those lives that are not lost outright, but still strongly affected by the harsh legacy of Severe Acute Respiratory Syndrome coronavirus type 2 (SARS-CoV-2). Understanding the life course health trajectories of people who survive COVID-19 and how their process of aging becomes affected by that acute experience is vital. Clinicians and researchers alike can prepare to work with people growing older with COVID-19-induced pulmonary fibrosis by reviewing current knowledge about aging with progressive fibrotic lung pathology secondary to other conditions.

Many people exposed to the SARS-CoV-2 virus experience no symptoms or relatively mild ones (Liu et al., 2020). By contrast, some patients experience catastrophic lung damage characterized by rapid-onset fibrosis. Pulmonary fibrosis involves the thickening of the small airways and surrounding tissue (Zhang, 2020). It can develop from COVID-19 and a variety of other conditions. Having milder symptoms from COVID-19 specifically appears to occur more commonly at younger ages—likely because less advanced age poses a comparatively lower risk of the "cytokine storm" that causes the most extensive fibrosis observed in COVID-19 patients (Qin et al., 2020). Yet even among much older patients, many survive the initial disease. And among younger patients, many survivors may still deal with enduring pulmonary fibrosis and other respiratory complications from the SARS-CoV-2 virus (Thomson, 2020).

Anticipating the likely care needs of aging COVID-19 patients thus requires intensive attention to the fact that survivors of all ages, and especially those who were older at age of onset, may live long term with pronounced lung fibrosis. Certainly, the process of growing older with pulmonary fibrosis is not unique to survivors of COVID-19. Many others, including myself, are on parallel paths due

to numerous congenital and acquired conditions. But unlike people newly aging with chronic pulmonary fibrosis from COVID-19, most of us had many years to grow accustomed to progressive lung damage. Pulmonary fibrosis usually develops gradually. Yet the cytokine storm associated with severe COVID-19 can thicken and scar the small airways extensively within just a few days (Jiang et al., 2020).

Severe respiratory complications seem to occur in about 20% of people who test positive for SARS-CoV-2 on polymerase chain reaction assays of throat swabs and blood samples (Zhang et al., 2020). Severe disease has been defined by Zhang et al. (2020) according to six criteria: (a) rapid deterioration of the patient condition, (b) lower levels of white blood cells that fight infection, (c) extreme inflammation throughout the body, (d) damage to immune system components such as the spleen and lymph nodes, (e) lesions in the lungs with a particular pathology, and (f) clotting and damage in blood vessels and multiple organs. New research suggests that the clotting and inflammation components play key roles in causing extensive, permanent lung damage (Jose & Manuel, 2020). Yet only about 3% of total people testing positive for the SARS-CoV-2 virus die from COVID-19. Consequently, this leaves about 17% of total SARS-CoV-2 patients developing severe clinical symptoms but surviving the initial infection. Among older survivors of COVID-19, the proportion affected by extensive fibrosis will likely be higher than that 17% estimate for the total population testing positive for SARS-CoV-2.

Health systems must thus prepare to care over the longer term for thousands of people who will likely age with severe pulmonary fibrosis. This process will require a particular emphasis on the needs of older patients whose lung fibrosis will likely be more severe. It will also require general attention to how COVID-19 survivors of all ages may be completely new to managing advanced pulmonary fibrosis. And it will require creative thinking about how and to what extent the lungs of affected people can be rehabilitated. This innovation will matter even and indeed especially for those older COVID-19 patients whose illnesses have been framed as pediatric diseases.

I am familiar with this framing process. Although I am only 36, I fall into the broader group of people framed as low priority for ventilator support should I develop severe COVID-19 symptoms. Older adults form one core of this group; people with certain chronic lung diseases form another. The particular disease I live with (cystic fibrosis [CF], a genetic disease rendering mucus extremely thick and sticky) means that being 36 suggests I am aging successfully (Minkler & Fadem, 2002) relative to the projected life expectancy of about 18 years for people with CF in my birth cohort (Jain & Goss, 2014).

CF progressively damages the mucous membranes by causing a variety of problems with a specific protein that moves salts back and forth across cell membranes (Bridges & Bradbury, 2018). The viscous mucus characteristic of this disease makes it easy for bacteria and fungi to colonize internal organs, especially the lungs (Kamath et al., 2016). Deposits of sticky mucus chronically infected with virulent bacteria then thicken further as they become harder to clear from the small airways, creating a vicious cycle of inflammation and tissue destruction. Over time—much like secondary pneumonia from COVID-19—these infections damage and scar the small tubes that help air reach the thin membrane sacs that diffuse oxygen into the bloodstream. Recent research in radiology suggests that severe COVID-19 does indeed produce lung fibrosis that mimics the characteristics of CF and other progressive diseases requiring extensive lifelong respiratory management (Ye et al., 2020).

Like most adults with CF, I have lived with pronounced lung damage for much of my life. I have also rehabilitated my lungs significantly in my 30s with ample support from clinical professionals and community resources alike. Incorporating evidence-based practices from innovative research on CF has informed my own process of pulmonary rehabilitation and health care quality improvement at every turn. As such, my lung health at 36 is markedly better than it was at 26. Yet CF remains a progressive disease, as do many other causes of lung fibrosis. Although I have benefited from aggressive interventions to mitigate existing damage to my lungs, I have also continued to feel how the disease is progressing in my lungs and other organs. Adapting my self-management strategies accordingly has proven critical in substantially slowing the progression of CF and thus improving my posterior probability (Girotto & Pighin, 2015) of long-term survival. In both Bayesian and hazard analysis frameworks, my odds of surviving into old age have risen.

I have consequently seen firsthand the benefits of time and experience in adapting to chronic pulmonary fibrosis. This is precisely what people with rapid-onset lung fibrosis resulting from COVID-19 do not have. So in addition to general emerging concerns about long-term adverse respiratory effects of COVID-19, we should think specifically about how many survivors will be completely new to dealing with these challenges. This general frame should guide our thinking as scholars and clinicians in anticipating both life course health challenges and appropriate responses to these challenges among COVID-19 survivors.

Understanding care needs and inquiry opportunities in aging survivors of COVID-19 requires first exploring the natural history and progression of adverse outcomes such as lung fibrosis among affected people. This should involve interconnected threads of (a) following general trajectories of life course COVID-19 pulmonary outcomes across all birth cohorts and age groups and (b) following specific trajectories of these outcomes for people who were already older at disease onset. Identifying potentially unique experiences for people who contracted COVID-19 at older

ages will help to shape geriatrics systems and services for affected people, as well as clinical education preparing new and existing providers to deliver evidence-based care for survivors.

Monitoring and investigating the trajectories of COVID-19 survivors aging with chronic lung fibrosis can inform and improve direct care services for affected individuals as people continue to grow older. This information should be used for both proactive care planning and reactive care adjustment in aging and older survivors. Both providers and patients should have access to current and detailed information about potential challenges in aging with rapid-onset pulmonary fibrosis and about resources for addressing those barriers. Dialogue about healthy aging with chronic lung fibrosis should permeate clinical interactions in a variety of settings within and beyond dedicated geriatrics practice.

Learning about and considering different drug therapies will constitute one important thread in these discussions. People with other fibrosis-causing lung diseases are often aging in good general health with support from a variety of drugs (Mora et al., 2017). These include mucolytics for thinning out secretions, bronchodilators for expanding airways, and inhaled steroids for controlling inflammation. Researchers and clinicians focused on aging and old people care should thus consider the promise of different drugs demonstrated to help with the management of chronic pulmonary fibrosis, as well as the appropriateness of using these therapies with people whose lung damage originated with COVID-19 specifically—and how that may differ in patients of older age at onset. As a novel pathogen in humans, SARS-CoV-2 clearly poses unique implications for lung tissue health and recovery (Pan et al., 2020). We continue to learn about both the nature of these respiratory consequences and their potential impact on life course and geriatrics-specific best practices for drug therapy.

Exploring the value and impact of physiotherapy for patients aging with chronic lung fibrosis caused by COVID-19 will also prove important. Physiotherapy with and without devices often proves hugely beneficial for people with pulmonary fibrosis (Jo et al., 2016). Across a variety of different fibrosis-causing conditions, patients can maintain optimal respiratory health by actively clearing mucus from the small airways. Percussion therapy is a common component of keeping fibrotic lungs healthy across the life course. This can be accomplished with manual clapping on the chest and back and/or assistive devices such as oscillating vests and handheld percussors. Respiratory muscle training is another approach. This again can be done manually through an active cycle of breathing exercise and/or using assistive devices such as flutter pipes and inspiratory/expiratory trainers. For older patients, it will be especially important to consider the relative value of each type of therapy given safety concerns associated with percussive pressure in people with lower bone density and/or more fragile skin.

Patient education and training will prove critical across the spectrum of clinical interventions for healthy aging with lung fibrosis from COVID-19. These supports should involve attention to both the biomedical and psychosocial aspects of living with advanced lung damage (Kalluri & Richman-Eisenstat, 2019). Because patients of all ages will be very new to managing the condition if it was caused by SARS-CoV-2 infection, they may have unique needs on this front. These needs and associated patient preferences may vary somewhat by age as well as other social locations and experiences. Newer lung fibrosis patients may need time to figure out what their needs and preferences even are in these areas (Kalluri et al., 2020). More experienced patients whose pulmonary fibrosis originated with other conditions can thus offer valuable support in developing both best clinical practices and responsive community resources for aging and older adults with long-term respiratory impacts from COVID-19.

Indeed, peer support should play a central role in adapting health systems and services to meet the emerging life course care needs of people aging after severe SARS-CoV-2 infection. Learning to manage chronic lung fibrosis is a challenging and often frustrating process even for people who have been on that path since childhood (Lindell et al., 2018). Consequently, many of us have found value in learning from fellow patients. Other fibrosis-causing lung diseases have highly activated and diverse patient communities that consistently show leadership in peer education and affirmation (Stoller, 2018). Peer support has also shown immense potential to help patients cope with instrumental and emotional challenges related to access and equity issues in health care, both in age-inclusive settings and older adult-specific ones (Holland et al., 2019). People who have recovered from COVID-19 may also benefit from joining integrated peer support spaces including people aging with pulmonary fibrosis from other origins. Pairing COVID-19 patients with people more experienced with pulmonary fibrosis secondary to other diseases, such as CF, may help with adjustment and self-management. Experienced patients can provide both technical education and social support for COVID-19 patients adjusting to life-long pulmonary fibrosis.

Beyond direct support provided from other patients, consciously leveraging these human resources for aging patients newly managing lung fibrosis will be critical for quality assurance in clinical and community care. Ample evidence from other fibrosis-causing lung disease populations demonstrates the quality improvement value of thoroughly capturing direct input from patients (Moor et al., 2017). Conscious incorporation of patient-driven data can improve life course and older adult-specific care in a variety of ways (Senanayake et al., 2018). These include informing meaningful approaches to goal setting, identifying actionable barriers to care access, and illuminating helpful communication strategies surrounding healthy aging. Actively incorporating the

experiences and perspectives of people who have spent large portions of our lives managing pulmonary fibrosis can help providers, managers, and scholars identify clinical and social supports for the emerging population of people with rapid-onset lung fibrosis from COVID-19. Centering the voices of patients with chronic lung fibrosis who have already reached advanced ages will be especially helpful in this process.

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Conflict of Interest

None declared.

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