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JOURNAL OF THE TENNESSEE
MEDICAL IMPAIRMENT RATING REGISTRY

**COVID-19
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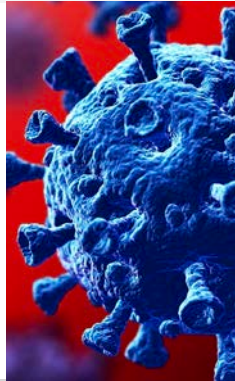
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Rating Survivors of COVID 19 for Permanent Impairment

*James B. Talmage, MD, Mark H. Hyman, MD, Robert B. Snyder, MD**

Almost every citizen is aware of the presence of COVID-19 illness, caused by the betacoronavirus SARS-CoV-2. Classifying COVID-19 as an occupational illness is controversial, with several states passing legislation granting the rebuttable presumption of causation by workplace exposure to some occupations (health care workers, first responders, etc.). This area of law is changing rapidly, and physicians will have to check the current status of such law in the applicable jurisdiction to a case before them. Administrative requests for impairment ratings before literature is published on the long-term outcomes in COVID-19 survivors will be seen. Many journals use a two-year outcome assessment as a criterion for “long-term” outcomes. This article should be considered as “interim advice.”



Individuals who claim to have had COVID-19 but who tested negative for the virus by Polymerase Chain Reaction (PCR), and individuals who state they were ill and were not permitted to be tested, will likely have to have the causation question formally adjudicated before physicians are asked to assess for Maximum Medical Improvement (MMI) and Permanent Physical Impairment (PPI).

For those cases either accepted by a workers' compensation insurer or adjudicated as work compensable, the questions arise: when is the person at MMI, and how should PPI be rated? The AMA Guides to the Evaluation of Permanent Impairment do not contain the words “COVID-19” or “SARS CoV2.”

Clinical Scenarios

There are several scenarios to consider in the workers with administratively accepted cases for which a date of MMI and a PPI rating are requested.

Scenario #1: There are individuals who are tested when asymptomatic only because they are known contacts of a positive case. An example would be a health care worker in a hospital or nursing home with known cases who is tested despite the absence of any symptoms. If this individual remains asymptomatic but did test positive on PCR for having a live virus, there are no known long-term complications in those with subclinical infection. These individuals can be considered to be at MMI a few weeks after the positive test, and there is no permanent impairment.

Scenario #2: For those who are pre-symptomatic (had not yet become symptomatic at the time of testing, but do later become symptomatic), the average onset of illness is about 2-5 days later (Arons, 2020; He, 2020). These people would be rated similarly to the scenarios below.

Scenario #3: There are individuals who test positive and who have mild disease. They are not hospitalized, and they recover at home, never having been significantly dyspneic. Once recovered, they are asymptomatic. When they are back to normal activity without symptoms, they can be declared to be at MMI and with no PPI (zero percent). There are currently no case reports of individuals with mild disease who recover at home and yet who have persisting symptoms suggesting permanent consequences. If necessary to support this opinion, symptom validity can be verified by Stress Echocardiography (Stress Echo) and Pulmonary Function Testing (PFT or spirometry).

Scenario #4: There are individuals who have moderate disease (test positive, are hospitalized, and treated with supplemental oxygen, but are not put in the ICU or on a ventilator). They usually have abnormal chest CT scans, and might have abnormal chest X-rays. Some are more seriously ill, and had an ICU stay or were placed on a ventilator, or both. In these cases, review of hospital records is required to objectively document the organ systems with objective pathology.

The most common concern in these cases will be residual pulmonary or cardiac pathology either from the virus or from the ventilator. There might also be cases in which significant pulmonary involvement was documented by outpatient or emergency room imaging, and the person convalesced at home. Psychological illness might also be present (discussed below).

History

If these individuals have persisting complaints of dyspnea on exertion or fatigue, the first assessment should be “face-to-face” in an office setting (NOT telemedicine). Using release of information forms to obtain records from primary care before the onset of COVID-19 and from health care providers and hospitals related to the treatment of COVID-19 will provide objective evidence of illness and help with questions about pre-existing status. Records should include evidence of a positive PCR test for the presence of the virus. Chest x-ray or chest CT scan results would confirm pulmonary involvement occurred, as would physician measured oxygen saturation below 95%.

Physical Examination

The physical exam would include traditional pulmonary and cardiac exams, and pulse oximetry. A further and simple in-office screening test is the 6-minute walk test while wearing a pulse oximeter. Norms for distance walked by age are available (Casanova 2020), but the most important information would be change in pulse from sitting to walking, and whether desaturation (oxygen level on pulse oximeter) occurs during walking. Tachycardia (pulse >100) and less than normal distance walked with preserved oxygen saturation would suggest deconditioning and not permanent impairment.

Guidelines

The American College of Occupational and Environmental Medicine (ACOEM) Guidelines on COVID-19 [April 24, 2020 update] (Hegmann, 2020) contains a section

on Disability and Return to Work. It states that based on prior experience with other similar viral illnesses, patients who recovered without hospitalization will generally be adequately recovered from post-infection fatigue and will be ready to return to work after 2-3 weeks. This is about the time when some patients may be retested to see if they are still shedding the virus. The clinical significance of a recovered patient still having viral shedding is unclear and might not be a barrier to work. For patients with documented pneumonia or who required supplemental oxygen therapy, recovery would be estimated to be 4-8 weeks after hospitalization or clinical recovery.

For patients who required mechanical ventilation for an Acute Respiratory Distress Syndrome (ARDS) illness, past experience has been that 50% of survivors might not have returned to work by 1 year from hospital discharge (Chen, 2017; Chiumello, 2016; Dinglas, 2018; DiSilvio, 2019; Herridge, 2016). They also point out that on spirometry lung volumes show about a 20% reduction that frequently resolves in 6 months. Thus, it would be logical to wait until hospitalized survivors are 6 months from discharge before evaluation for MMI and PPI.

Laboratory Testing

Blood testing for Complete Blood Count, Comprehensive Metabolic Panel should be obtained unless results from prior convalescent testing are available and normal.

If residual pulmonary impairment is plausible, then full spirometry (including measurement of diffusion capacity of carbon monoxide-the DLco, Impedance testing or Nitrogen Washout) should be obtained. The test results should be evaluated to verify that they meet ATS criteria for full effort and reliability (Graham, 2019; DHHS, 2012; Hyman, 2011).

Pulmonary impairment is rated from Table 5-4 (6th ed., p.88). In jurisdictions using the AMA Guides 5th edition, ratings come from Table 5-12 (5th ed., p.107). Many of the Sixth Edition internal medicine chapters have a footnote in the relevant table that identifies the "key factor" to be used for Class assignment. Table 5-4 does not have such a footnote, but the text, page 87, left column, first full paragraph reads, "The examiner should note that throughout the chapter the objective test results are used as the primary or "key factor." To be Class 0, EACH of the spirometry results for which tests are available must be normal, as defined by the numbers in the table. For Class 1 to Class 4 impairment, the worst of the tests determines class placement. Thus, if the diffusion capacity of carbon monoxide (DLco) results in a higher class assignment than the FVC or the FEV1, the class would be determined by the DLco result. ACOEM points out that lung diffusion abnormalities, if present, may take 5 years to resolve after ARDS. On spirometry, the DLco is the test that best reflects diffusion abnormalities. There are no published studies of spirometry results in COVID-19 survivors, but the pathophysiology so far appears to be predominantly Diffuse Alveolar Damage, Hyaline membranes and microangiopathic processes (Xu, 2020). The DLco may be the most impaired pulmonary function on spirometry.

Desaturation during exercise with normal spirometry would suggest impaired cardiac output (left ventricle ejection fraction by Echocardiogram) or interstitial lung disease for which full metabolic stress echocardiogram would be needed. If the ECHO is normal, then other systemic illnesses such as anemia or lung

Cardiovascular injuries that are seen in ARDS and could occur in COVID 19 include:

Condition	AMA 5th Edition Rating	AMA 6th Edition Rating
Cardiomyopathy	Table 3-9, p.47	Table 4-7, p.59
Arrhythmia	Table 3-11, p.56	Table 4-9, p.64
Cardiac muscle injury	Table 3-6a, p.36	Table 4-6, p.55
Pulmonary Emboli	Table 4-6, p.79	Table 4-14, p.72
Carotid Occlusion	Chapter 13 (or by analogy; Table 4-2, p.70)	Chapter 13
Deep Vein Thrombosis	Table 4-5, p, 76	Table 4-12, p.69

abnormalities are most likely. If the spirometry was normal, but stress testing showed the individual crossed the aerobic threshold (first ventilatory threshold on cardiopulmonary stress exercise testing, or CPEST (Mezzani 2017), or metabolic stress echocardiogram) and the subsequent maximum oxygen consumption was abnormal (VO₂ max), the VO₂ max measurement can be used in *Guides*, 6th ed., Table 5-4 or 5th ed., Table 5-12 for Class assignment. The formal interpretation for the test may provide evidence as to the pathophysiology of the individual (lung diffusion abnormality, pulmonary hypertension, reduced cardiac output, deconditioning or lack of effort on testing, etc.).

COVID-19 patients can have cardiac complications. Some COVID-19 patients have ST segment elevation on EKG and have corresponding clots in major epicardial coronary arteries from the hypercoagulable state many of these patients have (Bangalore, 2020). These patients can be rated as any other myocardial infarction patient. Some have viral myocarditis without large artery induced infarcts [Incuardu 2020]. These patients can be rated as any other cardiomyopathy patient. Left ventricle ejection fraction (EF by Echo or cardiac cath), Brain Natriuretic Peptide level (BNP), METs of exertion achieved on a treadmill test, or VO₂ max on CPEST or metabolic stress echocardiogram (if done) are the test results that the 6th edition uses as Key Factors to assign a Class.

Pulmonary emboli might occur due to a hypercoagulable state (Bowles, 2020) or prolonged inactivity (Casey, 2020). Impairment would be evaluated by spirometry (infarction reduced Forced Vital Capacity - FVC) and by echocardiogram or Metabolic Stress Echocardiogram showing pulmonary hypertension.

There are patients having large vessel strokes, presumably due to the hypercoagulable state known to occur in some patients with COVID-19 (Oxley 2020). These would be rated like any other large vessel stroke, and if cranial nerve

or visual impairment is present they would be rated from Chapters 11 and 12 in either Guides edition. Some severely ill patients with COVID-19 related Acute Respiratory Distress Syndrome have neurologic deficits while in the ICU, and some still have mental status alteration in short-term follow up [Helms 2020]. The *Guides* point out that the more subtle the persisting mental status deficit is, the more likely formal neuropsychological testing is to formally verify and document the deficit (6th Ed., Section 13.3d, p. 330; 5th ed., Section 13.3d, p.319).

Guillain-Barré syndrome and its variants have been reported during and just after COVID-19 illness (Toscano, 2020; Gutiérrez-Ortiz, 2020), and these are ratable from the Guides 5th and 6th edition central and peripheral nervous system chapter. This diagnosis should not be used for subjective complaints of weakness and fatigue with no objective documentation of Guillain-Barré actually having been present, by accepted criteria (Diamachkie 2013). The residual respiratory and limb consequences of objectively documented disease are ratable.

An unusual symptom in COVID-19 is anosmia, or loss of sense of smell. This is being reported. It is not clear from early reports whether this is just loss of sense of smell, or whether there is also loss of taste. Most of our sense of what food tastes like is determined by our sense of smell. Subjective loss of sense of smell is not always validated on testing. Loss of sense of smell from viral disease is known to recover in 32-66% of cases (Boesveldt, 2017), so olfaction should be tested with the UPSIT or Sniffin Sticks.

Note that the central and peripheral nervous system chapter also has a rating methodology for myopathy (Mao, 2020) or for generalized peripheral neuropathy (Sections 13-9 in either edition) that could be used in cases of these problems after objective documentation with electrodiagnostic tests and/or muscle ultrasound or MRI during the acute illness (Koch, 2014; Lacomis, 2013).

While COVID-19 patients might have a hypercoagulable state (elevated D-dimer, etc.), there are no current reports of a hypercoagulable state persisting after recovery. For individuals with a persistent or permanent hypercoagulable state, the sixth edition Table 9-12 or fifth edition Table 9-4 permits rating, but this will probably not be used in COVID-19 survivors. If thrombosis of a vessel(s) resulted in extremity complications, these would be rated using the extremity chapters. Similarly, if thrombosis in abdominal vessels occurred, that would be rated from the gastrointestinal or genitourinary chapter(s).

Acute hepatic injuries and acute kidney injuries in COVID-19 are usually markers of impending death, and survival with impairments in these organs is not common [Richardson 2020]. If an individual did survive these complications, they are ratable from the GI and GU chapters like any other liver or kidney disease patient.

Providing care to COVID-19 patients can be stressful (Lai, 2020; Walton, 2020). There are individuals who present with Post Traumatic Stress Disorder symptoms. Some had actual COVID-19; some were first responders or health care workers who experienced first-hand illness or deaths (Burrer, 2020; Chow, 2020; Heinzerling,

2020); and some had both of these experiences. Several states have created a legal presumption (sometimes rebuttable) that PTSD in these situations is presumed to have been caused by COVID-19.

The Mental and Behavioral Disorders chapter uses the now antiquated DSM-IV-TR criteria for PTSD diagnosis, and most mental health professionals are now using the more liberal diagnostic criteria in DSM-5. If the diagnosis is administratively accepted, and the MMI and PPI questions are asked, there are some caveats. Chapter 14 in either edition is largely silent about how MMI and permanency are to be objectively established in mental disorders. Modern systematic reviews indicate cognitive behavioral therapy (CBT) has better outcomes compared to medications (Charney, 2018; Giummarra, 2018; Ostacher, 2019), and therefore a 12 to 18 sessions of CBT should logically have occurred before MMI is established. A further consideration is the stability of employment. If the individual is still in a “temporary” off-work status, the outcome of PTSD with a change in employment is not known. Thus, if a health care worker is still unwilling to return to work after CBT, an alternate career choice might need to be made, and PPI should logically be assessed after re-employment.

For jurisdictions that apportion, the Mental and Behavioral Disorders chapter recommends that the rating be done twice, once using three assessment tools based on symptoms and function before the inciting workplace exposure, and then using the same tools to describe the current symptoms and function. Subtracting the pre-existing impairment from the current impairment yields the impairment due to the current mental disorder of interest.

Conclusion

In summary, this is preliminary advice for those who are asked to rate permanent consequences of COVID-19 illness in those administratively accepted or adjudicated cases. With further clinical experience, the approach to rating might need to be modified slightly. However, the suggestions outlined should remain applicable for most of the foreseeable future.

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***Robert B. Snyder, MD**

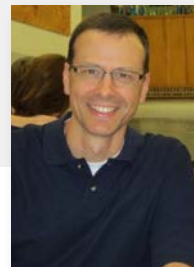
Dr. Snyder was appointed Medical Director for the Bureau of Workers' Compensation in January, 2014 after 37 years of private practice in Orthopaedics. He graduated from Wayne State University School of Medicine in Detroit and completed two years of general surgery training at the University of Pittsburgh before he came to Nashville, completing his residency in Orthopaedics and Rehabilitation at Vanderbilt University. Dr. Snyder has presented lectures for the American Academy of Orthopaedic Surgeons, Arthroscopy Society of Peru, the American Orthopaedic Society for Sports Medicine, the National Workers Compensation and Disability Conference, the National Association of Workers Compensation Judges, and in Tennessee: the Chiropractic Association, the Orthopaedic Society, the College of Occupational and Environmental Medicine, the Pain Society, the Neurosurgical Society, the Tennessee Medical Society, and Tennessee Attorney Memo. He has made numerous other presentations to attorneys, case managers, employers, adjusters and insurers. His activities with the Bureau have focused on Medical Treatment Guidelines, the Drug Formulary, Utilization Review, Case Management, Fee Schedules and physician/provider communications.

Battling the Opioid Crises

Pain Neuroscience Education (Part III)

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Sandy Murphy, DPT, ASTYM Cert., Cert. MDT*



In the Spring 2020 issue of *AdMIRable Review*, Pain Neuroscience Education (PNE) plus was introduced as an effective, evidence-based rehabilitation option to improve patient function and reduce opioid use. PNE plus is a protocol-driven system built upon four pillars of treatment: Pain Education, Aerobic Exercise, Sleep Hygiene, and Goal Setting.

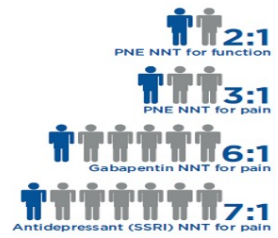
S·T·A·R PHYSICAL THERAPY The Four Pillars of the PNE+ Program



Each PNE Session focuses on those areas that are important to the patient along with medically indicated Pain Metaphors. The metaphors include a home assignment designed to reinforce knowledge of pain neurophysiology; benefits of aerobic and functional exercise; monitoring of goal activity and progress; and sleep hygiene. Manual therapy plays a role in PNE, building trust with the patient and addressing any lingering musculoskeletal dysfunction. However, active treatment is emphasized due to increased oxygenation and blood flow occurring during and following gentle aerobic exercise. Increased blood flow and thus oxygenation supplies about nerves has a calming effect and thus reduces pain (Kuphal, 2007; Hoffman 2005).

PNE plus programming is proven to be beneficial in the reduction of pain and improvement of function when compared to the use of medications alone. In a study comparing Gabapentin, antidepressants or PNE to address pain, PNE was found to be effective in 1 of 3 patients in improving pain and 1 of 2 patients in improving function, as compared 1 in 6 or 7 patients on medications only to improve pain and function (Moore, 2014).

1:2 Patients experienced improved function with PNE.
1:3 Patients experienced 50% reduction in pain with PNE.
1:6 Patients experienced 50% reduction in pain with Gabapentin.
1:7 Patients experienced 50% reduction in pain with Antidepressants.



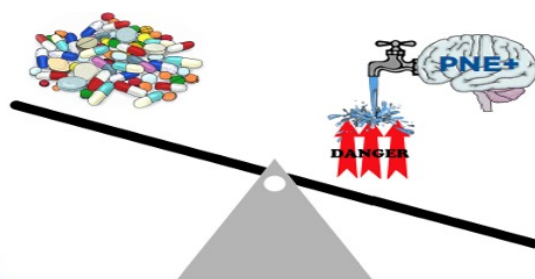
Our clinical use of PNE has produced similar outcomes to the study by Moore in 2014. Recently, we treated a 41-year-old client with a status-post gunshot wound to the left flank, with bullet fragments left near the left L3-4 spinal nerve root. There was also damage to the bowel requiring colostomy. The client presented with left lower extremity peripheral symptoms. The patient noted significant decreased left lower extremity stability and strength. Due to the traumatic nature of the injury, significant emotional overlay, increased home stressors, multiple injuries and protracted recovery, as well as significant sleep interruption, PNE plus programming was started.

KEY MEASURES PRIOR TO THERAPY			
PAIN RATING	RANGE OF MOTION	LOWER EXTREMITY FUNCTIONAL SCALE	MEDICATIONS
9/10	Low Back: 50-75% of normal ROM	44/80	Duloxetine, Gabapentin, Tizanidine (taken as prescribed by physician)

KEY MEASURES FOLLOWING THERAPY			
PAIN RATING	RANGE OF MOTION	LOWER EXTREMITY FUNCTIONAL SCALE	MEDICATIONS
0-3/10	Low Back: 75% of normal ROM	60/80	PRN for all meds (with some days not taking any medications)

The patient completed 17 sessions with an emphasis on PNE education including sensitive alarm pain education, diaphragmatic breathing, emotions and pain, in addition to strength, mobilization and therapeutic exercise, including overall cardiovascular endurance. The Sensitive Alarm Metaphor is an educational tool that the therapist covers with the patient. Highlights of the education are included below.

- **Threat Perception:** When there is an injury, the brain interprets that injury as a threat, and the nervous system wakes up. Usually, once the threat is removed, the nervous system calms down (de Jong, 2005).
- **Extra Sensitive Alarm:** With 1 in 4 people, the alarm system stays turned on due to fear, ongoing pain, failed treatments and frustration, various stressors, and different explanations as to the origin of pain. The alarm system is meant to protect the patient, but now it is over-protective (Louw, 2014).
- **Lessening the Sensitive Alarm:** Nervous system calming methods are highlighted to dampen the sensitive nerves. The therapist discusses education and its role in lessening pain, the role of easy, gentle aerobic exercise in improving needed blood flow, oxygenation to calm nerves, the role of fear and disuse in pain, and pacing methods to avoid pain spikes. “The alarm system is extra sensitive, and when movement or exercise happens the alarm is merely telling you that your body is moving-nothing is being injured” (Kuphal, 2007; Hoffman, 2005).



- **Homework:** Cognitive homework is given to reinforce the education portion of treatment, and that homework is reviewed at subsequent sessions.

This patient was fearful of exercise due to pain, so mantras such as “you may be sore, but safe” and “hurt does not equal harm” were integral reinforcements of the Sensitive Alarm metaphor (George, 2009).

By the end of the sessions, the patient experienced significant improvements in pain, function, range of motion and use of medications, including:

- Pain-60% Improvement;
- Range of Motion-25% Improvement;
- Perceived Functional Ability-20% Improvement;
- Pain Medication Use- Progressing from taking medications as prescribed to as needed, with days of taking no medications.

Additionally, the client could tolerate up to 30 minutes of activity, denied peripheral symptoms consistently, and was able to resume daily self-care, housework, and caring for children and grandchildren. The client still had symptoms but controlled them. Those symptoms did not severely limit daily activities, and fulfilling those daily activities no longer required use of pain medications consistently.

Biopsychosocial Model of Pain and Rehabilitation

It is significant to note the focus of the rehabilitation process with this gunshot wound client. PNE plus focused on the biopsychosocial pain model—the neurophysiology of pain—as opposed to the biomedical model, the tissue injury cause of pain (Mosely, 2015). Each model had valid explanations of pain for this client. Bullet fragments injure tissue, and that takes time to heal. Also, the injury sounded the neurologic alarm, and that alarm was still on when rehabilitation started some 8 months after the injury. The tissues healed, and yet the pain was still limiting the patient in every aspect of daily life.

By educating the patient that the pain is real but has another origin, restoration began. Through hard work by the patient and the therapist, a fantastic outcome was achieved. Restoration started by believing and buying into the vast evidence that the origin of the pain is the brain. Treatment had to focus on the origin of the problem to get a good outcome.

As the medical profession moves to combat the opioid crisis, PNE and its positive benefits to patient function and opioid utilization reduction shows that modifying perceptions of pain has to be at the core of battle, as demonstrated by the gunshot client. Changing course from a biomedical approach, which emphasizes pain as an input from an injured tissue, to a more balanced, evidence-based approach of the biopsychosocial model, which emphasizes pain as an output from the brain, will help with patients' understanding of pain as well as the injury. That understanding can empower the injured client to realize that pain is a routine, though not pleasant, phase of healing—a phase that can lead to restoration, medication reduction, and a return to higher quality of life.

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Dan Headrick is a physical therapist and a level III Certified Ergonomic Assessment Specialist serving injury prevention and treatment needs of employers and injured workers since 1992. He has been a presenter at the Tennessee Bureau of Workers' Compensation Physician Education Conference as well as the Bureau's education conference. He has presented at the Tennessee Safety Congress and currently serves as the membership chair of American Society of Safety Professionals, as well as the co-vice president of the Mid-South Worker's Comp Association. He works as the Industrial Specialist for STAR Physical Therapy, an outpatient physical therapy company with 67 locations across Tennessee and Arkansas. He is married to his college sweetheart and has two fantastic children.

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The Importance of Medical Proof in Communicable Disease Cases

Jane Salem, Esquire*



Claims alleging work-related COVID-19 are a new phenomenon in workers' compensation. As of May 31, 2020, 650 first reports of injury have been filed in Tennessee. Of those, 200 have been formally denied. At this point, unanswered questions abound regarding medical causation, impairment ratings, and an inability to return to work because the employer closed during the pandemic, to name just a few. While no directly on-point Tennessee case law is available to provide guidance for legal practitioners, a pair of Tennessee cases involving communicable diseases might be instructive.

First, in a 2003 opinion, the full Supreme Court ruled on a case where a worker's mental injury stemmed from her belief that she contracted HIV from a co-worker.

In *Guess v. Sharp Manufacturing Co. of America*, an assembly line worker accidentally came in contact with another worker's blood. The blood was on her hand, which she said had open cuts and was freshly manicured. She believed the co-worker was HIV positive. She testified that she became "hysterical" at the time of the incident and afterward began suffering panic attacks. A treating doctor diagnosed her with post-traumatic stress disorder as a result of the work injury. A treating psychologist gave the opinion that her fear was real and "her perception of events that transpired is her reality." However, an infectious disease specialist tested her five times; each test came back negative.

The trial court awarded permanent partial disability benefits for the mental injury, but the Supreme Court reversed. The case presented an issue of first impression in Tennessee: Was an employee alleging mental injuries based on perceived exposure to HIV in the work environment entitled to workers' compensation benefits where there was no proof of actual exposure to the virus? The justices said no, reminding that compensable mental injuries must involve a "sudden, identifiable work-related event" and that the worker must be put in "real, undeniable danger."

"We are unwilling to accept the appellee's subjective impressions concerning the co-worker's sexual orientation or frail medical condition as proof that his blood was in fact contaminated. To do so would be to further the prejudices and stereotypes surrounding AIDS," the Court held. "AIDS is a disease that spawns widespread public misperception based upon the dearth of knowledge concerning HIV transmission. Indeed, plaintiffs rely upon the degree of public misconception about AIDS to support their claim that their fear was reasonable. To accept this argument is to contribute to the phobia. Were we to recognize a claim for the fear of contracting AIDS based upon a mere allegation that one may have been exposed to HIV, totally unsupported by any medical evidence, or factual proof, we would open a Pandora's Box of 'AIDS-phobia' claims by individuals whose ignorance,

unreasonable suspicion or general paranoia cause them apprehension over the slightest of contact with HIV-infected individuals or objects.”

The second, more recent opinion involved a healthcare worker who alleged she contracted tuberculosis from a patient.

In a 2014 case from the Tennessee Supreme Court Special Workers’ Compensation Panel, *Wheatley v. State*, a registered nurse was taking a blood sample from a patient, but she was not wearing gloves because she was in a hurry. According to her, the patient became unruly, and a drop of the patient’s blood landed on a small wound on her ungloved finger. The worker said the patient was diagnosed with tuberculosis three weeks later, and afterward she also began experiencing unpleasant symptoms. However, after visiting countless doctors, including “specialists in Boston, Cleveland, and Denver,” none conclusively diagnosed her with tuberculosis.

She filed a workers’ compensation claim, but the Claims Commission dismissed her case. (Wheatley was a state employee.) The Claims Commissioner reasoned that she had no medical proof that she suffered an injury. On appeal, the Panel held that, because her claim involved a communicable bacterial disease, it was not “obvious, simple or routine.” The Panel concluded, “Because Ms. Wheatley presented no expert medical testimony that she was infected with or carried tuberculosis, she did not establish a workers’ compensation claim by the preponderance of the evidence. Courts simply are not equipped or authorized to diagnose a litigant in the absence of admissible medical testimony.”

Although this case pre-dated the Reform Act, the Appeals Board has since made essentially the same proclamation in *Lurz v. International Paper Company*, stating: “We have previously noted that judges are not well-suited to make independent medical determinations without expert medical testimony supporting such a determination. Likewise, parties and their lawyers cannot rely solely on their own medical interpretations of the evidence to successfully support their arguments.” (*Lurz* did not involve a communicable disease.)

So, in communicable disease cases, the same standard of medical proof on causation applies as it does to other potentially work-related injuries. Clearly in COVID cases, the medical evidence will be critical to their outcomes. But that is about all that is known for now.

*Jane Salem, Esquire

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Medical Aspects of Causation for COVID-19

Robert B. Snyder, MD, and James B. Talmage, MD



Physicians, whether the primary care provider or the authorized treating physician (ATP meaning MD or DO), with a patient who has a potential workers' compensation claim for COVID-19 might be asked for a statement on causation from the patient or from the insurance adjuster as part of the adjuster's investigation for compensability. In contested cases, it might be presented to a judge.

Much is unknown at this time about the epidemiology, transmission, contagiousness, pathophysiology, and residual permanent organ damage with a COVID-19 infection, whether the patient has any recognized initial symptoms or symptoms that might have required medical treatment. The information in this article should be considered preliminary and might change as the scientific knowledge surrounding COVID-19 evolves.

The decision on whether a case is accepted for workers' compensation benefits is a role of the insurance adjuster based on proper review of the medical information. If denied by the adjuster and disputed by the injured worker, the decision then rests with the judges in the Court of Workers' Compensation Claims (CWCC). Doctors do not make legal causation or compensability decisions, but they do need some understanding of the statutory requirements for a COVID-19 infection to be accepted (T.C.A. Section 50-6-102(14)) for the purposes of the Workers' Compensation Law. It is important to understand which information to provide for the decision-makers. Case law requires that a judge make the decision based largely on the medical proof, so the physician's opinion is a critical consideration.

Thus, it is helpful to provide to the adjuster and/or judge the following:

- Documentation of the employee's description of workplace exposure(s) to known COVID-19 cases;
- Documentation of known sources of exposure at home or out of the workplace;
- Current epidemiologic literature on the incidence and prevalence of COVID-19 in specific occupations or the employee's specific workplace; and
- Any determination of an appeal by the injured worker through Utilization Review (even though UR does not address causation).

It is the role of the medical practitioner to accurately and completely document the medical information necessary for all parties to make an informed decision. Even though the authorized treating physician might delegate certain duties to nurses (APNs) or physician assistants (PAs), under the Workers' Compensation Law, only a physician may give a valid opinion on causation. In addition, only the physician

chosen from a properly constructed panel would have a rebuttable presumption of correctness according to the statute.

It is not the duty of the physician to express an opinion concerning whether the exposure occurred consistent with the legal concept of “in the course and scope of employment,” although it is important to document exactly what the employee tells the physician concerning time and place of the exposure, either a single exposure or exposures at multiple times and/or places. The physician’s information may be useful but would not be controlling for the decision- makers.

Should COVID-19 cause an aggravation of an underlying condition that causes permanent organ damage, that damage must be more likely than not (>50%) due to the occupational exposure. It is the job of the physician to document the medical information based upon the information available or that can be obtained. Some of the references in the article on rating COVID-19 cases for permanent impairment (in this issue) might be useful to send to the insurer’s adjuster about known consequences of COVID-19. If a condition has not been reported in medical studies to accompany an infection or be a complication of COVID-19, then that condition would not be medically supported as caused by COVID-19, even in those who test positive for the virus. For example, currently there are no reports of permanent worsening neck or low back disorders from COVID-19, so a claim for low back pain or exacerbation of a previous low back disorder due to having had a positive test for COVID-19 would not be medically supportable. However, that decision would be case specific and dependent on the individual facts.

Causation might be difficult to determine, and in this circumstance harder, because of the lack of accurate information concerning some of the criteria established by Bradford-Hill.

The Bradford-Hill criteria have not been adopted by the Bureau or the Court but might provide guidance in decision-making. For example, accurate information concerning COVID-19 infections is not yet known for the criteria of consistency, specificity, and temporality. Because of the nature of transmission from asymptomatic individuals, these three criteria have not been supported by accurate data at present.

CAUSAL RELATIONSHIP CRITERIA

In 1965, the English statistician Sir Austin Bradford Hill proposed a set of nine criteria to provide epidemiologic evidence of a causal relationship between a presumed cause and an observed effect. For example, he demonstrated the connection between cigarette smoking and lung cancer. The list of the criteria is as follows (Hill, 1965):

1. **Strength** (effect size): A small association does not mean that there is not a causal effect, though the larger the association, the more likely that it is causal.
2. **Consistency** (reproducibility): Consistent findings observed by different persons in different places with different samples strengthens the likelihood of an effect.
3. **Specificity**: Causation is likely if there is a very specific population at a specific site and disease with no other likely explanation. The more specific an association between a factor and an effect is, the bigger the probability of a causal relationship.
4. **Temporality**: The effect has to occur after the cause (and if there is an expected delay between the cause and expected effect, then the effect must occur after that delay).
5. **Biological gradient** (dose-response relationship): Greater exposure should generally lead to greater incidence of the effect. However, in some cases, the mere presence of the factor can trigger the effect. In other cases, an inverse proportion is observed: greater exposure leads to lower incidence.[1]
6. **Plausibility**: A plausible mechanism between cause and effect is helpful (but Hill noted that knowledge of the mechanism is limited by current knowledge).
7. **Coherence**: Coherence between epidemiological and laboratory findings increases the likelihood of an effect. However, Hill noted that "... lack of such [laboratory] evidence cannot nullify the epidemiological effect on associations".
8. **Experiment**: "Occasionally it is possible to appeal to experimental evidence."
9. **Analogy**: The use of analogies or similarities between the observed association and any other associations.
10. Some authors consider, also, **Reversibility**: If the cause is deleted, then the effect should disappear as well.

Below is a checklist of the basic information to obtain. A “Yes” or “No” answer to any one of these questions does not necessarily make a final opinion. For example, even a negative RT-PCR test does not automatically make the causation opinion negative. Each case must be taken in its entirety.

SAMPLE QUESTIONNAIRE

NAME:

DATE:

JOB TITLE:

- YES or NO: Have you had a positive test for the COVID-19 virus? If “Yes,” please attach your positive test result.
- YES or NO: Have you had a specific exposure incident at work where you were within 6 feet for 10 minutes or longer of a co-worker who tested positive for COVID-19? If “Yes,” how many co-workers who tested positive for COVID-19 have you had this close contact with?
- YES or NO: Has a person you live with tested positive for COVID-19? If “Yes,” what is the date you tested positive? (Please provide details.)
- YES or NO: Has the Department of Health told you that you must quarantine at home due to your positive test for COVID-19? If “Yes,” What is the date you tested positive? Please attach a copy of the Department of Health order or communication.
- YES or NO: Has a doctor told you to “self-isolate” at home due to a confirmed specific exposure to a person with a positive test for COVID-19? If “Yes,” what is the date you test positive? Who is that doctor? (Please attach a copy of that doctor’s office note that states you should self-isolate.)
- YES or NO: Have you been directed by your employer to leave work or self-isolate? If “Yes,” provide a copy of the directions with dates.
- YES or NO: Were you hospitalized for symptoms related to COVID-19? If “Yes,” provide a copy of the medical record.
- YES or NO: Have you had an antibody test? If “Yes,” please provide a copy of the results.

EMPLOYER DUE DILIGENCE

In circumstances where an employer relies on its own interpretation of medical evidence without seeking an expert medical opinion to support its interpretation, fails to take reasonable steps to investigate a claim before denying it, fails to consider evidence in favor of the injured worker, and/or declines to reconsider its denial of a claim in the face of newly-discovered countervailing evidence, an interlocutory award of fees may be appropriate. *Travis v. Carter Express, Inc.*, 2019 TN Wrk. Comp. App. Bd. LEXIS 25, at *14 (June 24, 2019).

DOCUMENTED INACCURACIES OF COVID-19 TESTING

LINK: [CDC TESTING DATA](#)

LINK: [CORONAVIRUS TESTING ACCURACY](#)

LINK: [FALSE NEGATIVES IN QUICK TEST](#)

Documentation

These are the documents to be attached to authorized treating physician's office note on causation:

1. A copy of COVID-19 viral RNA PCR (RT-PCR) test results (positive or negative), with a legible date and result.
2. Employer-supplied job description and work attendance record.
3. Employee statement of details on potential workplace exposure to SARS COV2 virus and/or COVID-19 patients.
4. Results of any other tests given to persons the employee lives with or is consistently exposed to (positive or negative).
5. Any written communication from the Department of Health or a physician that directed or suggested home isolation.
6. Any direction from your employer to leave work or self-isolate because of COVID-19 exposure(s) or symptoms.
7. If hospitalized, a copy of the medical records.
8. A copy of any antibody test results.
9. Other documents that support or refute a potential claim.

BWC Instructions

Opinions must be given even with incomplete scientific data for analysis, taking the information available and applying the Bureau's Special Instructions on Causation: <https://www.tn.gov/content/dam/tn/workforce/documents/injuries/CausationNoticetoPhysicians.pdf>. This includes:

1. A description of the diagnosis (or diagnoses), both in medical and lay terms, including the appropriate ICD-10 code. Not only should this include the COVID-19 code but also descriptions and codes for any affected organs.
2. A complete and detailed description of the reported exposure(s) from the information you are provided including the mechanism, time, place, number, duration, or frequency of exposure(s).
3. If there were symptoms, pre-existing conditions, comorbidities, or prior or concurrent events unrelated to employment, these might be important contributing factors. If those factors existed without a present or ongoing need for treatment except for ("but for") the work exposure, an appropriate medical opinion might be that the work exposure is more than 50% responsible for the need for treatment.
4. Whether the need for treatment was an aggravation, a permanent and documented deleterious change of function or advancement of an underlying

condition. If so, was the aggravation itself more than 50% responsible for the need for treatment? For example, even though the injured worker tested positive for COVID-19, the need for treatment was due to complications of pre-existing chronic obstructive lung disease (COPD). Decide then whether this aggravation was (or was not) the cause of the need for medical treatment and was (or was not) more likely than not (>50%) because of the exposure at work.

5. When all this information is taken together, is it more likely than not, to a reasonable degree of medical certainty, that this described exposure or series of exposures was the cause of the need for treatment, death or disablement (time away from work or limited work capacity)?

Accurately recording the known facts and then forming a medical opinion must be supported by a reasonable explanation of the process of correlation supported by citing the available facts.

Examples of Assessments

- A 45 y/o nursing technician at a nursing home worked normal 12 hour shifts 4 days a week from March 1, 2020 through March 23, 2020 when she developed a fever of 101.5 with profound fatigue. She did not go to work and reported her illness to her supervisor. She was tested by the county health department and notified that she was positive for the coronavirus. She was seen and treated by her family physician with supportive antibiotics and additional inhalers for her pre-existing asthma. Her fever subsided but returned 5 days later for 3 days, necessitating an additional period of convalescence. She provided records from her family physician confirming the extra length of leave. She states no one living in her home had suggestive symptoms of COVID-19, and no one was tested for the virus. Her nursing home had greater than 10 cases of COVID-19, including two of the patients she regularly cared for during March. After recovery she felt she was back to baseline, and there were no changes in her medications or spirometry from her pre-illness status. With clear and repetitive exposure to COVID-19 patients at work, and with no known exposure outside the workplace, most physicians would feel this was a work-related case.
- A 25 y/o healthy grocery store clerk worked extra shifts from March 15 through April 21 because several co-workers chose not to come to work out of fear of the coronavirus. Despite being asymptomatic, he was able to get a viral RNA PCR test at a drive through testing center on April 21. It was reported as negative and he returned to work the following day. On April 27, he reported a fever, shortness of breath, and loss of sense of smell and taste. When tested again on April 28th he was negative. He was told to stay home for two weeks by his supervisor. No one else in his household was sick. When his shortness of breath worsened, he was seen in the ER and discharged with an inhaler and precautions. He was not tested for the coronavirus in the ER. His fever and lung symptoms subsided and he reported back to work May 11. He states that the loss of smell and taste have not returned as of June 25. With no proof he was ill with COVID-19, and with just occupational exposure to the general public (not to proven COVID-19 cases), most physicians would not feel this case has reached the ">50% threshold" for causation. The reported loss of sense of smell is a subjective symptom that has

not been confirmed by the UPSIT or Sniffin Sticks (testing). Loss of sense of smell occurs in several known viral respiratory diseases but recovers with time in 32-66% of cases (Boesveldt, 2017).

Conclusion

Doctors will be asked to make complex determinations regarding the work-relatedness of the employee's condition in COVID-19 claims. The more thorough the medical analysis, the more likely a claims adjuster and ultimately a judge is to accept the physician's opinion.

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Commentary on a Medical Abstract of Interest

Regarding Infection Disease Spread and its Implications for COVID-19

Robert B. Snyder, MD, and James B. Talmage, MD



N Engl J Med
1998 Mar 5;338(10):633-9.
doi: 10.1056/NEJM199803053381001

An Outbreak Involving Extensive Transmission of a Virulent Strain of *Mycobacterium Tuberculosis*

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Background and Methods

From 1994 to 1996, there was a large outbreak of tuberculosis in a small, rural community with a population at low risk for tuberculosis. Twenty-one patients with tuberculosis (15 with positive cultures) were identified; the DNA fingerprints of the 13 isolates available for testing were identical. To determine the extent of transmission, we investigated both the close and casual contacts of the patients. Using a mouse model, we also studied the virulence of the strain of *Mycobacterium tuberculosis* that caused the outbreak.

Results

The index patient, in whom tuberculosis was diagnosed in 1995; the source patient, in whom the disease was diagnosed in 1994; and a patient in whom the disease was diagnosed in 1996 infected the other 18 persons. In five, active disease developed after only brief, casual exposure. There was extensive transmission from the three patients to both close and casual contacts. Of the 429 contacts, 311 (72 percent) had positive skin tests, including 81 [corrected] with documented skin-test conversions. Mice infected with the virulent Erdman strain of *M. tuberculosis* had approximately 1000 bacilli per lung after 10 days and about 10,000 bacilli per lung after 20 days. In contrast, mice infected with the strain involved in the outbreak had about 10,000 bacilli per lung after 10 days and about 10 million bacilli per lung after 20 days.

Conclusions

In this outbreak of tuberculosis, the growth characteristics of the strain involved greatly exceeded those of other clinical isolates of *M. tuberculosis*. The extensive transmission of tuberculosis may have been due to the increased virulence of the strain rather than to environmental factors or patient characteristics.

Commentary

Twenty-one patients were identified and the DNA fingerprints of their cultures were identical, linking the infections. This outbreak strain of tuberculosis bacteria was shown to be highly virulent. The original source patient was diagnosed in 1994, after having initially been treated for a cough and pneumonia with antibiotics. The index patient, who worked in a Tennessee clothing factory, was diagnosed in 1995. The other 18 patients were infected by a patient who was not diagnosed until 1996, indicating a long asymptomatic but contagious period. Some of the infected patients were co-workers in whom the only known exposure was in the clothing factory. But some were family members whose only contact was limited to a few hours at Christmas and Easter. It took considerable time and resources to establish the timeline, pattern of transmission, and contact chart of the infections. Some of the ultimately identified patients had dormant infections for up to 9 months, including the original source patient. Extensive contact tracing occurred and revealed the extent of spread, allowing containment. Treatment was effective in those few patients in whom that data was recorded. Because of the known latency and potential reservoir of patients, active ongoing surveillance was suggested.

This case is instructive in 2020 for many reasons.

This uncommon strain of infectious tuberculosis was extremely virulent to some, and yet caused no symptoms in many of the patients. At present, this seems to be the case with COVID-19.

Since the known exposure for several cases was only at work, the treatment for these cases was covered both by the Tennessee and Kentucky Departments of Health Tuberculosis Clinics, and under workers' compensation. Identification and documentation in those cases was clear. In the present COVID-19 crisis, causation in first responders and frontline workers is being presumed by some jurisdictions. Chicken and beef processing plants are in the news as the sites of mini epidemics in their employees, with exposure to the virus postulated as in the workplace. In this issue of the *AdMIRable Review* is a discussion of the medical aspects of causation analysis for physicians in cases where a suspected work exposure to the virus has led to the need for treatment.

This study focused on contact tracing and control. What is described today as “track and trace” is not new and is a well-accepted method of identification and infection control. It is applicable to this pandemic. It is time intensive and requires expertise and sufficient resources to be effective.

Transmission assessment was not the focus of this article. It did comment on the unanticipated minimal contact that seemed to lead to some of the infections. Transmission characteristics were mentioned only as speculation based on traditional tuberculosis aerosol transmission. For this COVID-19 pandemic, those transmission characteristics are still being studied and seem to be important.

Survival and longevity characteristics of the infective agent are important. Mycobacterium is known to survive for weeks to months in soil, but the coronavirus only for days in most environments.

Mycobacteria are genetically stable, allowing treatments and control measures to be effective for longer periods of time. Coronaviruses are notoriously unstable, making contagion possible but treatment and vaccine production problematic.

With tuberculosis, there are good, reliable, and valid tests and many effective treatments. A vaccine is not necessary where cases now are so uncommon. That is, at present, not true in this COVID-19 crisis. Hopefully rapid, reliable, available, and accurate tests are coming, a valid antibody test with clinical relevance for the likelihood of longer-term immunity will soon be available, and an effective vaccine that confers significant and long-term immunity can be developed quickly.

Finally, the virulence of the strain was a greater factor in this outbreak than environmental factors or patient characteristics. So far, the COVID-19 pandemic seems to have all three characteristics: it is virulent, attacks certain at-risk populations, and can be influenced by environmental conditions.

Medical Abstracts of Interest

Regarding COVID-19

Selected James B. Talmage, MD

Published verbatim from [PubMed.gov](https://pubmed.gov), in the public domain.



Ann Intern Med. 2020 May 5;172(9):577-582.

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Epub 2020 Mar 10.

The Incubation Period of Coronavirus Disease 2019 (COVID-19) From Publicly Reported Confirmed Cases: Estimation and Application

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Background

A novel human coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was identified in China in December 2019. There is limited support for many of its key epidemiologic features, including the incubation period for clinical disease (coronavirus disease 2019 [COVID-19]), which has important implications for surveillance and control activities.

Objective

To estimate the length of the incubation period of COVID-19 and describe its public health implications.

Design

Pooled analysis of confirmed COVID-19 cases reported between 4 January 2020 and 24 February 2020.

Setting

News reports and press releases from 50 provinces, regions, and countries outside Wuhan, Hubei province, China.

Participants

Persons with confirmed SARS-CoV-2 infection outside Hubei province, China.

Measurements

Patient demographic characteristics and dates and times of possible exposure, symptom onset, fever onset, and hospitalization.

Results

There were 181 confirmed cases with identifiable exposure and symptom onset windows to estimate the incubation period of COVID-19. The median incubation period was estimated to be 5.1 days (95% CI, 4.5 to 5.8 days), and 97.5% of those who develop symptoms will do so within 11.5 days (CI, 8.2 to 15.6 days) of infection. These estimates imply that, under conservative assumptions, 101 out of every 10 000 cases (99th percentile, 482) will develop symptoms after 14 days of active monitoring or quarantine.

Limitation

Publicly reported cases may overrepresent severe cases, the incubation period for which may differ from that of mild cases.

Conclusion

This work provides additional evidence for a median incubation period for COVID-19 of approximately 5 days, similar to SARS. Our results support current proposals for the length of quarantine or active monitoring of persons potentially exposed to SARS-CoV-2, although longer monitoring periods might be justified in extreme cases.

Primary Funding Source

U.S. Centers for Disease Control and Prevention, National Institute of Allergy and Infectious Diseases, National Institute of General Medical Sciences, and Alexander von Humboldt Foundation.

Abstract 2

Selected by James B. Talmage, MD

Published verbatim from [PubMed.gov](https://pubmed.gov), in the public domain.

JAMA Inter Med.
2020 May 1;e202020.
doi: 10.1001/jamainternmed.2020.2020.

Contact Tracing Assessment of COVID-19 Transmission Dynamics in Taiwan and Risk at Different Exposure Periods Before and After Symptom Onset

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Importance

The dynamics of coronavirus disease 2019 (COVID-19) transmissibility are yet to be fully understood. Better understanding of the transmission dynamics is important for the development and evaluation of effective control policies.

Objective

To delineate the transmission dynamics of COVID-19 and evaluate the transmission risk at different exposure window periods before and after symptom onset.

Design, Setting, and Participants

This prospective case-ascertained study in Taiwan included laboratory-confirmed cases of COVID-19 and their contacts. The study period was from January 15 to March 18, 2020. All close contacts were quarantined at home for 14 days after their last exposure to the index case. During the quarantine period, any relevant symptoms (fever, cough, or other respiratory symptoms) of contacts triggered a COVID-19 test. The final follow-up date was April 2, 2020.

Main Outcomes and Measures

Secondary clinical attack rate (considering symptomatic cases only) for different exposure time windows of the index cases and for different exposure settings (such as household, family, and health care).

Results

We enrolled 100 confirmed patients, with a median age of 44 years (range, 11-88 years), including 56 men and 44 women. Among their 2761 close contacts, there were 22 paired index-secondary cases. The overall secondary clinical attack rate was 0.7% (95% CI, 0.4%-1.0%). The attack rate was higher among the 1818 contacts whose exposure to index cases started within 5 days of symptom onset (1.0% [95% CI, 0.6%-1.6%]) compared with those who were exposed later (0 cases from 852 contacts; 95% CI, 0%-0.4%). The 299 contacts with exclusive presymptomatic exposures were also at risk (attack rate, 0.7% [95% CI, 0.2%-2.4%]). The attack rate was higher among household (4.6% [95% CI, 2.3%-9.3%]) and nonhousehold (5.3% [95% CI, 2.1%-12.8%]) family contacts than that in health care or other settings. The attack rates were higher among those aged 40 to 59 years (1.1% [95% CI, 0.6%-2.1%]) and those aged 60 years and older (0.9% [95% CI, 0.3%-2.6%]).

Conclusions and Relevance

In this study, high transmissibility of COVID-19 before and immediately after symptom onset suggests that finding and isolating symptomatic patients alone may not suffice to contain the epidemic, and more generalized measures may be required, such as social distancing.

Abstract 3

Selected by James B. Talmage, MD

Published verbatim from [PubMed.gov](https://pubmed.gov), in the public domain.

MMWR Morb Mortal Wkly Rep.
2020 Apr 10;69(14):411-415.
doi: 10.15585/mmwr.mm6914e1.

Presymptomatic Transmission of SARS-CoV-2 - Singapore, January 23-March 16, 2020

Wycliffe E Wei, Zongbin Li, Calvin J Chiew, Sarah E Yong, Matthias P Toh, Vernon J Lee

Abstract

Presymptomatic transmission of SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19), might pose challenges for disease control. The first case of COVID-19 in Singapore was detected on January 23, 2020, and by March 16, a total of 243 cases had been confirmed, including 157 locally acquired cases. Clinical and epidemiologic findings of all COVID-19 cases in Singapore through March 16 were reviewed to determine whether presymptomatic transmission might have occurred. Presymptomatic transmission was defined as the transmission of SARS-CoV-2 from an infected person (source patient) to a secondary patient before the source patient developed symptoms, as ascertained by exposure and symptom onset dates, with no evidence that the secondary patient had been exposed to anyone else with COVID-19. Seven COVID-19 epidemiologic clusters in which presymptomatic transmission likely occurred were identified, and 10 such cases within these clusters accounted for 6.4% of the 157 locally acquired cases. In the four clusters for which the date of exposure could be determined, presymptomatic transmission occurred 1-3 days before symptom onset in the presymptomatic source patient. To account for the possibility of presymptomatic transmission, officials developing contact tracing protocols should strongly consider including a period before symptom onset. Evidence of presymptomatic transmission of SARS-CoV-2 underscores the critical role social distancing, including avoidance of congregate settings, plays in controlling the COVID-19 pandemic.

Abstract 4

Selected by James B. Talmage, MD

Published verbatim from [PubMed.gov](https://pubmed.ncbi.nlm.nih.gov/), in the public domain.

N Engl J Med.
2020 May 28;382(22):2081-2090.
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Epub 2020 Apr 24.

Presymptomatic SARS-CoV-2 Infections and Transmission in a Skilled Nursing Facility

Melissa M Arons , Kelly M Hatfield , Sujan C Reddy , Anne Kimball, Allison James, Jesica R Jacobs, Joanne Taylor, Kevin Spicer, Ana C Bardossy, Lisa P Oakley, Sukarma Tanwar, Jonathan W Dyal , Josh Harney , Zeshan Chisty, Jeneita M Bell, Mark Methner, Prabasaj Paul, Christina M Carlson, Heather P McLaughlin, Natalie Thornburg, Suxiang Tong , Azaibi Tamin, Ying Tao, Anna Uehara, Jennifer Harcourt, Shauna Clark, Claire Brostrom-Smith, Libby C Page , Meagan Kay, James Lewis , Patty Montgomery, Nimalie D Stone, Thomas A Clark, Margaret A Honein, Jeffrey S Duchin, John A Jernigan, Public Health-Seattle and King County and CDC COVID-19 Investigation Team

Background

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection can spread rapidly within skilled nursing facilities. After identification of a case of Covid-19 in a skilled nursing facility, we assessed transmission and evaluated the adequacy of symptom-based screening to identify infections in residents.

Methods

We conducted two serial point-prevalence surveys, 1 week apart, in which assenting residents of the facility underwent nasopharyngeal and oropharyngeal testing for SARS-CoV-2, including real-time reverse-transcriptase polymerase chain reaction (rRT-PCR), viral culture, and sequencing. Symptoms that had been present during the preceding 14 days were recorded. Asymptomatic residents who tested positive were reassessed 7 days later. Residents with SARS-CoV-2 infection were categorized as symptomatic with typical symptoms (fever, cough, or shortness of breath), symptomatic with only atypical symptoms, presymptomatic, or asymptomatic.

Results

Twenty-three days after the first positive test result in a resident at this skilled nursing facility, 57 of 89 residents (64%) tested positive for SARS-CoV-2. Among 76 residents who participated in point-prevalence surveys, 48 (63%) tested positive. Of these 48 residents, 27 (56%) were asymptomatic at the time of testing; 24 subsequently developed symptoms (median time to onset, 4 days). Samples from these 24 presymptomatic residents had a median rRT-PCR cycle threshold value of 23.1, and viable virus was recovered from 17 residents. As of April 3, of the 57 residents with SARS-CoV-2 infection, 11 had been hospitalized (3 in the intensive care unit) and 15 had died (mortality, 26%). Of the 34 residents whose specimens were sequenced, 27 (79%) had sequences that fit into two clusters with a difference of one nucleotide.

Conclusions

Rapid and widespread transmission of SARS-CoV-2 was demonstrated in this skilled nursing facility. More than half of residents with positive test results were asymptomatic at the time of testing and most likely contributed to transmission. Infection-control strategies focused solely on symptomatic residents were not sufficient to prevent transmission after SARS-CoV-2 introduction into this facility.

Abstract 5

Selected by James B. Talmage, MD

Published verbatim from [PubMed.gov](https://pubmed.ncbi.nlm.nih.gov/), in the public domain.

Nat Med.

2020 May;26(5):672-675.

doi: 10.1038/s41591-020-0869-5. Epub 2020 Apr 15.

Temporal Dynamics in Viral Shedding and Transmissibility of COVID-19

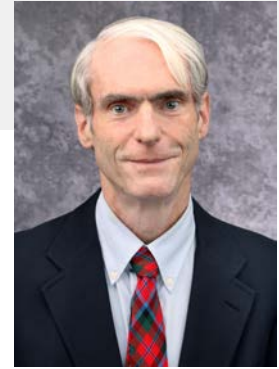
[Xi He](#), [Eric H Y Lau](#), [Peng Wu](#), [Xilong Deng](#), [Jian Wang](#), [Xinxin Hao](#), [Yiu Chung Lau](#), [Jessica Y Wong](#), [Yujuan Guan](#), [Xinghua Tan](#), [Xiaoneng Mo](#), [Yanqing Chen](#), [Baolin Liao](#), [Weilie Chen](#), [Fengyu Hu](#), [Qing Zhang](#), [Mingqiu Zhong](#), [Yanrong Wu](#), [Lingzhai Zhao](#), [Fuchun Zhang](#), [Benjamin J Cowling](#), [Fang Li](#), [Gabriel M Leung](#)

Abstract

We report temporal patterns of viral shedding in 94 patients with laboratory-confirmed COVID-19 and modeled COVID-19 infectiousness profiles from a separate sample of 77 infector-infectee transmission pairs. We observed the highest viral load in throat swabs at the time of symptom onset, and inferred that infectiousness peaked on or before symptom onset. We estimated that 44% (95% confidence interval, 25-69%) of secondary cases were infected during the index cases' presymptomatic stage, in settings with substantial household clustering, active case finding and quarantine outside the home. Disease control measures should be adjusted to account for probable substantial presymptomatic transmission.

Tennessee Workers' Compensation In the Time of Pandemic

Ronald W. McNutt



Nearly one-third of Americans were infected, and more than a half a million died, from the H1N1 strain in a series of outbreaks during the Spanish Flu pandemic of 1918-19. Americans serving in Europe during World War I were particularly afflicted, because young people were vulnerable to the disease. It caused lung congestion and pneumonia, and large numbers of deaths resulted, exacerbated by pressures on the healthcare delivery system, malnutrition and poor hygiene. A second wave in 1918 was particularly deadly, spiking in November with a mutated form of the virus. Due to the war effort, publicity about its impact was downplayed by countries in the war, and its apparent origin in Kansas was obscured. Spain, which was neutral, did not minimize the impact of the disease, so it became identified with the disease. With war casualties and the recent experience of other outbreaks such as typhoid, yellow fever, diphtheria and cholera, the experience of the Spanish flu outbreak did not remain prominent in the nation's consciousness, and people were eager to move on.

Another wave of the disease took place in 1919, after Tennessee joined the majority of states in adopting what was called by various titles: the workmen's compensation law, Senate bill 1000, or the Todd-Walker bill, when it was signed into law by Governor Albert Roberts. With the experience of the pandemic and other traumatic world events in the country's recent past, it seems reasonable to believe

that people were more open to reassessing their priorities, minimizing conflict and divisions, and coming together to uplift marginalized and vulnerable members of society by addressing this need for compensation for injured workers and the families of workers killed in industrial accidents. What follows is the story of how the Workers' Compensation law was passed in Tennessee.



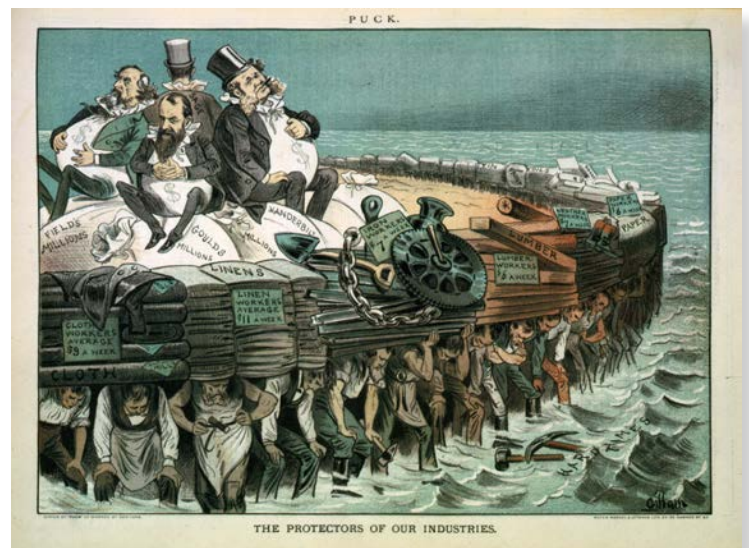
An increase in manufacturing and an industrial economy led to a national epidemic of industrial accidents in the late 1800s and the early 1900s. Mining

disasters, such as the May 19, 1902 explosion in Fraterville, Tennessee that killed about 216 men and boys, and the December 9, 1911 explosion in Briceville, two miles from Coal Creek, that killed 84 men and boys, left whole communities destitute. In 1907, there were 64,930 railroad workers injured nationwide in the line of duty, and 4,218 railroad workers were killed that year doing their jobs. By

the early 1900s, railroad labor unions and organized labor in mining had become an economic and political force. Union leaders such as Eugene Debs, who spoke at the Ryman Auditorium in 1910 to an enthusiastic audience, advocated for socialism as the best way to provide for safe work environments and bring about appropriate respect for working people. Industry would use the judicial system to enjoin strikes and imprison the labor leaders who organized them.

The Thirteenth and Fourteenth Amendments were adopted to protect the rights of African-Americans from the former Confederacy during Reconstruction, but the courts applied the Fourteenth Amendment's substantive due process protections to protect corporations from social and economic legislation intended to protect laborers and consumers. The courts scrutinized whether state laws deprived individuals or businesses of life, liberty or property without due process of law by balancing the interests of the implied police power of the state against the liberty interest of the individual or corporation. The courts heavily valued business interests, such as the liberty interest in freely contracting with workers, which inhibited state power to enact social and economic legislation for public safety and welfare.

The Supreme Court applied the due process liberty interest to protect the right to freedom of contract to restrict state action in *Lochner v. New York*, 198 U.S. 45 (1905). In a five-to-four decision, it held that a New York law restricting the work hours of bakery employees to no more than ten hours per day was unconstitutional and presented an "unreasonable, unnecessary and arbitrary interference with the right and liberty of the individual to contract." A statute like the workers' compensation law, which was enacted to protect public health, morals, or safety had to have a real or substantial relation to that purpose and not intrude unduly on fundamental rights to be constitutional. Common law defenses would bar recovery for workplace injuries, however, and most work injury cases would not get to court because defenses for acts of fellow servants, contributory negligence and assumption of risk would succeed on pretrial motions.



In his address to the Sixtieth Congress, which was printed on December 4, 1907, in the Nashville American, Theodore Roosevelt advocated for workers' compensation programs, stating that when an employer "starts in motion agencies which create risks for others, he should take all the ordinary and extraordinary risks involved." With a workers' compensation policy "would come increased care, and accidents

would be reduced," he argued, providing "automatic" payments that would not require lawsuits and that would provide "certain and definite compensation for all accidents in industry irrespective of negligence." He stated, "Only in this way can the shock of the accident be diffused, instead of falling upon the man or woman least able to bear it, as is now the case."



Workers at Bemis Cotton Mill

Workers' compensation law found a foothold in 1908, when the second version of the Federal Employers Liability Act, created by Congress to compensate for injuries that occurred among railroad workers in interstate commerce, finally withstood constitutional review as a valid exercise of Congress's power over interstate commerce. But the New York Court of Appeals, in *Ives v. South Buffalo Railway Co.*, 201 N.Y. 271 (1911), invalidated the New York workers' compensation law under the due process clause of the state constitution and the U.S. Constitution. The

court held that the workers' compensation law was an unlawful taking of property and an overextension of the state's taxing power, stressing that the law's provisions were compulsory and provided for employers to be liable without proof of failure to exercise ordinary care.

Momentum continued building for workers' compensation. In 1910, a Maryland law was enacted that was applicable to coal and clay mines in certain counties, and it was superseded in 1914 by a law with broader application. In 1911, New Jersey, Massachusetts, Illinois, Kansas, California, New Hampshire, Nevada, Ohio, Washington, and Wisconsin adopted workers' compensation laws. Massachusetts had a compulsory law. Many other states enacted elective laws, which eliminated common law defenses for employers which opted not to be covered under the state's workers' compensation system, but limited damages for negligence for those that came under the law.

In an editorial in the *Tennessean* on April 6, 1911, W. L. Mitchell, the chair of the legislative committee of the Locomotive Firemen and Enginemen union, explained that there was increased unrest over the previous few years regarding the amount of industrial accidents. He urged consideration of the "doctrine of compensation," with a "fixed amount to be paid to the injured employe[e] or his beneficiary, the cost to be charged to the commodity produced, the amount to be determined by the earning capacity of the employe[e] so injured or killed and in the same connection the number and age of the dependents are also considered." Characterizing the existing system as creating a one-sided burden of oppression to the laborers, and the dominating power of money as causing charitable businessmen to become despotic, Mr. Mitchell called upon those who "promised to lend every aid to the cause of humanity" to embrace the idea of a workers'

compensation system. He argued that Tennessee would not be among “the most earnest advocates of justifiable legislation for the working men,” but even as an average state in its response, would be doing a “long-deferred justice” to those who develop the state by implementing a workers’ compensation system.

On July 6, 1911, T. J. Hoskins, a locomotive engineer and union official who later served on the governor’s commission to propose a workers’ compensation law and served as a state senator, wrote a letter to the *Tennessean* to urge the repeal of the fellow-servants law in hazardous business, stating that a bill to repeal it had passed by a 20 to 12 vote in the senate and that it was the most important piece of unfinished work in the state legislature. Mr. Hoskins argued that the bill was eminently just, that passage would be an act of justice to the laboring people, and that it would not present a grievous burden to the employer. Stressing that casualty insurance was available, and arguing that an employer’s degree of care should affect its profitability, he stated that the law would provide for support of decedent’s families rather than “having them cast away to suffer and become criminals” because they would be left with no means of support.

The highest courts of three industrial states upheld the constitutionality of their state workers’ compensation laws in *State ex rel. Davis-Smith Co. v. Clausen*, 65 Wash. 156, 117 P. 1101 (1911); *Borgonis v. Falk Co.*, 147 Wis. 327, 133 N.W. 209 (1911); and *State ex rel. Yapple v. Creamer*, 85 Ohio St. 349, 97 N.E. 602 (1912). These decisions upheld the states’ police powers to ensure a remedy for injured workers. The states would provide elective remedies and would create commissions to provide compensation from funds derived from payroll taxes.

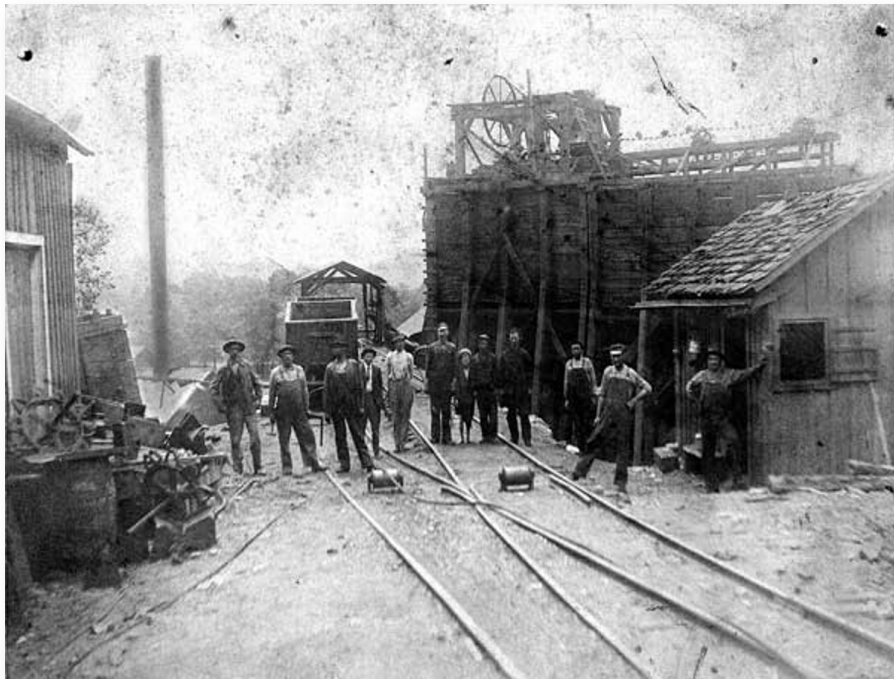
On March 10, 1913, the *Tennessean* reported that Governor Ben Hooper and prominent members of the General Assembly advocated for consideration of a workers’ compensation law like ones being passed in Colorado and in place in Ohio, which involved a commission setting out the rates of contribution to a fund for the awards to be distributed. It would be an elective system and cover hazardous occupations. On July 28, 1913, a *Tennessean* article recorded that the Workmen’s Compensation Commission had been created by legislation. Governor Hooper later named as members of the commission two lawyers, a large employer, a professor of economics and a locomotive engineer and labor leader. Its chairman was Whitefoord R. Cole of Nashville, the secretary was J. H. Turner of Nashville, and Professor G. W. “Gus” Dyer of Nashville, T. J. Hoskins of Knoxville, and James A. Fowler of Knoxville also



Wharf at Broad and Front Street (1st Avenue), Nashville, on the bank of the Cumberland River

were members. In 1914, the commission hearings gathered information that workers would receive compensation for on-the-job injuries in fewer than twenty percent of the cases, and if they won, they would owe about half of any recovery as attorney fees.

Local and state manufacturers' organizations opposed the initial efforts to propose a workers' compensation law. In an article on June 21, 1914, the *Tennessean* printed remarks of Walter Clarke, the chairman of the legislative committee of the Tennessee Manufacturer's Association. He warned that a workers' compensation law would add to the "evil of malingery" and would not increase safety. He claimed that it would have unintended consequences and that wages would decrease due to an increase in the cost of overhead. Conscientious manufacturers would be subsidizing the indifferent employers and would be led "to retire from the manufacturing business" and "place their money in other channels of trade." He also stated that employers would have to pay added amounts for injuries when workers had pre-existing disabilities, and that "a rigid examination will be conducted before employment is given, and the less skilled and impaired applicant will be refused a place in the workplace."

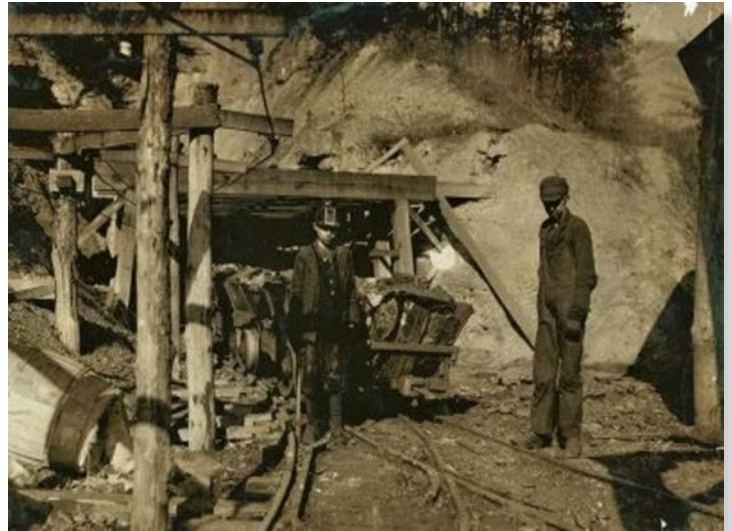


Coal Miners - Dunlap, Sequatchie County

In 1915, Senator Hoskins introduced the commission's proposed bill for workers' compensation to the legislature, but on March 25, 1915, the senate judiciary committee rejected the Committee's proposal by a six-to-four vote because of the objections to the proposal from manufacturers. The *Tennessean* reported on March 25, 1915, that Commission member Prof. Gus Dyer had argued to the committee, "I am opposed to socialism, but the people of this country are going to try socialism if they can't get out

from under the present system - then you can take the chances of having all your plants swept away from your ownership. The really great men of Tennessee came from the ranks of those who toil. Legislators should speak for this class and for those who cannot speak for themselves." The debate over the proposal resulted in procedural measures including a motion to refer the bill to the revenue ways and means committee, and the bill was returned to the calendar committee.

The Report of the Workmen's Compensation Commission to the 59th General Assembly of Tennessee in 1915 was described in the Bulletin of the U.S. Bureau of Labor Statistics, number 203, in January of 1917. The Commission report consisted of 55 pages of discussions, including a draft of the proposed bill. The report asserted that its proposed law would meet constitutional challenges and stated: "A refusal on the part of the legislature at this late date to pass a workmen's compensation law would brand Tennessee as a reactionary, non-progressive State, a State not alive to the interests of its working people." The Commission concluded that "the necessity and wisdom and feasibility of workmen's compensation laws are no longer debatable questions among those who are informed on the subject."



Cross Mountain Mine at Coal Creek, Claiborne County, 1922

The legislature would meet every two years, and setbacks brought lengthy delays. By the end of 1915, thirty one states and two territories had enacted workers' compensation laws. That same year, the U. S. Bureau of Labor Statistics conservatively estimated that 25,000 fatal industrial accidents among American workers of both sexes took place each year and that there were 700,000 workplace injuries every year involving disabilities lasting over four weeks.

Ohio's elective workers' compensation act was upheld in *Jeffrey Manufacturing Co. v. Blagg*, 235 U.S. 571 (1915), despite challenges that the law violated equal protection of the law under the Fourteenth Amendment. On September 7, 1916, President Wilson signed into law a federal workers' compensation Act that expanded workers' compensation benefits for federal civil-service employees during periods of disability.

The Supreme Court, in *New York Central Railroad Company v. White*, 243 U.S. 188 (1917), upheld New York's compulsory workers' compensation law, which was enacted after the state's constitution was amended to permit a workers' compensation law. The Court held:

It is not unreasonable for the State, while relieving the employer from responsibility for damages measured by common-law standards and payable in cases where he or those for whose conduct he is answerable are found to be at fault, to require him to contribute a reasonable amount, and according to a reasonable and definite scale, by way of compensation for the loss of earning power incurred in the common enterprise, irrespective of the question of negligence, instead of leaving the entire loss to rest where it may chance to fall — that is, upon the injured employee or his dependents.

On January 31, 1917, the *Tennessean* reported that workers' compensation bills were pending in the judiciary committees of both houses, which the paper described as a model law that had been scrutinized by experts in the field, and if enacted, would make Tennessee the thirty-third state to have a workmen's compensation law. The bill involved the appointment of an industrial commission to administer the proposed law. The 60th General Assembly adjourned on April 10, 1917 with no workers' compensation law bill, not long after the Supreme Court decision in *New York Central Railroad Company v. White* was issued on March 6, 1917.

Kentucky passed an elective law in 1916 after its 1914 law had been invalidated because a reviewing court held that, by creating a presumed contract between the worker and the employer, it violated Kentucky's right to remedy constitutional provision, which prevented the state from limiting the amount to be recovered for injuries or wrongful death. *Kentucky State Journal Co. v. Workmen's Comp. Bd.*, 161 Ky. 562 (1914). An editorial in the *Tennessean* on February 2, 1919 stated that the workers' compensation act was based upon Kentucky's law, and that it had seen beneficial results and had been strengthened with improved procedures. Workers' compensation was an idea that was becoming universal. In 1917, Washington's compulsory law was upheld in court. By that time, forty-six countries had some form of workers' compensation for industrial accidents, beginning with Germany in 1884, and followed by Austria in 1887 and Norway in 1894.

On December 27, 1918, after Governor Roberts's election, the *Tennessean* stated that he was in favor of a workers' compensation law that should "be a moderate act, wisely guarded in the interest of the employer as well as the employe[e]." The *Tennessean* article described the "growing spirit of unrest among the working classes," who were "fast losing faith in the law and its administration" because they were "required to seek legal redress under an archaic and obsolete system of law." The article stated that a workers' compensation law was needed to address industrial and social changes that affected laborers more profoundly than any other class because the people injured in the workplace were precluded from recovery through the fellow servant rule or by application of contributory negligence or assumption of risk defenses that originated when "industrial processes were simple and direct and a working man would be injured through his own fault." "With the revolution of industry and its modern highly complex and intricate nature, the reasons" supporting those defenses "have long ago disappeared," yet they "remain as relicts of a past industrial era to plague and work injustice to the laboring classes."

The official papers of Governor Roberts contain two letters from local unions that urged enactment of the Act. A February 14, 1919 letter from a local chapter of the United Brotherhood of Carpenters and Joiners of America in Jackson reads, "We as a body of working men earnestly request and insist that you use every honorable means and just efforts to [enact] the Workmans Compensation Act now pending before the Legislature." A February 15, 1919 letter from the Memphis division of the Amalgamated Association of Street and Electric Railway Employees of America

implored, "We appeal to you in the name of the thousands of widows and orphans, and in the name of the thousands of crippled and maimed working men and women of this state, so incapacitated by reason of the absence of this law from our statute books. Surely old Tennessee is not destined to fall behind in the march of progress, now."

On April 10, 1919, the Senate passed an amendment to the bill to exempt operators of coal mines from being part of the Act, by a vote of 26 to 4. Union members were lobbying the legislators on the floor of the Senate, and several other amendments were rejected. A workers' compensation law passed with only one vote to spare in the House of Representatives on a Saturday afternoon, after considerable time discussing amendments that were voted down, with the exception of a provision to include coal mining under its application. A conference committee was convened to settle the dispute about exclusion of coal mines from the law.

On April 12, 1919, the general counsel for the Tennessee Manufacturers Association, Dan E. McGugin, wrote a public letter to the General Assembly in the Tennessean stressing that work accidents were causing a greatly increasing army of dependents, and that his association believed in the wisdom and expediency of the proposed legislation. His letter stated: "The bill provides in no sense for charity; it provides only for justice, while operating to reduce accidents in the industrial occupations." He argued that similar laws were in effect in at least forty-two states, having come into place after the "public conscience began to be awakened ten years ago." He wrote, "In passing this measure the Tennessee Legislature will add prestige to the state; the measure will actually operate as a very great economy, after deducting the present heavy costs attached to a multitude of individual suits."

On April 13, 1919, in an article in the Tennessean, Governor Roberts explained that the proposal was prepared by a joint committee with participation by the Tennessee Manufacturers Association and the legislative committee of the Tennessee Federation of Labor, and assisted by the Tennessee State Bar Association. Governor Roberts stated that both labor and manufacturers agreed to the provisions, as well as both political parties, and that he had campaigned in favor of adopting the legislation. Governor Roberts stated that the proposed provisions had been "worked out in detail by technical men," who were familiar with these laws and "have the approval of those most vitally interested in the operation of the law." Governor Roberts argued that because there were many casualties caused by dangerous and complicated machinery of industry, "resulting in throwing widows and orphans on the mercy and charity of the world, such legislation has become an economic necessity." He stated that "laboring men of Tennessee are appealing to you with one voice for relief" and that the manufacturers "desire to do what is right and just by the toilers whom they employ."

The legislature was in its final week, and Senate leaders would stand firm in opposing coal mining from the law's application. In two or three messages, the

governor had urged passage of the bill and the article anticipated more trouble ahead. The Senate version prevailed on April 19, 1919. An article on April 20, 1919, described the signing of the bill into law by Governor Roberts in the presence of Mr. McGugin and Tennessee Manufacturers' Association secretary, Charles Gilbert. He presented the gold pen he had used to sign the bill to Mr. McGugin "as a recognition of his service in preparing the measure and getting the bill enacted into law."

The Tennessee workmen's compensation law had provisions similar to those in most states. Section 6 exempted from coverage common carriers, coal mining, employers with fewer than ten regularly-employed workers, casual laborers, domestic servants, and state, county or municipal employees. Section 11 provided an option for the employer to opt out from the provisions of the law and forfeit the formidable common law defenses of contributory negligence, negligence of the fellow employee, and assumption of risk. Section 20 provided for a compensation rate of fifty percent of the worker's average weekly wage, with a minimum of \$5 per week and a maximum of \$11 per week.

A schedule of compensation provided various benefits such as 200 weeks of benefits for loss of an arm, 350 weeks of benefits for loss of an eye and an arm, and 400 weeks of benefits for the loss of two arms or hands or two legs or two feet. Section 20 also provided benefits for permanent and total disability for certain combinations of injuries, which were paid at 400 weeks plus another 150 weeks at the minimum compensation rate, not to exceed a total of \$5,000. Section 25 of the Act provided a total limit of \$100 for medical services at rates prevailing in the community where the injured worker resided. Section 30 provided up to 400 weeks of benefits for the dependents of workers who were killed in work accidents. Unlike the majority of states, which had administrative commissions or boards to decide claims, section 32 provided a system for adjudication or approval of claims through the circuit, criminal or chancery courts where the worker resided or where the accident occurred. A Tennessean article stated that the bill was "not all that the laboring people wanted, nor all that the operators of industry desired," but that it represented a step toward "enactment of a more agreeable law after years of work and worry."

The Act brought together a comprehensive set of provisions adopting the considered wisdom of competing interests. Many of its provisions have endured to the present time. It embodied the spirit of humanity's desire to protect and lift up injured and impoverished fellow humans, and to give credit to the hard-working laborers who were responsible for building the industry and prosperity of Tennessee.

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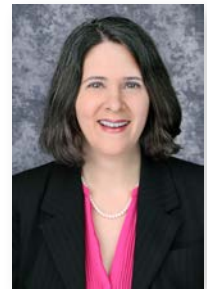
Kyle Jones

Kyle Jones is the Communications Coordinator for the Tennessee Bureau of Workers' Compensation. After receiving his bachelor's degree from MTSU, he began putting his skillset to work with Tennessee State Government. You'll find Kyle's fingerprints on many digital and print publications from videos to brochures published by the Bureau. Kyle hopes that visuals like motion graphics can help explain and break down complex concepts into something more digestible and bring awareness to the Bureau's multiple programs that are designed to help Tennesseans.



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