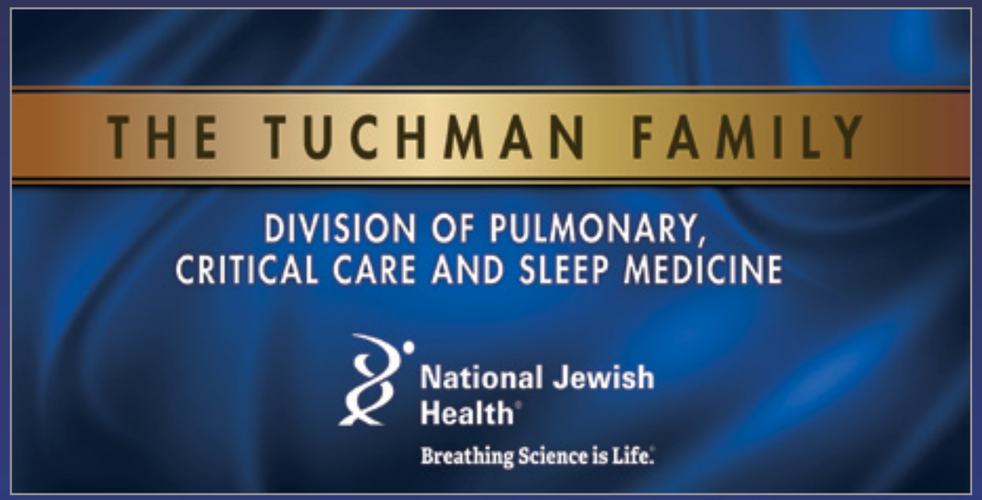
National Jewish Health

PULMONARY HIGHLIGHTS 2021-2022

BEST HOSPITALS U.S.News & WORLD REPORT PULMONOLOGY & LUNG SURGERY 2021-22

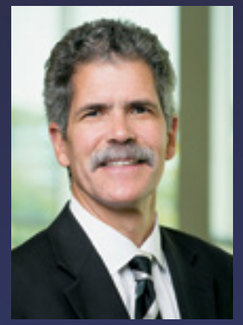
National Jewish Health®

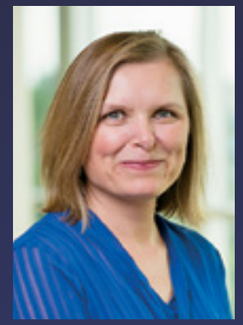
Breathing Science is Life.®



National Jewish Health acknowledges The Tuchman Family Foundation and Debra and Ken Tuchman for their generous gift to establish The Tuchman Family Division of Pulmonary, Critical Care and Sleep Medicine.

For more than 20 years, Debra and Ken Tuchman and the Tuchman Family have been committed to National Jewish Health through board service and as outstanding advocates for the institution.





Dear Colleague,

We have all faced another challenging year as the pandemic continues to evolve and affect so many people around the globe. At the same time, at National Jewish Health we have worked hard to meet the needs of not only those patients suffering from COVID, but also the many who have serious and chronic illnesses of every nature. Our experts have followed the science, worked as a team to advance care and continued to adapt to changing conditions. Teamwork in the intensive care unit, at our Center for Post-COVID Care and Recovery and within our diagnostic and research laboratories across the institution continues to be key, combining varied strengths into a powerful, unified effort. With COVID as with other illnesses, we have found that existing scientific and clinical evidence continues to serve as our guide to protect our patients and staff and as a springboard for helping people recover from illness.

As a hospital system focused on respiratory and related diseases, we have historically placed high value on working across disciplines and have built strong and unique programs in areas such as cardiac care. Our approach is straightforward. Patients who come to us receive extensive evaluation by expert pulmonologists in collaboration with cardiologists, gastroenterologists, allergists, oncologists, rheumatologists and others, all located within one facility to bring an integrated approach to patients. Evaluation, testing and consultation all occur in just a few days in most cases. We then draw from our extensive experience, developing effective care management plans for patients with both common and rare conditions. Finally, we help patients return home to work with their hometown physicians, while we remain a resource for both patients and physicians.

National Jewish Health has one of the largest pulmonary divisions in the country, with recognized international leaders in fields such as asthma, COPD, cystic fibrosis, interstitial lung diseases and many others. We continue to be named #1 or #2 on the *U.S. News & World Report* list for best hospitals in pulmonology. With this unrelenting focus on research and care for patients, we are prepared to meet the ongoing issues from the pandemic, as well as the many challenges faced by millions of patients across the globe who have respiratory and related diseases.

With teamwork, evidence and responsiveness, we are sure to find solutions for our patients and yours. We hope you will take a few moments to read and discover more about how National Jewish Health advances pulmonary medicine for so many.

Kevin K. Brown, MD
Chair, Department of Medicine
National Jewish Health

Irina Petrache, MD
Chief, Division of Pulmonary,
Critical Care and Sleep Medicine
National Jewish Health

Fighting the Pandemic: Year Two

As the COVID-19 pandemic rolled into its second year, National Jewish Health continued to be at the forefront of providing care and research to battle the ongoing challenges. Researchers and clinicians approached the disease from every angle, continuing testing programs and developing new ones, providing care and expanding treatments, and responding to the need to provide vaccine throughout the community.

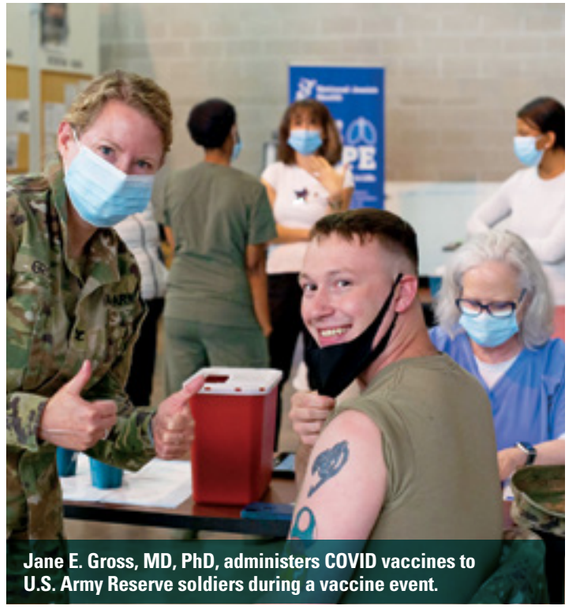
When the first vaccines were approved for emergency use, National Jewish Health leadership worked with state officials and others to create a multiphase distribution plan that was ready to launch when vaccines arrived.

"We had a great, multidisciplinary team that was focused on preparing to administer the vaccine across our organization and beyond," said Steve Frankel, MD, executive vice president of Clinical Affairs. "They worked on best practices with other hospitals and with the state to follow the guidelines. All efforts focused on getting the vaccine to people as quickly and safely as possible."

From December 2020 through June 2021, National Jewish Health vaccinated more than 70,000 people at mass vaccination events held in parking lots on the medical campus and in partnership with the University of Denver, local churches and others to reach more people, including underserved populations. Staff conducted special events where needed, including an event for soldiers in a local U.S. Army Reserve Medical Operations Readiness Unit.

"Many who wouldn't have gotten vaccinated were thankful that we brought the vaccine to them," said Kristi Melton, MSN, RN, vice president of Clinical Business Operations. "They arrived in the parking lot and stayed in their cars for the vaccine and observation period. It ran like clockwork."

Amy Schouten, RN, AE-C, provides the Pfizer vaccine to a young girl on the day it was approved for children ages 5-11.



Jane E. Gross, MD, PhD, administers COVID vaccines to U.S. Army Reserve soldiers during a vaccine event.

As soon as they were approved, National Jewish Health was among the first facilities to provide third dose boosters to qualified patients and first and second doses of the Pfizer vaccine to children ages 5-11.

As variants became a major concern, the organization sought innovative ways to help identify variants, including the adaptation of a novel technology that uses both the genetic sequence and the molecular weight of target mutations to rapidly identify which mutations are present in a sample and distinguish among the variants that can cause coronavirus infections in individuals, including all of the "variants of concern" and "variants of interest." This process is much faster and less expensive than genetic sequencing and can help reveal what is happening within a community or region in real time.

The National Jewish Health Advanced Diagnostic Laboratories leveraged the same technology to create one of the earliest tests that could detect coronavirus, influenza A and B, and respiratory syncytial virus A and B from a single nasal swab to help monitor populations such as schools, nursing homes and prisons.

"Staff, faculty and physicians across the institution have risen to the challenge of the pandemic with foresight, expertise and nose-to-the-grindstone grit to develop tests that have been crucial in our battle to defeat the pandemic," said Dr. Frankel.

For patients who were already infected with COVID-19, National Jewish Health also opened its doors as an infusion site to provide monoclonal antibody treatments. The institution was well-positioned for the task, as it maintained a safe location with negative pressure and staff members experienced in providing infusion treatments for patients with other conditions.

During this time, National Jewish Health critical care physicians, who work at intensive care units throughout Denver, also stayed focused on the pandemic. Working with the National Institutes of Health, they were part of trials of several medications to help reduce inflammation in patients' lungs that comes as a consequence of fighting the virus.

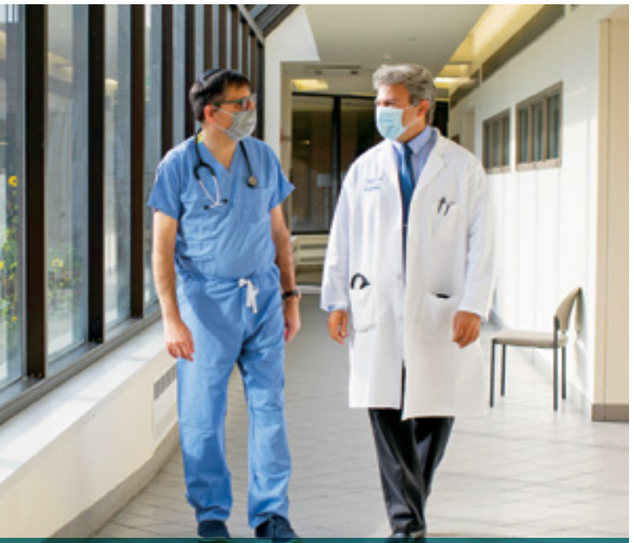
"Inflammation is a huge problem for people with vibrant immune systems, where the collateral damage can really harm the lungs, which are so sensitive," said William Janssen, MD, section head of Critical Care Medicine. "We really need to have therapies that help limit inflammation, but yet enable the body to control the virus."

Unique Center Focuses on COVID Care and Recovery

Almost as soon as National Jewish Health physicians began seeing patients with COVID-19, they realized those patients would need ongoing care after the acute phase of their disease had passed. To address this need, the institution opened the multidisciplinary Center for Post-COVID Care and Recovery in the spring of 2021. The Center now serves more than 300 patients a month and has touched more than 3,000 patients from Colorado and around the nation.

The wide range of long-COVID symptoms people suffer has become a hallmark of the COVID pandemic. "This is not one disease, it is many," said Nir Goldstein, MD, director of the Center for Post-COVID Care and Recovery and a pulmonologist. "We have pulled together a dedicated team of experts in pulmonology, cardiology, neurology, gastroenterology, rheumatology, infectious disease, allergy and immunology to understand the full constellation of symptoms that each patient suffers. We then deliver state-of-the-art care tailored to each individual."

Some symptoms are well understood, often arising from severe pulmonary viral illnesses or following acute care in intensive care units. Those symptoms can range from ongoing lung inflammation to scarring of the lungs, trauma to the airways and inflammation of the heart, all of which have well-established treatments.



Nathan Rabinovitch, MD, pediatric allergist and immunologist, and Nir Goldstein, MD, pulmonologist, discuss patient care in the Center for Post-COVID Care and Recovery.

Other symptoms, such as unexplained fatigue, rapid heart rate, "brain fog," and an inability to exercise, are less easy to explain and treat. Medications may improve symptoms for some. For others, supportive care and rehabilitative therapy are the best treatments.

While adults account for the majority of COVID patients with lingering symptoms, children and adolescents also can suffer debilitating effects of long-COVID, which spurred National Jewish Health *for Kids* to develop the COVID Assessment Program for younger patients. Working as part of the Center for Post-COVID Care and Recovery and housed within the Pediatric Care Unit, patients and their parents come for several days of comprehensive evaluation by a dedicated team of pediatric specialists who then develop treatment plans.

"We see slightly different symptoms in children with long-COVID than in adults, often including new-onset asthma," said Hara Levy, MD, head of the Division of Pediatric Pulmonary Medicine. "We work hard to develop treatment plans that will help those children."

"By launching new programs for both adult and pediatric long-COVID early in the pandemic, we have gained experience and expertise in addressing the long-term consequences of COVID-19," said Irina Petrache, MD, chief of Adult Pulmonary, Critical Care and Sleep Medicine. "But there is still so much we do not know."

Research continues, including initial research that has provided clues to some of the mysteries surrounding long-COVID.

"We need to continue to work to understand the causes and guide development of effective treatments for long-COVID," said Dr. Goldstein.

Study Helps Understand Relationship of Exercise Fatigue and Long-COVID

Irina Petrache, MD, examined how mitochondrial dysfunction can cause exercise intolerance in long-COVID patients.

One recent study out of the Center for Post-COVID Care and Recovery found that malfunctioning mitochondria may contribute to fatigue and exercise intolerance in patients with long-COVID.

A multidisciplinary team, including clinicians and scientists with expertise in evaluation of long-COVID patients and in exercise physiology, tested 50 patients with symptoms of the disease. Most patients had previously received clean bills of health from usual testing such as X-rays, echocardiograms and MRIs. However, where once they were able to compete in endurance races, like marathons and triathlons, they were now unable to exercise at all.

The team indirectly tested how patients' mitochondria were functioning by looking at their lactate levels. The patients completed a cardiopulmonary exercise test on a cycle ergometer, which increased in difficulty until each patient was exhausted. Blood and breath samples were collected throughout exercise to measure lactate, carbon dioxide production and oxygen utilization. They found that in patients with long-COVID, lactate levels rose much sooner at a lower wattage of exercise than they should. These findings suggested that the mitochondria do not efficiently utilize fatty acids as fuel to produce energy to meet the demand of increasing exercise load.

The study provided possibly the first evidence that a better understanding of mitochondrial dysfunction could advance our understanding of how long-COVID develops in patients with otherwise healthy pulmonary and cardiac function.

"By knowing what the problem is, we can start identifying solutions for the problem," said Irina Petrache, MD, chief of Adult Pulmonary, Critical Care and Sleep Medicine, a co-author of the studies. "There is still more work to do to identify eventual treatments, like drugs or exercise protocols, but we know now where to look and can assure patients that what they are experiencing is not all in their heads."

Her team is now embarking on more in-depth investigations to learn more about this phenomenon.

Special Programs Advance Understanding of Diseases

National Jewish Health physicians bring their expertise to research and projects that impact the understanding of various diseases and the improvement of treatments and care modalities. Following are several areas where that impact has been felt.

Study Finds Corticosteroid Use OK in COVID-19 Pandemic

Patients with chronic pulmonary diseases, including asthma and COPD, who require treatment with either inhaled or systemic corticosteroids, should continue their use during the COVID-19 pandemic. That was the conclusion of National Jewish Health researchers who examined if the use of the corticosteroids affects the likelihood of developing COVID-19 infection. Their study was published in Respiratory Medicine in January 2021.

The team, led by Shu-Yi Liao, MD, ScD, a pulmonologist at National Jewish Health, used the institution's electronic medical record research database to identify a cohort. This consisted of 900 patients who were tested for suspected COVID-19 between March and June 2020, the majority of which had a history of chronic pulmonary diseases.

The team found that not only was there no significant association between inhaled corticosteroid use and testing positive for infection, but also that systemic corticosteroid use was associated with lower odds of testing positive.

Physicians Define Process to Diagnose Hypersensitivity Pneumonitis

The American College of Chest Physicians published new guidelines this year to better diagnose and evaluate hypersensitivity pneumonitis. Evans Fernández, MD, a pulmonologist at National Jewish Health, spearheaded the effort and was the lead author.

There is no single diagnostic test for the disease, and it is frequently over tested and misdiagnosed. Dr. Fernández and his colleagues sifted through hundreds of scientific papers and consulted with additional experts to develop 14 major recommendations and a step-by-step algorithm that guides physicians through a process that builds evidence for or against the disease.

Their main recommendation is that physicians should start with the least invasive tests and progress to more invasive tests only if more evidence is needed, ideally in the setting of consensus multidisciplinary discussion, patient preferences, prognosis and nature of the treatment.

Expert Promotes Updated Lung Cancer Screening Guidelines

Debra Dyer, MD, chair of the National Jewish Health Department of Radiology and chair of the American College of Radiology Lung Cancer Screening Steering Committee, has been working at the national level to publicize and disseminate the updated U.S. Preventive Services Task Force (USPSTF) lung cancer screening recommendations released this year.

The USPSTF now suggests annual screening for lung cancer with low-dose computed tomography in adults ages 50 to 80 years who have at least a 20 pack-year smoking history and currently smoke or have quit within the past 15 years. This recommendation is five years earlier than guidance set nearly a decade ago and the number of pack years was lowered from 30 to the equivalent of 20, either one pack a day for 20 years or two packs a day for 10 years.

These new recommendations will almost double the number of people eligible for lung cancer screening and will help address some of the racial and gender disparities identified with the previous criteria.

Institution Now a PCD Center

National Jewish Health is now an accredited Primary Ciliary Dyskinesia (PCD) Foundation Clinical Center site, led by Hilda Metjian, MD. There are fewer than 30 such sites in the country.

To achieve this status, sites must be able to provide access to high-quality diagnostic and treatment tools and have the expertise to give appropriate care to PCD patients such as screening machines or geneticists to counsel patients.

This collaboration provides more research opportunities for patients with PCD to help develop breakthroughs and new therapies. In addition, all of the centers connect regularly to discuss their cases and assist each other with research protocols.

Center for Outpatient Health Opens

In October 2021, National Jewish Health opened its state-of-the-art Center for Outpatient Health. The five-story, 230,000-square-foot building was designed to help serve increasing numbers of patients, while also enabling expanded space for research and education and other clinical services in other areas of the campus.

"Patient demand for our care has grown substantially over the past several years, requiring more space, particularly for advanced outpatient care," said Michael Salem, MD, president and CEO of National Jewish Health. "We knew we needed more room to maximize the time that our practitioners could spend with patients, 'listening to them,' evaluating their situations and offering the latest clinical research trials, all of which we believe is critical in finding answers."

The Center contains 110 examination and procedure rooms, with areas dedicated for children and adults. Caregivers treat patients for a wide variety of illnesses, including respiratory-related conditions, cardiac conditions, asthma and allergies, rheumatology, gastroenterology, neurology, cancer and others.

Immediate Care Program Introduced for Urgent Needs

The Immediate Care program grew out of a need identified during the pandemic to provide same-day, non-emergent care. Throughout the COVID-19 pandemic, National Jewish Health adapted, innovated and evolved to meet the ever-changing needs of patients and the community. While COVID patients were treated in specialty clinics set-up just for them and focused on COVID, others with immediate needs could now be addressed in an alternate unique setting. Launched in the spring of 2021, the walk-in clinic continues to help patients with suspected infections of many varieties, as well as other illnesses and minor injuries such as broken bones and intestinal issues.

Long known for being a specialty care center, National Jewish Health added board-certified emergency physicians to its list of specialists to work with the new program. Physicians address each patient with individualized treatment of the immediate complaint and a plan for follow-up care.

IMMEDIATE CARE National Jewish Health

CLINICAL EXPERTISE

National Jewish Health provides comprehensive evaluations, diagnoses and treatment plans for people from around the nation and the world. Our pulmonary specialists and their colleagues in cardiology, gastroenterology, oncology, immunology, rheumatology and radiology lead the way in providing our unique, comprehensive approach to care. Areas of our clinical expertise are highlighted here.

Advanced Diagnostic Laboratories

We provide unparalleled expertise in immune and respiratory disease to our clinical, biotech, pharmaceutical, public health and diagnostic partners. Our CLIA and CAP15189[SM]-certified laboratories have decades of experience developing immunology, complement, infectious disease and molecular genomic tests. In 2020, we launched novel tests for active COVID-19 infection and IgG and IgM antibodies to SARS-CoV-2.

Allergy and Immunology

Our nationally recognized experts use the latest testing and treatments to diagnose and manage allergies and other immune disorders, which can impact respiratory health. Plus, our patients have access to the latest allergy and immunology clinical trials.

Asthma

Thorough upper and lower airway evaluations in our multiday adult and pediatric asthma programs help us phenotype patients and understand complicating factors, from aspiration to allergies, vocal cord dysfunction and inhaler technique. Our faculty members lead numerous National Institutes of Health (NIH) studies and industry-sponsored clinical trials.

Behavioral Health

Teaching patients to understand and manage behavioral health issues that often accompany chronic respiratory diseases is an integral part of our whole-patient approach. Additional prevention and wellness programs offer help with tobacco cessation and vaping cessation for adults and young people.

Cardiology

Our cardiologists are experts in the heart-lung interface. They work closely with pulmonologists to diagnose and treat the cardiac causes and consequences of lung disease, including pulmonary hypertension, cardiac sarcoidosis and other rare diseases.

Interstitial Lung Disease

Joshua Solomon, MD
Director, Interstitial Lung Disease Program

The National Jewish Health Interstitial Lung Disease Program is one of the largest interstitial lung disease (ILD) centers in the country. Joshua Solomon, MD, was named Program Director in 2021.

Detailed evaluations allow physicians to identify the specific type of ILD out of the wide range of possibilities such as ILD related to autoimmunity, exposures in the environment and medications, as well as idiopathic disease. During a multidisciplinary conference, our lung specialists meet weekly with rheumatologists, radiologists and pathologists to examine complex cases from every angle. Our team also partners with patients and their primary caregivers to develop customized, comprehensive care plans based on the latest research and treatment options, many of which have been discovered at National Jewish Health. We also have several ongoing clinical trials of promising new treatments for ILD.

Chronic Beryllium Disease

National Jewish Health has more experience with the diagnosis and treatment of chronic beryllium disease than any other health care organization in the world. We developed the first diagnostic blood test for beryllium sensitization, which is now the gold standard diagnostic tool. We emphasize early detection and intervention.

Chronic Obstructive Pulmonary Disease (COPD)

We are advancing pulmonary medicine with COPDGene™ and other studies to diagnose and phenotype COPD, striving to individualize therapies for chronic bronchitis, bronchiolitis, emphysema and bronchiectasis. In addition, we are a leading center for the diagnosis and management of alpha-1 antitrypsin deficiency and offer clinical trials for those with this condition.

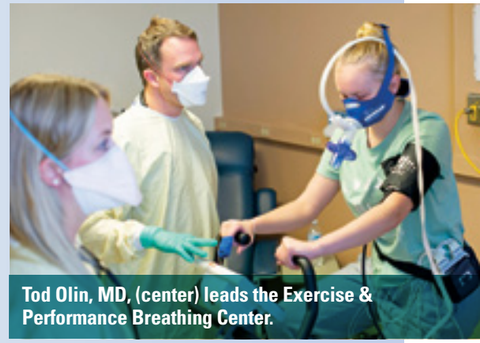
Cystic Fibrosis

We have the largest and most experienced adult cystic fibrosis program in the nation. Our team of pulmonary specialists, nurse coordinators, respiratory therapists, registered dietitians, psychologists and social workers provides treatment for more than 400 adults annually. We have more than two dozen ongoing clinical trials to evaluate new cystic fibrosis therapies.

Environmental Health

We define, diagnose and treat patients with a broad range of occupational, environmental and granulomatous lung diseases, including chronic beryllium disease, bronchiolitis obliterans and respiratory disease among warfighters returning from deployment in the Middle East.

Exercise and Breathing Performance



Tod Olin, MD, (center) leads the Exercise & Performance Breathing Center.

The Exercise & Performance Breathing Center at National Jewish Health evaluates exercise intolerance and treats exercise-related respiratory problems in a state-of-the-art exercise physiology lab. Innovative on-site therapists aid in treating specific problems and guide using exercise as a medicine.

Led by J. Tod Olin, MD, MSCS, the Center is one of the few in the world that can readily perform continuous laryngoscopy during exercise, a diagnostic procedure for exercise-induced laryngeal obstruction, which enables the visualization of the upper airway during intense exercise. The team is composed of pulmonologists, cardiologists, allergists, otolaryngologists, speech-language pathologists and behavioral health providers. Dr. Olin and his team are credited with the introduction of new therapies to treat this condition, including therapeutic laryngoscopy during exercise and the Olin Exercise-Induced Laryngeal Obstruction Biphasic Inspiration (EILOBI) breathing techniques.

In 2021, the team published a questionnaire to quantify the physical and psychological factors central to well-being in patients with exercise-induced laryngeal obstruction. The questionnaire could become a benchmark for how doctors care for their patients and measure the impact of interventions for clinical trials in the future.

Gastroenterology

We have special expertise in GI motility disorders, pulmonary-related GI conditions, GI cancer screening and treatment of GI malignancies. We diagnose and treat the entire range of GI illnesses, including liver disease, biliary disorders, inflammatory bowel disease, GERD and esophageal disorders, pancreatic disease and functional disorders of the gut.

Neurology

In 2021, Jinny Tavee, MD, joined National Jewish Health to lead the Division of Neurology & Behavioral Health. Dr. Tavee brings nearly 20 years of experience to this new role. She most recently served as the Medical Director of the Neuromuscular Division at Northwestern University Feinberg School of Medicine.

Jinny Tavee, MD
Chief, Division of Neurology & Behavioral Health

With a focused and integrated approach, the Division's aim is to diagnose and treat complex neuromuscular diseases and related metabolic and respiratory disorders, as well as neuropsychological disorders. The team sees patients with conditions such as amyotrophic lateral sclerosis, myasthenia gravis, neuropathy and sarcoidosis.

The Division also has been focused on the care of patients suffering from post-COVID conditions. The team tests for abnormalities that might otherwise be dismissed and works with specialists in cardiology, speech and cognitive therapy as needed to address symptoms.

Interventional Pulmonology

Our interventional pulmonologists offer a wide spectrum of minimally invasive diagnostic, therapeutic and palliative airway procedures for pulmonary nodules, lung cancer, airway obstruction and more. We also insert airway stents and perform bronchial thermoplasty for severe asthma. Our specialists work closely with thoracic surgeons to individualize therapeutic options for those with severe emphysema, including bronchoscopic lung volume reduction and intra-bronchial valve placement.

Mycobacterial Infections: TB and NTM

National Jewish Health began as a hospital for destitute tuberculosis (TB) patients more than 123 years ago, and we continue to provide consultations and manage nontuberculous mycobacterial (NTM) infections today. Our unprecedented experience with thousands of complex mycobacterial infections gives us a deep knowledge of personalized antibiotic regimens and surgical options.

Oncology

Our expert pulmonologists, thoracic radiologists, gastroenterologists and surgeons help us diagnose and treat cancers of the lungs, head and neck, and digestive system. Lung cancer screening and our tumor registry help us screen and monitor patients at high risk for lung cancer.

Pediatrics

National Jewish Health *for Kids* physicians are nationally recognized leaders in the diagnosis and treatment of asthma, vocal cord dysfunction and other pediatric pulmonary diseases. Our Severe Asthma Clinic and Pediatric Day Program offer multiday evaluations, education and management plans for children with pulmonary and atopic diseases.

Pulmonary Hypertension

Cardiologists, pulmonologists, rheumatologists, physical therapists and other specialists on our pulmonary hypertension team collaborate to provide comprehensive and sophisticated outpatient and inpatient services. Detailed diagnostic procedures, such as right-heart catheterization with cardiopulmonary exercise testing, allow precise phenotyping and treatment of complex patients.

Pulmonary Palliative Care

We improve the quality of life for individuals suffering from diverse respiratory conditions and help manage symptoms by integrating interventions with existing clinical care plans.

Pulmonary Pathology

Our vast pathology experience examining lung tissue and recognizing respiratory diseases contributes to our unparalleled diagnostic capabilities, which generate consultation requests from around the country.

Pulmonary Physiological Services

Our state-of-the-art pulmonary physiology laboratory offers many unique tests, including cardiopulmonary exercise tests with full metabolic testing, arterial line, lactate levels and cardiac data; and continuous laryngoscopy with exercise tolerance tests to evaluate exercise-induced respiratory distress.

Radiology

National Jewish Health is recognized around the world for thoracic imaging expertise. Our highly experienced team of radiologists and technicians performs imaging studies on more lungs than any other facility. Our experts provide interpretations of imaging test results and consultations to help doctors nationwide make accurate and timely diagnoses.

Rare Lung Disease

As a national pulmonary referral center, we have extensive experience diagnosing and managing a variety of rare lung diseases, including pulmonary alveolar proteinosis (PAP), lymphangioleiomyomatosis (LAM) and eosinophilic syndromes that most pulmonologists rarely see.

Rheumatology

Our rheumatologists work to diagnose, manage and research a variety of rheumatologic disorders, with special expertise in interstitial lung diseases caused by systemic autoimmune diseases. The Rheumatology Division is a designated Scleroderma Foundation Research and Treatment Center.

Sarcoidosis

Our experience with thousands of sarcoidosis patients has helped us better define and address the multi-organ nature of the disease. The Foundation for Sarcoidosis Research named our Sarcoidosis Program a Center of Excellence.

Scleroderma

The Scleroderma Program at National Jewish Health is designated a Scleroderma Foundation Research Treatment Center. Our multidisciplinary team of specialists in rheumatology, interstitial lung disease, pulmonary hypertension, cardiology, gastroenterology and nephrology ensures that our patients receive comprehensive care. Services include advanced diagnostic and treatment options, access to scleroderma clinical trials, nutritional counseling and specialized pulmonary and physical rehabilitation programs.

Sleep

Our comprehensive Sleep Center has a full complement of pulmonologists, sleep medicine specialists, psychologists, respiratory therapists and polysomnographic technologists.

Pulmonary Vascular Biology

National Jewish Health has added a Pulmonary Vascular Biology (PVB) program within its Division of Pulmonary, Critical Care and Sleep Medicine. The program includes a focus on the full spectrum of research in this area, from basic to clinical, providing key information for many of the diseases that National Jewish Health physician scientists treat or study. Tim Lahm, MD, is the program Director.

Primary areas of research interest include investigation of pulmonary vascular and right heart function in chronic lung disease, nutritional and exercise interventions in pulmonary hypertension, and gender differences in lung disease. Faculty and staff within this area have capacity to perform deep phenotyping by collecting lung, heart and skeletal muscle tissues and using new, cutting edge approaches, such as genomics and proteomics, to study pulmonary vascular and right heart function in great detail.

Tim Lahm, MD
Director, Pulmonary Vascular Biology Program

CLINICAL RESEARCH — SELECTED RESULTS

National Jewish Health has a robust clinical research program with more than 300 active clinical trials. We collaborate on clinical research with the National Institutes of Health, industry leaders and research institutions across the country through numerous research networks and consortiums. Highlights of our clinical research results from 2021 are provided below.

New Monoclonal Antibody Shows Promise for Severe Asthma

Michael Wechsler, MD, and colleagues found that itepekimab is a safe and effective treatment for patients suffering from moderate-to-severe asthma in a phase 2 trial. The novel monoclonal antibody is designed to target interleukin-33, and the team found it led to a lower incidence of events indicating a loss of asthma control than placebo and improved lung function.
N Engl J Med. 2021 Oct 28; 385(18):1656-1668

Michael Wechsler, MD
Director, National Jewish Health
Cohen Family Asthma Institute

Monoclonal Antibody Shows Promise for Adults and Adolescents with Uncontrolled Asthma

Michael Wechsler, MD, and colleagues reported a successful trial of the anti-TSLP monoclonal antibody tezepelumab as a promising new treatment for severe, uncontrolled asthma. Patients with severe, uncontrolled asthma who received tezepelumab had fewer exacerbations and better lung function, asthma control and health-related quality of life.
N Engl J Med. 2021 May 13;384(19): 1800-1809

Ozone Climate Penalty and Health Equity Along the Colorado Front Range

James L Crooks, PhD, and colleagues at the Union of Concerned Scientists showed that climate change has increased ground-level ozone in the Denver Metro area. This has delayed the region's ability to meet national ozone standards and imposes additional public health burdens on residents, especially those living in Latinx neighborhoods and neighborhoods with high rates of asthma and diabetes.
J Expo Sci Environ Epidemiol. 2021 Sep 10

Bruce Bender, PhD
Co-Director, Center for Health Promotion

Asthma Toolkit Bootcamp Improves Rural Pediatric Asthma Care

Bruce Bender, PhD, reported successful results from the Asthma Toolkit Bootcamp program, a hands-on program that trains rural physicians how to diagnose and manage pediatric asthma. The program improved physician adherence to current asthma guidelines, leading to fewer hospitalizations, emergency room visits and decreased use of oral corticosteroids among the patients in participating practices.
J Allergy Clin Immunol Pract. 2021 Aug;9(8):3091-3097.e1

Jessica Hui, MD, tests the impact of increased hand hygiene practices during the COVID-19 pandemic.

Hand Hygiene Impact on Health Care Workers with Atopic Dermatitis

Jessica Hui, MD; **Donald Y.M. Leung**, MD; and **Elena Goleva**, PhD; evaluated the impact of increased hand hygiene practices as a result of the COVID-19 pandemic on health care workers and patients with atopic dermatitis. They found that health care workers have chronic use of hand sanitizer and a higher incidence of irritant contact dermatitis, which may explain a significantly higher transepidermal water loss area under the curve after the use of hand sanitizer because they have an already compromised skin barrier.
Ann Allergy Asthma Immunol. 2021 Aug 13;S1081-1206(21)00565-2

Replacement with Non-Allergenic Joints Can Provide Relief

Karin Pacheco, MD; **Annyce Mayer**, MD; and their colleagues reported positive patient outcomes in their program to identify allergies in people with artificial joints that have failed. The majority of patients referred to the MetALLs Allergy program for evaluation of artificial joint failures not caused by infections or mechanical issues did have allergies to metals in the joints or the bone cement used to secure them. Patients who received new joints with non-allergenic metals and no bone cement reported reduced swelling, pain, itching and loose joints. Nickel was the most common allergenic metal in the joints.
J Allergy Clin Immunol Pract. 2021 Aug;9(8):3109-3117.e1

A Human Skin Commensal Microbe for Bacteriotherapy of Atopic Dermatitis

Donald Y.M. Leung, MD, and research colleagues at National Jewish Health and the University of California San Diego School of Medicine, identified a universal strain of bacteria derived from healthy human skin, Staphylococcus hominis A9 (ShA9), as a safe and effective topical therapy for atopic dermatitis that avoids the side effects of steroids and other medications that target the immune system.
Nat Med. 2021 Apr;27(4):700-709

CLINICAL RESEARCH — OPEN CLINICAL TRIALS

Below are brief descriptions of some of our active clinical trials.

Alpha-1 Antitrypsin Deficiency

Potential New Treatment for Alpha-1 Antitrypsin Deficiency

Principal Investigator: Robert Sandhaus, MD

Researchers want to see if a new drug, alvelestat, improves the symptoms of lung disease caused by COPD due to alpha-1 antitrypsin deficiency (AATD), as well as symptoms of AATD.

Asthma

PrecISE Severe Asthma Interventions

Principal Investigator: Michael Wechsler, MD

The purpose of this study is to understand how to treat different types of severe asthma using precision medicine, which targets treatments to defined subgroups of patients who share similar characteristics such as a specific genetic variation or high levels of eosinophils. Study participants will receive various treatments based on their type of severe asthma.

Cancer

Skin Reactions to Cancer Immunotherapy

Principal Investigators: Donald Leung, MD, PhD, and Jeffrey Kern, MD

This study focuses on side effects caused by cancer immunotherapy, specifically skin reactions. The purpose of this study is to understand what changes occur in the immune system and how these changes lead to skin reactions as a side effect. By understanding these changes, our goal is to define the best treatment for the skin reactions, or possibly prevent the reactions.

COVID-19

Response to COVID-19 Vaccines in People with Chronic Conditions

Principal Investigators: Barry Make, MD, and Michael Wechsler, MD

Researchers are working to understand the antibody response to COVID-19 vaccines in people with chronic diseases. Researchers are focused on the short-term and long-term antibody response by people with chronic respiratory diseases, as well as other chronic diseases.

Cystic Fibrosis

Impact of Triple Combination Therapy for People with CF with Sinusitis

Principal Investigator: Jennifer Taylor-Cousar, MD

This observational study will assess the impact of a new triple-combination CFTR modulator therapy (ivacaftor/tezacaftor/elexacaftor) on chronic sinusitis in adults with cystic fibrosis. In previous studies, this therapy has been shown to improve lung function and sweat chloride. Researchers are trying to determine if this triple combination therapy can also improve computed tomography sinus CT scan findings, sense of smell and quality of life for people with CF with chronic sinusitis.

Eczema

Atopic Dermatitis & Skin Infections

Principal Investigator: Donald Leung, MD, PhD

The purpose of this study is to learn more about skin cells and how they regulate the skin barrier. Studies indicate that those with atopic dermatitis and psoriasis may be more susceptible to bacterial infections. Our researchers will use samples from patients with atopic dermatitis, psoriasis and healthy people to examine the differences in their genes. Researchers also will be trying to determine if inflammation affects the function of skin cells.

Hypersensitivity Pneumonitis

Predicting Fibrosis in Hypersensitivity Pneumonitis

Principal Investigator: Evans Fernández, MD

Researchers believe they will be able to predict which patients with chronic hypersensitivity pneumonitis (HP) will develop fibrosis by looking at their genes and biomarkers in their blood. For this observational study, researchers will collect samples and data from participants with rapidly progressing HP and slowly progressing HP to look for patterns that can help predict the development of ILD and form specialized treatment plans.

Lymphangioleiomyomatosis

Investigational Medication Sirolimus for Lymphangioleiomyomatosis (LAM)

Principal Investigator: Gregory Downey, MD

The purpose of this study is to see if a drug called sirolimus slows development of lymphangioleiomyomatosis (LAM), a lung disease in which abnormal cells growing inside the lungs prevent them from working properly. Sirolimus is approved by the United States Food and Drug Administration (FDA) for the treatment of LAM. A recent trial showed that sirolimus stabilized lung function in patients with moderate and severe disease. Our researchers want to find out if giving low-dose sirolimus earlier in the course of treatment safely and effectively prevents further lung damage from LAM.

Pulmonary Hypertension

New Trial Medication for Pulmonary Arterial Hypertension

Principal Investigator: Marjorie Patricia George, MD

The ADVANCE OUTCOMES study is evaluating the effects of adding the investigational drug ralinepag to patients' current therapies for pulmonary arterial hypertension. Ralinepag is designed to help the body receive prostacyclin, which is known to widen blood vessels and relax artery walls, potentially improving blood flow in adults with pulmonary arterial hypertension.

Rheumatoid Arthritis

ILD & Early Rheumatoid Arthritis

Principal Investigator: Joshua Solomon, MD

There is evidence that rheumatoid arthritis (RA)starts in the lungs in a subset of patients. The purpose of this study is to learn how interstitial lung disease develops and progresses over time in people with early RA.

Insomnia & OSA

Treating Insomnia & OSA with Cognitive Behavioral Therapy

Principal Investigator: Jack D. Edinger, PhD

The purpose of this study is to determine if using a web-based program called Sleepio™ helps treat insomnia in patients with obstructive sleep apnea (OSA). The Sleepio™ program provides insomnia sufferers with cognitive behavioral therapy (CBT), a structured type of treatment that aims to identify and change inaccurate or negative thinking patterns, resulting in more constructive responses to challenging situations.

Lisa Maier, MD
Chief, Division of Environmental & Occupational Health Sciences

Sarcoidosis

Lymphocytes & Sarcoidosis Inflammation

Principal Investigator: Lisa Maier, MD

Researchers want to learn how lymphocytes control inflammation in sarcoidosis patients, and if lymphocytes are the reason why each patient experiences a different outcome of the disease. The goal is to better understand lymphocytes to be able to identify different states of the disease and to identify new treatment options.

Visit **www.njhealth.org/clinicaltrials** to learn more about clinical trials.

FRONTIERS OF PULMONARY SCIENCE

National Jewish Health researchers conduct basic, translational and clinical research that advances the frontiers of science and medicine. This year alone we published more than 500 peer-reviewed scientific journal articles. Here is some of the groundbreaking basic and translational research being conducted at National Jewish Health.

SELECTED 2021 RESEARCH REPORTS

Longitudinal Analysis of SARS-CoV-2 Spike Reveals Emergency and Geographic Distribution of Mutations

William Showers, MS; **Sonia Leach**, PhD; and **Michael Strong**, PhD; and colleagues analyzed 437,006 unique genomes and identified trends in mutations over time and geographic location, and examined the structural features of mutations. They validated previous findings of the predominance of spike: D614G and Nsp12: P323L in the population, while uncovering recent increases in the prevalence of new mutations in Nsp12 in the spike protein and that trends in the emergence of new variants vary by geographic area. *Infect Genet Evol.* 2021 Nov 18;97:105153

Lambda Variant of SARS-CoV-2 Has Better Chance than Delta Variant to Escape Vaccines

Haolin Liu, PhD; **Katja Aviszus**, PhD; **John Yang**, PhD; **Lyndon Reynoso**, MSHA, RPh; **Gregory P. Downey**, MD; **Stephen Frankel**, MD; **John Kappler**, PhD; **Philippa Marrack**, PhD; **Gongyi Zhang**, PhD; and their colleagues discovered that sera from the Pfizer-BioNTech vaccine retain high reactivity toward the receptor binding domain (RBD) of the Delta variant while it drops dramatically toward that of the Lambda variant. This raised major concerns that the Lambda variant could have been the next surging candidate spreading in the world. *bioRxiv.* 2021 Aug 26;2021.08.25.457692

Tolerance Induction in Memory CD4 T Cells Is Partial and Reversible

Laurent Gapin, PhD; **Jennifer Matsuda**, PhD; **John Kappler**, PhD, **Philippa Marrack**, PhD; and their colleagues examined the response of memory CD4 T cells to tolerogenic signals. Although memory CD4 T cells could respond to antigen delivered without adjuvant, they undergo cell death upon further restimulation. Their data suggests that the T cells die as a consequence of mitotic catastrophe that occurs when cells are unable to complete cell division. *Immunology.* 2021 Jan; 162(1): 68-83

Molecular Signatures of Idiopathic Pulmonary Fibrosis

Tasha Fingerlin, PhD, and colleagues used a system biology approach and have identified novel molecular relationships in idiopathic pulmonary fibrosis (IPF). They combined the coding and noncoding transcriptomes, DNA methylomes and proteomes from IPF and healthy lung tissue to identify molecules and pathways associated with this disease. Their analysis confirmed previously validated molecules and pathways known to be dysregulated in disease and implicated novel molecular features as potential drivers and modifiers of disease. *Am J Respir Cell Mol Biol.* 2021 Oct;65(4):430-441

Chest CT Diagnosis, Clinical Management of Drug-related Pneumonitis in Patients Receiving Molecular Targeting Agents and Immune Checkpoint Inhibitors

Kevin Brown, MD; and **David Lynch**, MD; and colleagues provide simplified diagnostic criteria, a CT pattern approach and management recommendation of drug-related pneumonitis (DRP) in the emerging era of molecular targeting agents and cancer immunotherapy by using a multidisciplinary approach. The diagnosis of DRP is usually achieved by excluding other potential known causes. Awareness of the incidence and risk factors for DRP is becoming increasingly important. Imaging features of DRP should be assessed in consideration of the distribution of lung parenchymal abnormalities (radiologic pattern approach). The CT patterns reflect acute (diffuse alveolar damage) interstitial pneumonia and transient (simple pulmonary eosinophilia) lung abnormality, subacute interstitial disease (organizing pneumonia and hypersensitivity pneumonitis) and chronic interstitial disease (nonspecific interstitial pneumonia). *Radiology.* 2021 Mar;298(3):550-566

NOTEWORTHY ONGOING RESEARCH

Novel Risk Factors for Severe COVID-19 Infections

Through a grant from the American Lung Association, **Irina Petrache**, MD, is investigating if e-cigarette vaping and the influenza virus are novel risk factors for COVID-19 infections, either predisposing individuals to COVID-19 infections or leading to more serious cases. This effort could help discourage vaping and reinforce the need for flu vaccinations in the effort to decrease the morbidity of COVID-19.

Incidence and Transmission of COVID-19 Among Children

Max Seibold, PhD, and his team are providing experimental and computational analysis expertise for the Human Epidemiology and Response to SARS-CoV-2 Study (HEROS) to determine the role of children in the pandemic. His lab is analyzing COVID-19 tests taken sequentially over several months from 2,000 children and their family members to learn how many children become infected and if they spread the disease to others.

Clinical Trial Evaluates Saracatinib in Idiopathic Pulmonary Fibrosis

Gregory Downey, MD, and his team are conducting clinical trials of an experimental medication, called saracatinib, to treat idiopathic pulmonary fibrosis. The drug inhibits the activity of an enzyme that drives fibrosis. The team's previous work in preclinical cell culture and animal models showed that saracatinib is more effective than currently approved medications at slowing fibrosis.

Associated Factors for COVID

Vamsi P. Guntur, MD, MSc, and her colleagues continue to identify clinical factors (demographic, vital signs, laboratory and pulmonary function tests) consistent with COVID-19 in patients with chronic respiratory disease, initially evaluated at the National Jewish Health Acute Respiratory Clinic early in the pandemic. The results of the work help the team and others distinguish COVID-19 from other respiratory conditions with similar clinical presentation. Factors associated with test positivity and seroconversion post-infection continue to be studied as COVID-19 evolves.

The Maternal and Fetal Outcomes for Women with Cystic Fibrosis

Jennifer Taylor-Cousar, MD, is co-leading a study that will follow 300 women with cystic fibrosis (CF) through their pregnancies and two years afterward. This will help researchers understand how the mothers' lung function or overall health, and that of their babies, is impacted both by CF itself and by use of new CF medications during pregnancy. Because new treatments have increased life expectancies of CF patients, the number of women with CF who became pregnant doubled from 2019 to 2020, necessitating new data. This work is being funded by the Cystic Fibrosis Foundation.

Jennifer Taylor-Cousar, MD, talks with a patient.

EDUCATION — ACADEMIC TRAINING

Our physicians and scientists are thought leaders in their fields who elevate the standard of patient care while teaching the next generation of health care professionals through fellowships, training and continuing medical education. National Jewish Health is an accredited teaching affiliate of the University of Colorado School of Medicine, where our physicians and scientists have faculty appointments.

Clinical Fellowships

Based at National Jewish Health:
- Adult Sleep Medicine
- Pediatric Allergy and Immunology
- Adult Allergy and Immunology
- Mycobacterial Disease

Based at University of Colorado School of Medicine with rotations at National Jewish Health:
- Adult Pulmonary and Critical Care Medicine
- Interventional Pulmonology
- Infectious Disease
- Pediatric Pulmonary Medicine
- Rheumatology
- Cardiothoracic Radiology

In collaboration with the Colorado School of Public Health, National Jewish Health also offers fellowships in:
- Occupational and Environmental Medicine
- Pediatric Sleep Medicine

Postdoctoral Fellowships

Numerous opportunities exist for postdoctoral training in laboratories in the Department of Biomedical Research, the Division of Cell Biology and the Basic Science Section of the Department of Medicine.

National Jewish Health has a robust discovery and translation research enterprise, placing it in the top 6% of institutions funded by the National Institutes of Health.

Graduate Education

Students enrolled in one of the PhD programs offered by the Graduate School of the University of Colorado School of Medicine have the opportunity to perform their thesis research in the laboratories of the faculty at National Jewish Health.

Residents and Medical Students

Residents and medical students at the University of Colorado School of Medicine have rotations at National Jewish Health in a variety of specialties, including pulmonary medicine, cardiology, allergy and gastroenterology. In addition, our faculty train residents in internal medicine and family medicine at locations across our system.

National and International Visiting Fellows

National Jewish Health hosts visiting fellows from pulmonary and critical dare training programs throughout the country and around the world for rotations in various subspecialty areas of pulmonary medicine and exercise physiology.

Department of Medicine Grand Rounds

Throughout the pandemic, the Department of Medicine (DOM) Grand Rounds at National Jewish Health continued to offer weekly presentations covering the latest in research, clinical care and other pertinent topics. Under the administrative leadership of Amen Sergew, MD, sessions were moved to an online format for safety. Each seminar is presented by either an expert from the institution or from around the world and has featured speakers from the National Institutes of Health (NIH) and scientists from Germany and New Zealand.

DOM Grand Rounds is open to researchers, clinicians, advanced practice providers, nurses, alumnae, all other health care workers, non-clinical staff members at National Jewish Health and its affiliates, and interested community members. Continuing medical education credits are offered to health care professionals.

To learn more or request enrollment in DOM Grand Rounds, please email **johnsona@njhealth.org**.

EDUCATION — CONTINUING MEDICAL EDUCATION

Building on expertise of the world-renowned faculty at National Jewish Health, our Office of Professional Education creates innovative educational activities for physicians, pharmacists, nurses and other health care providers to develop and enhance their knowledge and competency related to the diseases National Jewish Health treats and researches. National Jewish Health is accredited by the Accreditation Council for Continuing Medical Education, Accreditation Council for Pharmacy Education and the California Board of Registered Nursing.

Through robust educational offerings, with the ultimate goal of improved patient outcomes, we work to deliver on our mission to educate as a preeminent health care institution.

With the ongoing pandemic, online education remains the primary format for delivering medical education. Along with virtual meetings and online educational activities, we looked to new formats for education and launched a series of National Jewish Health Twitter-based continuing medical education activities. Four respiratory-focused journal clubs in COPD, interstitial lung disease, pulmonary hypertension and non-tuberculous mycobacteria were developed using Zoom-based webinars and live Twitter chats to summarize, share and educate on important respiratory journal articles.

Annual Respiratory Disease Young Investigators' Forum

Committed to increasing the number of physician-scientists and helping young scientists grow to become leaders in the research and treatment of respiratory diseases, the National Jewish Health Office of Professional Education each year hosts the Respiratory Disease Young Investigators' Forum. Thirty young investigators selected by an expert panel present their abstracts in basic science or clinical research related to respiratory disease. Junior faculty and physicians enrolled in a pediatric, pulmonary, allergy or immunology fellowship program and conducting research in disease are eligible to participate.

Online Courses Include:

- Evidence and the Evolving Treatment Landscape for COVID-19 with Virus Neutralizing Antibodies
- Enhancing Access to COVID-19 Breakthrough Therapy with Virus Neutralizing Antibodies: Strategies for Equitable Care Clinical Decision Points in the Diagnosis and Treatment of Non-Eosinophilic Asthma
- Where Are the New Targets in Severe Asthma? Looking Upstream in the Inflammatory Cascade
- Primary Care Decision Points in COPD: Why Preventing Exacerbations Remains a Challenge Case in COPD
- A Multidisciplinary Approach to the Management of New and Emerging Therapies for Moderate-to-Severe Atopic Dermatitis
- Hyper Eosinophilic Syndrome Roadmap: A Guided Workflow for Improved Diagnosis and Treatment in HES
- New Treatments in Chronic Rhinosinusitis with Nasal Polyps: Expert Insights into the Evidence
- Are You Prepared for the Difficult Virtual Visit? How to Be Successful with Challenging Adult Telemedicine Encounters

To view all of our online courses and learn more about the National Jewish Health Office of Professional Education, visit **njhealth.org/CME** call **800.844.2305** or email **proed@njhealth.org**.

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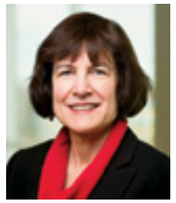
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RESPIRATORY INSTITUTES ELEVATE CARE AND RESEARCH

Through our unique Respiratory Institute® model, National Jewish Health collaborates with hospitals around the country. The Respiratory Institutes combine the strengths of the collaborating institutions while bringing our multidisciplinary, team-based model of care to patients as well as providing a common platform for expanded research. National Jewish Health also collaborates with, and is an academic partner with, the University of Colorado School of Medicine and UCHealth, in Denver.

MOUNT SINAI - NATIONAL JEWISH HEALTH
Respiratory Institute
Icahn School of Medicine at Mount Sinai
National Jewish Health

Mount Sinai — National Jewish Health Respiratory Institute

The Mount Sinai – National Jewish Health Respiratory Institute provides state-of-the-art, multidisciplinary, outcomes-driven care in a network dedicated to elevating respiratory care and research. The Institute achieves this goal with clinical expertise, personalized medicine, patient-focused protocols and integration of the latest research advances in respiratory care.

Physicians at National Jewish Health and Mount Sinai have jointly developed protocols for the treatment of patients with respiratory disease and have established regular conferences to discuss complex cases. The two institutions are also collaborating on protocols for care of post-COVID-19 patients and have developed protocols for joint research.

Jane and Leonard Korman
Respiratory Institute
Jefferson Health
National Jewish Health

Jane and Leonard Korman Respiratory Institute — Jefferson Health and National Jewish Health

Together, Jefferson Health and National Jewish Health bring extraordinary expertise to address complex illnesses. The collaboration leverages the strengths of each organization, defining best practices for treatment and research of pulmonary and related diseases, including COVID-19, COPD, asthma, interstitial lung diseases and sarcoidosis.

National Jewish Health
SCL Health
SAINT JOSEPH

Collaboration with Saint Joseph Hospital

Our collaboration with Denver-based Saint Joseph Hospital, a part of the SCL Health System, has grown from its inception in 2014 to expanding to now include an inpatient Respiratory Institute that includes a dedicated 36-bed unit and expanded research opportunities between the institutions.

School of Medicine
UNIVERSITY OF COLORADO
ANSCHUTZ MEDICAL CAMPUS

Collaborations with University of Colorado School of Medicine and UCHealth

National Jewish Health has had a long-standing key relationship with the University of Colorado that encompasses opportunities for joint research, collaborative care and programs and training for medical students. The organizations offer regular interaction through Grand Rounds and other medical and research programs.

SELECTED 2021 PUBLICATIONS

In 2021, National Jewish Health faculty published more than 500 articles in peer-reviewed scientific and medical journals. Included below is a selection of noteworthy articles.

COVID-19/SARS-COV-2

Longitudinal analysis of SARS-CoV-2 spike and RNA-dependent RNA polymerase protein sequences reveals the emergence and geographic distribution of diverse mutations.
Showers WM, Leach SM, Kechris K, **Strong M.** *Infect Genet Evol.* 2021 Nov 18;97:105153.

CT of Post-Acute Lung Complications of COVID-19.
Solomon JJ, Heyman B, Ko JP, Condos R, **Lynch DA**. *Radiology.* 2021 Nov;301(2):E383-E395.

Decreased Fatty Oxidation and Altered Lactate Production During Exercise in Post-Acute COVID-19 Patients.
de Boer E, **Petrache I, Goldstein NM, Olin JT, Keith RC, Modena B, Mohning MP, Yunt ZX**, San-Millán I, **Swigris JJ**. *Am J Respir Crit Care Med.* 2021 Oct 19.

QIBA guidance: Computed tomography imaging for COVID-19 quantitative imaging applications.
Avila RS, Fain SB, Hatt C, Armato SG 3rd, Mulshine JL, Gierada D, Silva M, **Lynch DA**, Hoffman EA, Ranallo FN, Mayo JR, Yankelevitz D, Estepar RSJ, Subramaniam R, Henschke CI, Guimaraes A, Sullivan DC. *Clin Imaging.* 2021 Sep;77:151-157.

Respiratory epithelial cell responses to SARS-CoV-2 in COVID-19.
Bridges JP, Vladar EK, **Huang H, Mason RJ**. *Thorax.* 2021 Aug 17:thoraxjnl-2021-217561.

The Usefulness of Chest CT Imaging in Patients With Suspected or Diagnosed COVID-19: A Review of Literature.
Machnicki S, Patel D, Singh A, Talwar A, Mina B, Oks M, Makkar P, Naidich D, Mehta A, Hill NS, **Brown KK**, Raoof S. *Chest.* 2021 Aug;160(2):652-670.

Influenza virus infection increases ACE2 expression and shedding in human small airway epithelial cells.
Schweitzer KS, Crue T, Nall JM, Foster D, Sajuthi S, Correll KA, Nakamura M, Everman JL, Downey GP, Seibold MA, Bridges JP, Serban KA, Chu HW, Petrache I. *Eur Respir J.* 2021 Jul 1;58(1):2003988.

Cytokine signatures of end organ injury in COVID-19.
Gómez-Escobar LG, Hoffman KL, Choi JJ, Borczuk A, Salvatore S, Alvarez-Mulett SL, **Galvan MD**, Zhao Z, Racine-Brzostek SE, Yang HS, Stout-Delgado HW, Choi ME, Choi AMK, Cho SJ, Schenck EJ. *Sci Rep.* 2021 Jun 15;11(1):12606.

The basis of a more contagious 501Y.V1 variant of SARS-CoV-2.
Liu H, Zhang Q, **Wei P**, Chen Z, **Aviszus K, Yang J, Downing W**, Jiang C, Liang B, **Reynoso L, Downey GP, Frankel SK, Kappler J, Marrack P, Zhang G**. *Cell Res.* 2021 Jun;31(6):720-722.

Genetic and non-genetic factors affecting the expression of COVID-19-relevant genes in the large airway epithelium.
Kasela S, Ortega VE, Martorella M, Garudadri S, Nguyen J, Ampleford E, Pasanen A, Nerella S, Buschur KL, Barjaktarevic IZ, Barr RG, Bleecker ER, **Bowler RP**, Comellas AP, Cooper CB, Couper DJ, Criner GJ, Curtis JL, Han MK, Hansel NN, Hoffman EA, Kaner RJ, Krishnan JA, Martinez FJ, McDonald MN, Meyers DA, Paine R 3rd, Peters SP, Castro M, Denlinger LC, Erzurum SC, Fahy JV, Israel E, Jarjour NN, Levy BD, Li X, Moore WC, Wenzel SE, Zein J; NHLBI SubPopulations and InteRmediate Outcome Measures In COPD Study (SPIROMICS); NHLBI Trans-Omics for Precision Medicine (TOPMed) Consortium, Langelier C, Woodruff PG, Lappalainen T, Christenson SA. *Genome Med.* 2021 Apr 21;13(1):66.

COVID-19 as an occupational disease.
Carlsten C, Gulati M, Hines S, **Rose C**, Scott K, Tarlo SM, Torén K, Sood A, de la Hoz RE. *Am J Ind Med.* 2021 Apr;64(4):227-237.

501Y.V2 and 501Y.V3 variants of SARS-CoV-2 lose binding to bamlanivimab in vitro.
Liu H, Wei P, Zhang Q, Chen Z, **Aviszus K, Downing W, Peterson S, Reynoso L, Downey GP, Frankel SK, Kappler J, Marrack P, Zhang G**. *MAbs.* 2021 Jan-Dec;13(1):1919285.

Association of inhaled and systemic corticosteroid use with Coronavirus Disease 2019 (COVID-19) test positivity in patients with chronic pulmonary diseases.
Liao SY, Petrache I, Fingerlin TE, Maier LA. *Respir Med.* 2021 Jan;176:106275.

Coronavirus disease 2019: investigational therapies in the prevention and treatment of hyperinflammation.
Amigues I, Pearlman AH, Patel A, Reid P, Robinson PC, Sinha R, Kim AH, Youngstein T, Jayatilleke A, Konig M. *Expert Rev Clin Immunol.* 2020 Dec;16(12):1185-1204.

EXPERT GUIDELINES

Behavioral and psychological treatments for chronic insomnia disorder in adults: an American Academy of Sleep Medicine clinical practice guideline.
Edinger JD, Arnedt JT, Bertisch SM, Carney CE, Harrington JJ, Lichstein KL, Sateia MJ, Troxel WM, Zhou ES, Kazmi U, Heald JL, Martin JL. *J Clin Sleep Med.* 2021 Feb 1;17(2):255-262.

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