



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Contents lists available at ScienceDirect

The Journal for Nurse Practitioners

journal homepage: www.npjjournal.org



COVID-19 Telemedicine and Vaccination at an Urban Safety Net HIV Medicine Clinic

Ryan Anson, Aaron Willcott, Will Toperoff, Afsana Karim, Michael Tang, Darcy Wooten, J. Tyler Lonergan, Laura Bamford

A B S T R A C T

Keywords:

coronavirus disease 2019
coronavirus disease 2019 vaccination
human immunodeficiency virus primary care
monoclonal antibody
pulse oximetry
telemedicine
virtual health care

In response to the emerging coronavirus disease 2019 (COVID-19) pandemic in March 2020, the Owen Clinic at UC San Diego Health scaled up telemedicine to ensure the continuity of human immunodeficiency virus primary care. A group of nurse practitioners, physicians, and a physician assistant developed a dedicated COVID-19 telemedicine clinic to provide virtual health care services to patients with or at risk for severe acute respiratory syndrome coronavirus 2 infection. This effort contributed to successful health outcomes for the clinic's 476 patients diagnosed with COVID-19. The Owen Clinic was also the first ambulatory clinic within UC San Diego Health to implement on-site COVID-19 vaccines. Nurse practitioners and a physician assistant spearheaded these 2 clinical initiatives.

© 2022 The Author(s). Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

In response to the emerging coronavirus disease 2019 (COVID-19) pandemic in March 2020, the Owen Clinic at UC San Diego Health (UCSDH) scaled up telemedicine to ensure the continuity of human immunodeficiency virus (HIV) primary care. A group of nurse practitioners (NPs), physicians, and a physician assistant (PA) from Owen developed a COVID-19 telemedicine clinic to provide dedicated virtual health care services to patients with or at risk for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. Rapid diagnostic testing, telephone evaluation, home pulse oximetry, monoclonal antibody treatment, and intensive follow-up for patients through electronic health record–based video assessments contributed to overall successful health outcomes for the clinic's 476 patients diagnosed with COVID-19. The Owen Clinic was also the first ambulatory clinic within UCSDH to implement on-site COVID-19 vaccines. Two NPs and a PA played a central role in the development and implementation of these 2 clinical initiatives.

About the Owen Clinic

The Owen Clinic is the largest and most comprehensive HIV medicine clinic in San Diego, serving over 3,100 patients. In addition to HIV primary care, it provides social work services, HIV prevention resources, substance use disorder treatment, hepatitis C treatment, and gender health care. Owen's clinicians include 14 physicians, most of whom are board-certified infectious disease specialists; 1 PA and 5 NPs; 2 psychiatrists; 3 clinical pharmacists; and 2 licensed clinical social workers. A full-time substance use

disorder counselor, recovery specialist, 3 registered nurses, and 6 licensed vocational nurses also work at the clinic. Clinicians collaborate closely to deliver full-spectrum HIV specialty care, internal medicine, multimodal interventions for substance use disorders, hepatitis C treatment, and pre-exposure prophylaxis for patients at high risk for HIV acquisition. NPs are integral members of the primary care team and function as HIV specialists. One is an expert in lumbar puncture procedures, whereas the other helps lead a high-resolution anoscopy program for anal dysplasia surveillance. The Owen Clinic is a unique, interdisciplinary setting that supports a diverse safety net population.

COVID-19 and the Adoption of Telemedicine

When SARS-CoV-2 first spread across the globe, its impact on people with HIV (PWH) was not fully known. Experts initially observed that COVID-19 did not lead to higher rates of hospitalization, need for mechanical ventilation, or death in PWH compared with people without HIV.^{1,2} Subsequent research led to equivocal conclusions, with some studies suggesting worse outcomes for PWH depending on their immune status or comorbid medical conditions.^{3–7} However, it is clear that the unparalleled disruption of comprehensive services beginning in March 2020 presented unique challenges to a population already struggling with homelessness, mental illness, food insecurity, and substance use.⁸ In an anonymous survey of 781 PWH in San Diego, 37% of respondents reported chronic mental illness, 41% reported active substance use,

and 25% reported being unstably housed or homeless, highlighting the challenges faced by this population.⁹

Before the start of the pandemic, the Owen Clinic had not been routinely using telemedicine. Health systems nationwide, including Owen, soon recognized how telemedicine functioned as an effective intervention that addressed complex psychosocial concerns as well as primary care needs in vulnerable communities.¹⁰ Telemedicine, the use of information and communications technology to deliver digital health care services, was quickly embraced by clinics, hospitals, and insurance payers as COVID-19 spread around the world and severely limited face-to-face encounters in medical settings.^{11–13}

As cases in San Diego increased in the summer of 2020, NPs and other providers at the Owen Clinic used this nascent technology to deliver both COVID-19 care and HIV primary care. Billable virtual encounters allowed clinicians to evaluate and treat their patients remotely. NPs and physicians called patients or logged into MyChart video sessions through Epic (the electronic health record used at UCSDH) on a daily basis to assess individuals with worsening cough, fatigue, and shortness of breath or who were otherwise suspected of having COVID-19 complications. NPs also partnered with Owen triage nurses to implement polymerase chain reaction (PCR) testing for patients who reported symptoms consistent with COVID-19. Virtual visits, combined with the test-based approach to care from nursing triage, likely reduced the risk of viral transmission within the health care setting and the broader community because it prevented patients from needing to enter the clinic for provider evaluation.¹⁴

The Owen Clinic's digital health care modality evolved as a dynamic clinical management tool during subsequent COVID-19 case surges in late 2020 and through 2021. The small team of NPs and other clinicians expanded the effort to deliver COVID-19 telehealth to hundreds more patients as new diagnoses quickly grew over the 2020 winter holiday season. Outreach involved daily phone check-ins by licensed vocational nurses and MyChart video visits with providers. The most acute patients received weekend telephone check-ins by on-call physicians and at least 2 or 3 detailed, virtual appointments within the first 1 to 7 days of symptom onset. With the introduction of home-based pulse oximetry by August 2020 using Coronavirus Aid, Relief, and Economic Security Act (CARES) funds, Owen Clinic providers obtained objective data to evaluate a patient's respiratory status. Access to these data greatly enhanced clinical decision making during telemedicine visits, particularly when deciding whether to triage a patient to an emergency level of care.¹⁵

For patients diagnosed with COVID-19 in the outpatient setting, intravenous monoclonal antibody (mAb) therapy had become the standard of care by November 2020 at UCSDH. Owen's HIV specialists initially referred patients to the health system's infectious disease clinic, which ordered mAbs for patients not requiring hospitalization or supplemental oxygen. However, during the summer 2021 Delta-related wave, infectious disease physicians trained 2 Owen NPs on protocols to order and coordinate mAb infusions for Owen Clinic patients. Both NPs became the only providers at Owen who routinely ordered this highly effective treatment. Before the circulation of the now dominant Omicron variant, the dual-agent mAbs, such as casirivimab/imdevimab, had been found in clinical trials to greatly reduce the risk of COVID-related hospitalization and death.¹⁶ Because of its retained activity against the first Omicron subvariant, sotrovimab was the only mAb being used at UCSDH for patients with SARS-CoV-2 infection through early winter of 2022.

COVID-19 prevalence as well as COVID-19-related morbidity and mortality at the Owen Clinic have remained low over the last 22 months. Between March 1, 2020, and February 1, 2022, 476 of 3,177

patients (15%) had a positive COVID-19 PCR test. More than 2,478 (78%) unique patients were screened during that same time frame. From March 2020 through February 2021, the period before widespread transmission of the Delta and Omicron variants, 25 patients were admitted (9% of all positive cases through February 2021), and 3 (1% of all positive cases) died. Although rates of hospitalization and death were not higher among PWH, this patient population was more than 3 times as likely to test positive for COVID-19 than individuals without diagnosed HIV at UCSDH and may be at an ongoing, higher risk for SARS-CoV-2 infection.¹⁷ Although Owen's sample of patients with COVID-19 was small and no comparison group inside or outside UCSDH was studied, dedicated telemedicine, along with home pulse oximetry monitoring and direct access to mAb therapies, may have prevented higher morbidity and mortality among the clinic's patients.

In addition to COVID-19 care, virtual medical services enhanced appointment access for this marginalized population and cut down on missed appointments, a trend noted across the literature on telemedicine in HIV clinics.¹⁸ Before the emergence of virtual health care at Owen, the no-show rate averaged 20% in any month, and it was 30% immediately before the pandemic's onset. Before March 15, 2020, no phone or video appointments had ever been scheduled. From March 16, 2020, when telemedicine was launched, through May 20, 2020, more than 85% of visits were conducted through a video or phone platform. By early July when more patients began returning to the clinic and well after virtual services were fully established, just 11% of patients no showed to any appointment, whether it was in person or by phone or video. The appointment attendance pattern suggests telemedicine increased access to all forms of care during the first 5 months of the COVID-19 pandemic. The Owen Clinic team is making sustained efforts to close technological barriers for patients who struggle with device or electronic health record navigation.

Moreover, neither the move to telemedicine nor the pandemic itself substantially impacted the proportion of PWH who maintained HIV viral suppression. In March 2020, 93% of patients were virally suppressed. Five months into the pandemic, viral suppression remained at 93%. By February 1, 2022, 94% of PWH at Owen still had viral loads below the level of detection. Other institutions experienced mixed results in terms of longitudinal viral suppression data during this health emergency. An urban safety net clinic in San Francisco, which serves a patient population similar to that of the Owen Clinic, witnessed a 31% overall reduction in HIV viral suppression in their patients, whereas a community health center in Boston saw no change in HIV viral suppression rates after its transition to telemedicine.^{19,20}

COVID-19 Vaccination at the Owen Clinic

In-clinic delivery of COVID-19 vaccinations was a second, important pandemic-related initiative. UCSDH first began administering COVID-19 vaccines in December 2020 to the San Diego community in a rapid, efficient, and organized fashion through the rollout of vaccination superstations such as the Petco Park site. This approach allowed for the fast dissemination of vaccines to thousands of high-risk individuals. In the ensuing months, resources for outpatient clinics to connect patients with vaccinations grew. Nurses were able to easily schedule patients at superstation locations, and a vaccination tent was erected directly across the street from the Owen Clinic on UCSDH's Hillcrest campus.

Despite these efforts, preliminary vaccination rates at Owen Clinic remained low. By the end of June 2021, 45% of the clinic's patients had not received their COVID-19 vaccine, and many others had not completed the primary vaccine series after receiving the first dose. Many of these patients were also considered moderately

or severely immunocompromised because of low CD4 counts or untreated HIV, putting them at increased risk for worse COVID-19 outcomes.

An Owen PA and its medical director recognized having access to COVID-19 vaccines on-site was critical for this patient population. The clinic operates as a medical home for its vulnerable patients. Owen has worked hard over the years to decrease psychosocial and physical barriers to care. Many PWH have experienced, and continue to face, HIV-related stigma within the health care setting, and some are hesitant to access care outside of the Owen Clinic. Providers felt that they would be able to leverage the trust and relationships that they had built with patients over the years to provide a safe and supportive environment in which they could answer patients' questions and provide the vaccine.

On June 25, 2021, the clinic's sole PA proposed a pilot program for clinic-based COVID-19 vaccine administration. With support from clinic leadership, other physician directors at UCS DH, the hospital pharmacy, and the Owen nursing team, staff began administering Pfizer vaccines on July 8, 2021. Its workflow has been expanded to offer any available COVID-19 vaccine for patients. Over 88% of patients have now completed a 2-dose messenger RNA-based COVID-19 vaccination series or the 1-dose Janssen vaccine as of February 1, 2022. The most at-risk patients with severely compromised immune systems had a 15% increase in vaccine uptake as a result of this initiative. In comparison, just 56% of patients at UCS DH's internal medicine department were vaccinated during the same time period. The internal medicine clinic did not offer on-site COVID-19 vaccinations to its patients.

The rapid transmission of the highly infectious Delta and Omicron variants in San Diego County added greater urgency to vaccine rollout efforts and intensified COVID-19 telemedicine. Two hundred sixty-six (56%) of the clinic's 476 total COVID-19 cases occurred after the emergence of these 2 more transmissible variants. Two hundred forty-four (92%) of the mostly mild Delta and Omicron cases have been among vaccinated individuals. Only 6 (2%) patients were hospitalized between June 2021 and the end of January 2022, and just 1 person died. When compared with the 9% hospitalization rate seen from March 2020 to February 2021, the vaccination program has been beneficial and appears consistent with previous reports demonstrating strong immune responses to COVID-19 vaccines in PWH.^{21–24} Data on Delta- and Omicron-associated incidence, total numbers of tests completed, and positive tests within the larger UCS DH patient population were not available at the time of this article's submission. As new variants appear on the horizon, continued development of vaccination programs to educate and provide vaccination access for fragile patients is needed. A PA and nurse-led vaccine booster effort at the Owen Clinic is currently underway.

Conclusion

These 2 NP and PA-led initiatives demonstrated how innovations in telemedicine, emerging mAb therapies, and clinic-based administration of COVID-19 vaccinations within the medical home were effective in treating, monitoring, and preventing complications related to SARS-CoV-2 infection in a high-risk and psychosocially complex patient population. However, it is not possible to conclude if these interventions are applicable to other health settings given this article's lack of data on clinical and telemedicine-related outcomes among UCS DH patients without HIV. Routine telemedicine for both HIV primary care and COVID-19 care and vaccination services will continue at Owen as long as there is a demand among patients. These efforts were successful because of the trust and relationships between patients and providers and maintained the goal of keeping this population safe during a

challenging public health crisis. NP and PA advocacy, leadership, and patient-centered care are strengths of UCS DH that should be increasingly used in all aspects of primary care at the Owen Clinic and across the health system.

References

- del Amo J, Polo R, Moreno S, et al. Incidence and severity of COVID-19 in HIV-positive persons receiving antiretroviral therapy: a cohort study. *Ann Intern Med.* 2020;173:536–541.
- Gervasoni C, Meraviglia P, Riva A, et al. Clinical features and outcomes of patients with human immunodeficiency virus with COVID-19. *Clin Infect Dis.* 2020;71:2276–2278.
- Hadi Y, Naqvi S, Kupec JT, Sarwari AR. Characteristics and outcomes of COVID-19 in patients with HIV: a multicentre research network study. *AIDS.* 2020;34(13):F3–F8.
- Western Cape Department of Health in collaboration with the National Institute for Communicable Diseases, South Africa. Risk factors for coronavirus disease 2019 (COVID-19) death in a population cohort study from the Western Cape Province, South Africa. *Clin Infect Dis.* 2021;73:e2005–e2015.
- Braunstein SL, Lazar R, Wahnich A, Daskalakis DC, Blackstock OJ. Coronavirus disease 2019 (COVID-19) infection among people with human immunodeficiency virus in New York City: a population-level analysis of linked surveillance data. *Clin Infect Dis.* 2021;72:e1021–e1029.
- Tesoriero JM, Swain C-AE, Pierce JL, et al. COVID-19 outcomes among persons living with or without diagnosed HIV infection in New York State. *JAMA Netw Open.* 2021;4:e2037069.
- World Health Organization. Clinical features and prognostic factors of Covid-19 in people living with HIV hospitalized with suspected or confirmed SARS-CoV-2 infection. WHO global clinical platform for Covid-19. July 15, 2021. <https://apps.who.int/iris/bitstream/handle/10665/342697/WHO-2019-nCoV-Clinical-HIV-2021.1-eng.pdf>
- Pinto R, Park S. Covid-19 pandemic disrupts HIV continuum of care and prevention: implications for research and practice concerning community-based organizations and frontline providers. *AIDS Behav.* 2020;24(9):2486–2489.
- 2017 Survey of People with HIV in San Diego County. 2017 HIV/AIDS needs assessment subcommittee, planning council support staff at the San Diego County, HIV, STD, and Hepatitis Branch.
- Mgbako O, Miller EH, Santoro AF, et al. Covid-19, telemedicine, and patient empowerment in HIV care and research. *AIDS Behav.* 2020;24(7):1990–1993.
- Budak JZ, Scott JD, Dhanireddy S, Wood BR. The impact of Covid-19 on HIV care provided via telemedicine—past, present, and future. *Curr HIV/AIDS Rep.* 2021;18(2):98–104.
- Smith E, Badowski M. Telemedicine for HIV care: current status and future prospects. *HIV AIDS (Auckl).* 2021;13:651–656.
- Bokolo A. Exploring the adoption of telemedicine and virtual software for care of outpatients during and after Covid-19 pandemic. *Ir J Med Sci.* 2021;190(1): 1–10. <https://doi.org/10.1007/s11845-020-02299-z>
- Bokolo A Jr. Use of telemedicine and virtual care for remote treatment in response to Covid-19 pandemic. *J Med Syst.* 2020;44(7):132. <https://doi.org/10.1007/s10916-020-01596-5>
- Luks A, Swenson E. pulse oximetry for monitoring patients with Covid-19 at home: potential pitfalls and practical guidance. *Ann Am Thorac Soc.* 2020;17(9):1040–1046.
- Weinreich D, Sivapalasingam S, Norton T, et al. REGEN-COV antibody combination and outcomes in outpatients with Covid-19. *N Engl J Med.* 2021;385(23):e81.
- Tang ME, Gaufin T, Anson R, Zhu W, Mathews WC, Cachay ER. People with HIV have a higher risk of COVID-19 diagnosis but similar outcomes to the general population. *HIV Med.* 2022 Apr 8. <https://doi.org/10.1111/hiv.13312>
- Wood BR, Lan K, Tao Y, et al. Visit trends and factors associated with telemedicine uptake among persons with HIV during the Covid-19 pandemic. *Open Forum Infect Dis.* 2021;8(11):ofab480.
- Mayer KH, Levine K, Grasso C, Gonzalez A, Biello K. 541. Rapid migration to telemedicine in a Boston community health center is associated with maintenance of effective engagement in HIV care. *Open Forum Infect Dis.* 2020;7(suppl 1):S337–S338.
- Spinelli MA, Hickey MD, Glidden DV, et al. Viral suppression rates in a safety-net HIV clinic in San Francisco destabilized during Covid-19. *AIDS.* 2020;34(15):2328–2331.
- Pormohammad A, Zarei M, Ghorbani S, et al. Efficacy and safety of COVID-19 vaccines: a systemic review and meta-analysis of randomized clinical trials. *Vaccines (Basel).* 2021;9(5):467.
- Dagan N, Barda N, Kepten E, et al. BNT162b2 mRNA Covid-19 vaccine in a nationwide mass vaccination setting. *N Engl J Med.* 2021;384:1412–1423.
- Ruddy JA, Boyarsky BJ, Bailey JR, et al. Safety and antibody response to two-dose SARS-CoV-2 messenger RNA vaccination in persons with HIV. *AIDS.* 2021;35:2399–2401.
- Woldemeskel BA, Karaba AH, Garliss CC, et al. The BNT162b2 mRNA vaccine elicits robust humoral and cellular immune responses in people living with human immunodeficiency virus (HIV). *Clin Infect Dis.* 2022;74(7):1268–1270.

All authors are affiliated with the Owen Clinic at UC San Diego Health (UCSDH) in San Diego, CA. Ryan Anson, NP-C, directs Owen's COVID-19 telemedicine program. Aaron Willcott, PA-C, is the population health lead for the Owen Clinic. Will Toperoff, FNP-BC, provides primary and specialized care for individuals living with HIV/AIDS. Afsana Karim is a program analyst at UCSDH. Darcy Wooten, MD, is an associate professor of medicine in infectious disease at UCSDH and infectious disease fellowship program director. She is also the Director of Education at UCSDH's HIV clinic. Michael Tang, MD, are physicians at the Owen Clinic. J. Tyler Longergan, MD, are physicians at the Owen Clinic. Laura Bamford, MD, is an

associate professor of medicine in the Division of Infectious Diseases and Global Public Health at UCSDH. She is the medical director of the Owen Clinic and the codirector of the Clinical Investigation Core for the San Diego Center for AIDS research.

Funding: Data for part of this work was supported by the National Institutes of Health (NIH T32 AI007384-29; 2021) and allocated to coauthor Michael E. Tang. In compliance with standard ethical guidelines, the authors report no relationships with business or industry that would pose a conflict of interest.