EXTENDED REALITY TELEHEALTH
FOR RURAL SPACES

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CONTENTS

ABSTRACT

Rural Americans encounter substantial healthcare disparities when compared to urban counterparts, including provider shortages, less access to specialists, and higher mortality risks from various chronic and acute conditions. While 13.8% of the U.S. population lives in rural areas, rural regions comprise two-thirds of healthcare provider shortage areas. Accordingly, broadband-enabled telehealth that mitigates barriers to healthcare access can be a transformative solution for patients and physicians in rural areas.

Emerging telehealth platforms extend beyond traditional video consultations, incorporating extended reality (XR) technologies comprising virtual reality (VR) and alternative reality (AR) solutions. Additionally, artificial intelligence (AI) promises unique diagnostic and epidemiological benefits for care management. These technologies collectively offer advancements for mental health treatment, physician training, and personalized care management.

Rural broadband infrastructure is critical to enabling these technological healthcare innovations, representing a key pathway to improving medical access and patient outcomes for rural users.

I. INTRODUCTION AND OVERVIEW

While 13.8% of the U.S. population lives in rural areas,[1] approximately 66% of health care provider shortage areas are in rural counties.[2] This disparity in healthcare access is pronounced by findings that rural residents are, on average, older and less likely to be insured than urban counterparts and moreover endure higher mortality risks from heart disease, cancer, unintentional injury, stroke, and respiratory disease than their urban peers.[3] By way of example, while rural residents have higher rates of diabetes, nearly two-thirds of rural counties lack self-management programs[4] in which participation can be critical to prevent collateral conditions including blindness or limb loss.[5] Compounding these challenges is a lack of access to specialists, comparatively long travel time to providers and facilities, and fewer options for public transportation.[6] Approximately 4% of rural hospitals closed between 2013 and 2020. In those communities, residents now travel approximately 20 miles farther for common inpatient services and approximately 40 miles farther for specialty services, including substance use disorder

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[1] Davis, J.C., Cromartie, J., Farrigan, T., Genetin, B., Sanders, A., & Winikoff, J.B, *Rural America at a Glance: 2023 Edition* (Report No. EIB-261). U.S. Department of Agriculture, Economic Research Service (2024) (https://doi.org/10.32747/2023.8134362.ers) (visited Sep. 27, 2024).

[2] "Designated Health Professional Shortage Areas Statistics: Fourth Quarter of Fiscal Year 2024, Designated HPSA Summary," Bureau of Health Workforce, Health and Human Services Administration, U.S. Department of Health & Human Services, at 3 (2024). The report also addresses shortage distributions for mental health, primary care, and dentistry. (https://data.hrsa.gov/default/generatehpsaquarterlyreport) (visited Nov. 19, 2024).

[3] "Rural Public Health," U.S. Centers for Disease Control (May 2024) (https://www.cdc.gov/rural-health/media/pdfs/2024/05/CDC-Rural-Public-Health_At-a-Glance_May-2024.pdf) (visited Sep. 27, 2024).

[4] "Diabetes Self-Management: Rural Policy Brief," U.S. Centers for Disease Control (2024) (internal citation omitted) (https://www.cdc.gov/rural-health/php/policy-briefs/diabetes-policy-brief.html#:~:text=Diabetes%20is%20about%2017%25%20more,not%20have%20a%20DSMES%20program) (visited Sep. 27. 2024).

[5] *See,* "Vision Loss and Diabetes," U.S. Centers for Disease Control (https://www.cdc.gov/diabetes/diabetes-complications/diabetes-and-vision-loss.html#:~:text=Diabetic%20retinopathy%20(DR)%20is%20the,DR%20usually%20affects%20both%20eyes) (visited Sep. 27, 2024), *and* "Preventing Diabetes-Related Amputations," U.S. Centers for Disease Control (https://www.cdc.gov/diabetes/diabetes-complications/preventing-diabetes-related-amputations.html) (visited Sep. 27, 2024).

[6] *See,* Onyi Lam, Brian Broderick, and Skye Toor, "How Far Americans Live From the Closest Hospital Differs by Community Type," Pew Research Center (Dec. 12, 2018) (https://www.pewresearch.org/short-reads/2018/12/12/how-far-americans-live-from-the-closest-hospital-differs-by-community-type/#:~:text=Taking%20local%20traffic%20patterns%20into,for%20those%20in%20urban%20areas.) (visited Sep. 27, 2024), *and* "Building Better Public Transport in Rural America," VIA Transportation (Oct. 30, 2020) (https://ridewithvia.com/resources/building-better-public-transit-in-rural-america#:~:text=Where%20rural%20transit%20networks%20exist,if%20not%20weeks%2C%20in%20advance) (visited Sep. 27, 2024).

(SUD) treatments.[7] Additionally, in 2018, more than half of rural counties did not have hospital-based obstetric services; by 2030, availability is projected to be half of demand.[8]

Rural poverty can also affect access to healthcare by discouraging both the purchase of health insurance and physician visits as well as reluctance to miss work for appointments.[9] Rural poverty rates in 2020 were measured at 14.1% compared to metro poverty rates of 11%.[10] Difficulty obtaining childcare can also impede healthcare access for parents and guardians; distance from providers can create needs for overnight travel, further increasing both travel and lodging expenses and potential childcare burdens.

II.   DEMAND FOR TELEHEALTH CAPABILITIES PERSISTS IN THE WAKE OF THE COVID-19 PANDEMIC

The COVID-19 pandemic triggered substantial interest and growth in telehealth engagement. Prior surveys of providers and patients revealed hesitation, if not lukewarm reception, to telehealth.[11] In contrast, telehealth visits increased dramatically in 2020. Among Medicare patients, one-third of all mental health visits were conducted via telehealth, compared to 8% for general care and 3% for specialty care.[12] Within the general population, in-person healthcare visits decreased 30% in the early months of the COVID-19 pandemic, while telehealth visits increased up to 2013%.[13] A late 2020 survey of more than 900 mental health practitioners found that telehealth use had increased from less than 20% of visits in December 2019 to nearly 78%

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[7] Alyssa Hundrup, "Why Health Care is Harder to Access in Rural America," Government Accountability Office (May 16, 2023).

[8] *Id.*

[9] Taber, J.M., Leyva, B, and Persoskie, A., "Why Do People Avoid Medical Care? A Qualitative Study Using National Data," National Library of Medicine, National Institutes of Health (Mar. 2015) (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4351276/) (visited Sep. 27, 2024).

[10] Shrider, E.A., Kollar, M., Chen, F., Semega, J., "Income and Poverty in the United States: 2020," U.S. Census Bureau Report No. P60-273 (Sep. 2021) (https://www.census.gov/library/publications/2021/demo/p60-273.html) (visited Sep. 27, 2024). This report divides spaces between those that are inside and outside of Metropolitan Statistical Areas (MSAs), which are typically urban centers, but which may include outlying rural areas if there are sufficient labor and other connections between the spaces. An MSA has a population of at least 50,000. Counties that are not part of an MSA are classified as rural.

[11] *See,* Comstock, J., "Nielsen: Access to Digital Health Lags Behind Patient Interest," Mobi Health News (Nov. 4, 2015) (https://www.mobihealthnews.com/48233/nielsen-access-to-digital-health-lags-behind-patient-interest (visited Sep. 27, 2024).

[12] Samson, L.W., Wafa., T., Turrini, G., Sheingold, S., "Medicare Beneficiaries' Use of Telehealth in 2020: Trends by Beneficiary Characteristics and Location," U.S. Department of Health and Human Services, at 1 (Dec. 2021) (Medicare Beneficiaries' Use of Telehealth in 2020: Trends by Beneficiary Characteristics and Location (hhs.gov) (visited Sep. 27, 2024).

[13] Ong, T., Wilczewski, H., Paige, S., Welch, B., Bunnel, B., "Extended Reality for Enhanced Telehealth During and Beyond COVID-19: Viewpoint," 9 Journal of Medical Internet Research 1, at 2 (2021) *citing* Patel, S.Y., Mehrotra, A., Huskamp, H.A., Uscher-Pines, L., Ganguli, I., and Barnett, M.L. "Trends in Outpatient Care Delivery and Telemedicine During the COVID-19 Pandemic in the U.S.," Journal of American Medicine (Nov. 16, 2020) (https://games.jmir.org/2021/3/e26520/PDF) (visited Nov. 15, 2024) (Ong, *et al.* (2021)).

by the spring of 2020. Importantly, the survey also revealed that "[t]he majority [of respondents] endorsed a desire to continue implementing tele-mental health services in the future. . . ."[14] A University of Michigan report concluded telehealth "improved access and timeliness of patient care."[15]

Users have also embraced sensor-based devices that can collect and transmit health-related data. The National Institutes of Health (NIH) reports 30% of U.S. adults are using wearable health devices.[16] 73% of digital health users (blood pressure monitors, glucose meters, sleep monitoring devices) indicate that they feel more "in control" of their health; 67% say these devices help them establish health goals.[17] At the same time, patients engaging telehealth to replace in-person appointments avoided travel costs and reductions in worker productivity.[18] These are notable benefits when held against Department of Veterans Affairs (VA) reports that 50%-70% of rehab patients do not receive services due to travel barriers, missing work, caregiver duties, or lack of access in rural areas.[19] Telehealth can also be a tool for participation in tobacco cessation programs,[20] which is particularly important for rural areas where the smoking rate is 18.1% as compared to 10.5% in urban areas.[21]

Physicians are benefitting, as well: Studies find that telehealth enables mental health care providers to increase their caseloads, expand their hours of service, operate across different time

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[14] Reilly, S.E., Zane, K.L., McCuddy, W.T., Soulliard, Z.A., Scarisbrick, D.M., Miller, L.E., and Mahoney III, J.J., "Mental Health Practitioners' Immediate Practical Response During the COVID-19 Pandemic: Observational Questionnaire Study," 7 Journal of Medical Internet Research: Mental Health 10 (Oct. 2020) (https://mental.jmir.org/2020/10/e21237/) (visited Nov. 15, 2024).

[15] "Much Can Be Learned from Physicians' Experiences with Telehealth Expansion in Michigan," Center for Health and Research Transformation, University of Michigan, at 5 (Feb. 2022) (CHRT U/MI).

[16] Roos, L.G. and Slavich, G.M., "Wearable Technologies for Health Research: Opportunities, Limitations, and Practical and Conceptual Considerations," National Library of Medicine, National Institutes of Health (2024) (https://pmc.ncbi.nlm.nih.gov/articles/PMC11233111/) (visited Nov. 15, 2024).

[17] Rick Kowalski, "Health Tech in America: Bridging Access Gaps," Consumer Technology Association (Mar. 29, 2023) (https://www.ces.tech/articles/2023/april/health-tech-in-america-bridging-access-gaps/) (visited Nov. 15, 2024) (Kowalski).

[18] Butzner, M., Cuffee, Y., "Telehealth Interventions and Outcomes Across Rural Communities in the United States: Narrative Review," 23 Journal of Medical Internet Research 8, at 2 (2021) (https://www.jmir.org/2021/8/e29575/PDF) (visited Nov. 19, 2024).

[19] "VA Immersive: Virtual Reality Use in Health Care – Literature Review," U.S. Department of Veterans Affairs, at 7 (Sep. 25, 2023) citing Naro, A., Calabro, R.S., "What Do We Know About the Use of Virtual Reality in the Rehabilitation Field? A Brief Overview," Electronics 2021, Vol. 10, at 1042 (2021) (VA Immersive).

[20] See, "Telehealth as a Vehicle to Support Tobacco Cessation," American Lung Association (Feb. 7, 2023) (https://www.lung.org/getmedia/0df40b1c-cca4-4f8d-b17f-1c0ef19052a1/telehealth-tobacco-cessation.pdf) (visited Nov. 19, 2024).

[21] "Top 10 Communities Disproportionately Affected by Cigarette Smoking and Tobacco Use," American Lunch Association (2024) (https://www.lung.org/research/sotc/by-the-numbers/top-10-populations-affected#:~:text=Adults%20who%20live%20in%20rural,that%20live%20in%20urban%20areas.&text=They%20are%20also%20more%20likely,and%20live%20in%20urban%20areas) (visited Nov. 19, 2024).

zones, and redirect savings from travel costs and office expenses toward retaining additional medical staffing.[22] While telehealth usage has declined from COVID-19-era peaks, overall demand for telehealth is significantly higher than it was pre-COVID-19 and is expected to increase.[23]

Other positive impacts of telehealth include "health economics," which contemplate the impact of the distribution of healthcare resources on societal welfare.[24] In addition to improved patient outcomes, telehealth benefits can be measured in avoided medical costs and avoided productivity costs (a 2010 study found telehealth produced a $52 billion savings in U.S. productivity costs).[25] Potential productivity costs extend beyond those linked directly to the patient and can include, for example, costs incurred when a parent or caregiver must accompany a young patient to an appointment.

Notwithstanding its benefits, telehealth is best viewed as a tool to supplement, but not supplant, in-person patient care. Poor audio and video quality can affect patient and physician rapport; limited sightlines can deprive providers of valuable perspectives gained from observing gait, posture, and total body language; and off-screen distractions can compromise care. Some therapists have cited detrimental impact on patients for whom in-person treatment would compel better grooming and self-care.[26] Overall, however, telehealth is perceived as enabling net gains in improved patient outcomes as well as lowering healthcare costs.

III.   EMERGING TECHNOLOGY FOR RURAL TELEHEALTH

A.   VIRTUAL AND AUGMENTED REALITY

1.   Physical and Occupational Therapy

Telehealth comprises several modalities, including commonly used audio and video interactions. However, telehealth relies on other platforms, as well, including wearables and ambient sensors. Developers are also applying extended reality to healthcare. These include virtual reality (VR) (fully simulated environments); (AR) augmented reality (simulated objects or environments superimposed on user's view of the natural (the "actual real") environment); and immersive

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[22] Ong, T., Ivanova, J., Soni, H., Wilczewski, H., Barrera, J., Cummins, M., Welch, B.M., Bunnell, B.E., "Therapist Perspectives on Telehealth-Based Virtual Reality Exposure Therapy," at 4 (https://doi.org/10.1007/s10055-024-00956-7) (2023) (Ong, *et al.* (2024)).

[23] *See,* Shaver, J., "The State of Telehealth Before and After the COVID-19 Pandemic," Primary Care Clinical Office Practice (2020) (https://pmc.ncbi.nlm.nih.gov/articles/PMC9035352/pdf/main.pdf) (visited Nov. 19, 2024); *see, also,* Jenny Cordina, Jennifer Fowkers, Rupal Malani, Lauda Medford-Davis, "Patients Love Telehealth – Physicians are Not Sure," McKinsey & Co. (Feb. 2022) (internal citation omitted) (Cordina, *et al.*).

[24] Snoswell, C. L., Smith, A. C., Page, M., Schuffham, P., Caffery, L. J., "Quantifying the Societal Benefits from Telehealth: Productivity and Reduced Travel," International Society for Pharmacoeconomics and Outcomes Research, Inc., at 1 (2022) (Snoswell, *et. al.*).

[25] Snoswell, *et. al.,* at 1 (internal citation omitted).

[26] Ong *et. al.* (2024) at 6.

mixed reality (IMR) (interactions with both virtual and natural environments) (collectively, extended reality, or XR).

AR and VR applications enable providers to engage with the patient in an environment that can replicate the patient's and/or other distant environments, including workplace settings. IMR, in contrast, combines virtual with actual environments. This approach can be particularly beneficial for rural patients by enabling distant providers to work with patients in their natural environments, or by enabling the provider to create a virtual environment that, while drawing from the patient's natural environment, is more conducive to patient outcomes than relying solely on the patient's natural environment. An overall goal is allowing a patient to obtain treatment while being "surrounded by their least restrictive environment."[27] Accordingly, when clinically indicated, XR interactions that enable more nuanced and interactive diagnostic and consultative experiences can enable better patient/physician interactions than standard video-based telehealth. XR can also enable a better therapeutic alliance, which is defined as the "relationship between the provider and patient, fostered through mutual agreement of clinical goals and the strategies to achieve those goals."[28] As of September 2024, the U.S. Food and Drug Administration authorized nearly 70 AR and VR medical devices.[29]

VR can create a simulated setting that "evoke[s] presence – the perception, feeling, and interaction with simulations as if they were real . . ."[30] One article explains,

> During the VR experience, the patients are asked to grab a virtual ball and throw it back into the virtual space. For these patients, the immersive experience could act as a personal rehabilitation physiotherapist who engages their upper limb movement multiple times a day, allow for possible neuroplasticity and a gradual return of normal motor function to these regions.[31]

Uses like these can be particularly beneficial in rural areas where health care shortages persist. A review by the VA cited a report that evaluated 27 studies and 128 publications and found improved physical performance among patients who were engaging VR-based therapy.[32] XR can be a tool for cardiac rehabilitation, especially for patients who lack either geographically

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[27] Wahlert, B., Utech, E., "Immersive Virtual Reality (VR) and Telehealth to Promote Engagement in Occupations for Rural Populations: Manual for Occupational Therapists," Department of Occupational Therapy, University of North Dakota, at 13 (2021) (Wahlert and Utech).

[28] Ong, *et al.* (2021) at 4.

[29] "Augmented Reality and Virtual Reality in Medical Devices," U.S. Food and Drug Administration (Sep. 6, 2024) (https://www.fda.gov/medical-devices/digital-health-center-excellence/augmented-reality-and-virtual-reality-medical-devices) (visited Dec. 9, 2024).

[30] Ong, *et. al.* (2021) at 1.

[31] Bohr, A., Memarzadeh, K., "The Rise of Artificial Intelligence in Healthcare Applications," at Sec. 2.3.3.2, p.38 (2020) (internal citation omitted) (Bohr and Memarzadeh).

[32] VA Immersive at 7 *citing* Howard, M.C., "A Meta-Analysis and Systematic Literature Review of Virtual Reality Rehabilitation Programs," Computers in Human Behavior, Vol. 70 (May 2017).

proximate access or transportation.[33] Post-stroke patients can use XR platforms to engage virtual activities of daily life (ADL) exercises including cooking and other household tasks.[34] Studies have incorporated games that include lifting and reaching for physical and occupational therapies, focusing on "gait training, balance, table-top activities, strengthening exercises of the upper limb, and ADL training."[35]

Gamification (the application of gaming tools to non-gaming endeavors) can encourage and increase patient compliance. This can be especially useful for rehab programs that incorporate repetitive exercises over the long-term. Gamification includes elements that are familiar to health care – goals and progress reports – and layers on top of them competition and rewards. The global health care gamification market is valued at about $3.3 billion and is expected to grow at a more than 10% compound annual growth rate over the next decade.[36] Virtual games for physical therapy have included platforms "where patients used their toes to flick a coconut."[37] Pulmonary rehab patients have indicated that VR programs are "more exciting and enjoyable than traditional rehabilitation methods. . ."[38] For rural spaces, gamified health care can be an important tool in encouraging compliance when in-person interactions and peer support may be more limited than those available in urban environments.

As XR platforms evolve, developers are enhancing the virtual settings. By way of example, depth perception and timing in virtual environments are not always matched perfectly to natural environments.[39] Replicating physical reactions solely in a virtual setting may require additional training and adjustments for useful transition to natural settings. Nevertheless, strength training, general motion, and other strategies that can be transferred to actual environments can be developed in virtual settings. Overall, XR platforms for virtual telehealth promise a new and effective approach for treatment.

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[33] "Telehealth in Rural Communities," U.S. Centers for Disease Control (www.cdc.gov/chronicdisease/resources/publications/factsheets/telehealth-in-rural-communities.htm) (visited Oct. 2, 2023).

[34] Wahlert and Utech at 18 (internal citation omitted).

[35] Wahlert and Utech at 19.

[36] "Healthcare Gamification Market Size, Share, Competitive Landscape, and Trend Analysis Report by Game Type, by Application, by End User: Global Opportunity Analysis and Industry Forecast 2021-2031," Allied Market Research (Sep. 2022) (https://www.alliedmarketresearch.com/healthcare-gamification-market-A10988) (visited Nov. 19, 2024).

[37] Wahlert and Utech at 27.

[38] Jung, T., Moorhouse, N., Shi, X., and Amin, M.F., "A Virtual Reality-Supported Intervention for Pulmonary Rehabilitation of Patients with Chronic Obstructive Pulmonary Disease: Mixed Methods Study," Journal of Medical Internet Research (2020) (https://pmc.ncbi.nlm.nih.gov/articles/PMC7381058/#:~:text=From%20the%20patients'%20perspective%2C%20VR,practice%20%5B22%2C42%5D) (visited Nov. 19, 2024).

[39] VA Immersive at 8.

2.   Mental Health Therapy

Extended reality can also be engaged to support mental health therapy (MHT) and treatment for substance use disorders (SUD). Candidate treatments include pain management, anxiety, depression, phobias, eating disorders, and grief/loss.[40] In a telehealth program for patients with chronic eating disorders, 54% of participants reported increased compliance and improvements in body mass index (BMI), quality of life, and mental and physical health.[41] Telehealth is not a replacement for in-person therapy but can be a valuable tool to supplement treatment where provider shortages, privacy, or cultural norms may present barriers to traditional modalities. Telehealth can also increase the frequency of physician/patient interactions, a notable benefit for patients who do not have ready access to nearby providers.

For rural spaces, virtual MHT can deliver important benefits. By way of example, the American Farm Bureau (AFB) reports that farming is correlated with increased levels of anxiety and depression, as well as suicide rates that are higher than the national average. The AFB Farm State of Mind initiative, which offers resources for farmers, cites "natural disasters, extreme weather events, financial uncertainty, fluctuating markets, labor shortages, trade disruptions and other factors" as potentially affecting farmers and ranchers who often live far from medical services.[42] Rural residents, generally, are also less likely to seek professional MHT due to social stigmas.[43] Responding to those dynamics, AFB joined other agricultural interests to launch Togetherall, an online support community for which users can register anonymously. The platform is moderated by licensed clinicians and enables users to seek peer-to-peer support among fellow farmers, students, or other similarly situated members. Users who require support beyond that which is available in the platform can escalate to individual consultations as necessary.[44]

VR is especially suitable for exposure therapy because it allows therapists to recreate safely the anxiety-causing experience. Veterans with treatment-resistant PTSD demonstrated significant improvements over standard therapeutic practices when participating in VR treatments.[45] VR has

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[40] Emily Laurence, "Virtual Reality Therapy: Everything You Need to Know," Forbes (May 2, 2023) (www.forbes.com/health/mind/virtual-reality-therapy) (visited Nov. 19, 2024).

[41] Butzner and Cuffee at 2 (internal citation omitted).

[42] "Farm State of Mind," American Farm Bureau (https://www.fb.org/initiative/farm-state-of-mind) (visited Nov. 18, 2024).

[43] Morales, D.A., Barksdale, C.L., Beckel-Mitchener, A.C., "A Call to Action to Address Rural Mental Health Disparities," Journal of Clinical and Transactional Science (May 2020) (https://pmc.ncbi.nlm.nih.gov/articles/PMC7681156/#:~:text=Research%20suggests%20that%20individuals%20living,14%2C22%E2%80%9324%5D) (visited Nov. 18, 2024).

[44] A. Buckman, J. Cabrera, personal communication (Dec. 9, 2024). *See, also,* "Farm Family Mental Health and Wellbeing Services Revolutionized," American Farm Bureau Federation (Jan. 21, 2024) (https://www.fb.org/news-release/farm-family-mental-health-and-wellbeing-services-revolutionized). (visited Dec. 9, 2024).

[45] Ong *et. al.* (2024) at 2.

been implemented to support pain management for terminally ill patients[46] and can be customized to create individualized settings and treatment plans. Although some providers have cautioned that teletherapy does not enable them to fully assess patient body language, coloring, and gait, VR enables provider interaction with patients beyond clinical settings, which can be especially important for exposure therapy. VR can be used to help providers assess cue reactivity, which refers to the patient's reaction to environmental stimuli.[47] Cue exposure therapy, similar to exposure therapy in the context of anxiety or phobias, aims to suppress harmful conditioned responses to stimuli.

Some patients and physicians report lower levels of expression or insight during phone or video meetings.[48] However, XR can offer innovative treatment strategies and enable patients to engage mental health therapy more effectively; the platform can also help patients maintain continuity of care. A trial of 30 patients using 3-D XR reduced pain more than when using 2-D interventions; in addition to improved pain management, patients decreased post-surgical opioid use.[49] This can have substantial benefits for rural counties where mortality rates linked to opioid overdose are 31% higher than urban counties.[50] The American Medical Association reports that up to 19% of prescription pain medication users develop addictions and that approximately 45% of heroin addictions follow an addiction to prescription drugs.[51]

Even as its benefits are documented, XR modalities are noted as inducing adverse side effects that include disorientation and nausea among patients.[52] Nevertheless, as these are managed through increased technological development and patient use, XR offerings can be expected to mitigate provider shortages in rural areas. This is especially important for rural spaces that at the outset have less access to MHT professionals than urban areas, and which are moreover exacerbated by overall findings of (and expectations of continued) increased "burnout and

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[46] Guenther, M., Gorlich, D., Bernhardt, F., et al., "Virtual Reality Reduces Pain in Palliative Care – A Feasibility Trial," BMC Palliative Care (2022) (https://doi.org/10.1186/s12904-022-01058-4) (visited Nov. 19, 2024).

[47] *See,* Segawa, T., Baudry, T., Bourla, A., Blanc, J. N., Peretti, C. S., Mouchabac, S., Ferreri, F., "Virtual Reality (VR) in Assessing Treatment of Addictive Disorders: A Systematic Review," 13 Frontiers in Neuroscience 1409 (2020) (https://doi.org/10.3389/fnins.2019.01409) (visited Nov. 19, 2024).

[48] Ong *et. al.* (2024) at 5, 6.

[49] Greg Goth, "The Promise of Virtual Reality in Surgery," QMed, Medical Device and Diagnostic Industry (Nov. 3, 2022) (www.mddionline.com/digital-health/promise-virtual-reality-surgery) (visited Nov. 19, 2024).

[50] Spencer, M.R., Garnet, M.F., and Minino, A.M., "Urban-Rural Differences in Drug Overdose Death Rates, 2020," NCHS Data Brief No. 440, Nation Center for Health Statistics, U.S. Centers for Disease Control (Jul. 2022) (https://www.cdc.gov/nchs/products/databriefs/db440.htm#:~:text=The%20rate%20of%20deaths%20involving%20psychostimulants%20with%20abuse%20potential%20was,in%20urban%20counties%20(4.0)) (visited Sep. 27, 2024).

[51] *See,* "Opioid Use Disorder," American Psychiatric Association, *citing* "Prescription Opioid Epidemic: Know the Facts," American Medical Association Alliance (https://www.psychiatry.org/patients-families/opioid-use-disorder) (visited Sep. 27, 2024).

[52] Wahlert and Utech at 26.

turnover" among mental health therapists.[53] Accordingly, technologies that enable more efficient distribution of health care resources can be expected to ease physician workloads while enabling effective access by patient users.

3. Elder Care

The use case for telehealth to support elder care is especially important for rural spaces where, on average, 17.5% of the population is 65 years or older (as compared to 13.8% in urban areas).[54] 85% of the 1,104 U.S. counties that are designated "older-age counties" (those in which more than 20% of the population is 65 years or older) are rural.[55] Declines in mobility, cognitive functions, memory, and physical ability are common conditions associated with aging and which affect independent living.

Where feasible, aging in place can be a preferred route, particularly when familiarity of surroundings and existing social networks can be preserved. The National Council on Aging estimates $4,500 mos./$54,000 annually for assisted living;[56] in-home care for ADL assistance, including housekeeping and cooking, implicates comparable costs, with national averages for home care and home health aides averaging approximately $57,000 per year.[57] Where medical or social needs can be met, aging in place is generally viewed as a preferable alternative to in-patient care because it maintains greater levels of independence and environmental familiarity. As is the case with telehealth for treatment of chronic and acute conditions or to deliver MHT, telehealth is best viewed as a tool in an overall care strategy. Cloud-supported technology can enable remote caregivers to not only obtain information about the patient-client but to also model the living environment and condition of patients.[58] PIR (passive infrared) sensors can share insight into how the user moves about the house, including time in bed, kitchen, and bath, as well as frequency of movement. Unobtrusive monitors that rely on off-the-shelf mass market technology can also enable medications monitoring, a critical aspect of managing chronic health

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[53] *See,* Jordan Baker, "The Behavioral Health Workforce Crisis and its Impact on families," Behavioral Health News (Jan. 17, 2023).

[54] Amy Symens Smith and Edward Trevelyan, "In Some States, More Than Half of Older Residents Live in Rural Areas," U.S. Census Bureau (Oct. 22, 2019) (https://www.census.gov/library/stories/2019/10/older-population-in-rural-america.html) (visited Jun. 11, 2024).

[55] John Cromartie, "Rural Aging Occurs in Different Places for Very Different Reasons," Economic Research Service, U.S.D.A. (Dec. 20, 2018) (https://www.usda.gov/media/blog/2018/12/20/rural-aging-occurs-different-places-very-different-reasons) (visited Jun. 11, 2024).

[56] Kate Van Dis, "How Much Does Assisted Living Cost?" National Council on Aging (Jun. 21. 2023) (https://www.ncoa.org/adviser/local-care/assisted-living/costs/) (visited Jun. 11, 2024).

[57] Jeff Hoyt and Scott Witt, "Senior In-Home Care Costs," Senior Living (Mar. 8, 2024) (https://www.seniorliving.org/home-care/costs/) (visited Jun. 11, 2024).

[58] *See,* Facchinetti, G., Petrucci, G., Albanesi, B, De Marinis, M. G., Piredda, M., "Can Smart Home Technologies Help Older Adults Manage Their Chronic Condition? A Systemic Literature Review," International Journal of Environmental Research and Public Health, 20/1205, at 2 (2023) (https//doi.org/10.3390/ijerph20021205) (Facchinetti, *et al.*).

conditions among the elderly.[59] Ambient sensors can evaluate settings to monitor movement and mobility, enabling providers to create fall prevention and detection strategies; the estimated U.S. healthcare costs of falls among the elderly is $50 billion annually.[60] Interventions derived from these technologies can help users avoid ordinary yet adverse ADL-related events. Acceptability among potential users can be expected as broadband adoption among the elderly increases;[61] communications providers who can recommend broadband-enabled devices can accordingly associate them with technology with which the user is already familiar.

4. Veterans

Approximately one-quarter (4.4 million) of the nation's nearly 18 million U.S. service veterans live in rural areas,[62] and approximately 48% of rural veterans participate in the VA healthcare system.[63] The VA Office of Rural Health provides services to veterans in rural spaces, including telehealth support services. These efforts are especially important because veterans in rural spaces face similar healthcare access challenges as do their non-veteran rural peers (distance from facilities, lack of access to providers). Older veterans are more likely to be diagnosed with diabetes, high blood pressure, and cardiac conditions; younger veterans are likely to confront combat-related needs, including PTSD.[64] The VA has worked with third parties to increase awareness and accessibility to telehealth services for veterans, including the deployment of Virtual Living Rooms[SM] in rural communities across the country. Administered by the Foundation for Rural Service, a grant program supports publicly accessible telehealth kiosks in libraries, American Legion Posts, and other spaces for U.S. service veterans who can use the facilities to access medical and other online VA services.[65]

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[59] While the cost of ineffective medication adherence has been estimated at more than $500 billion annually, nearly one-third of U.S. older adults cite affordability as a barrier to compliance. *See,* Dan Klein, "Medication Non-Adherence: A Common and Costly Problem," PAN Foundation (Jun. 2, 2020) (internal citation omitted) (https://www.panfoundation.org/medication-non-adherence/) (visited Nov. 19, 2024).

[60] Kristen Fischer, "Older Adults Falls Cost About $50B in Medical Costs a Year, Data Show," McKinghts Long Term Care News (Nov. 30, 2023) (https://www.mcknights.com/news/older-adults-falls-cost-about-50b-in-medical-costs-a-year-data-shows/#:~:text=Kristen%20Fischer,for%20the%20differences%20in%20cost?) (visited Nov. 19, 2024).

[61] Michelle Faverio, "Share of Those 65 and Older Who Are Tech Users Has Grown in the Past Decade," Pew Research Center (Jan. 13, 2022) (https://www.pewresearch.org/short-reads/2022/01/13/share-of-those-65-and-older-who-are-tech-users-has-grown-in-the-past-decade/) (visited Nov. 19, 2024).

[62] "Rural Veterans: 2021-2023," U.S. Department of Veterans Affairs (https://www.data.va.gov/stories/s/Rural-Veterans-FY2021-2023/kkh2-eymp/) (visited Nov. 15, 2024).

[63] "Rural Veteran Health Care Challenges," Office of Rural Health, U.S. Department of Veterans Affairs (https://www.ruralhealth.va.gov/aboutus/ruralvets.asp#:~:text=4.4%20million%20Veterans%20reside%20in,combat%2Drelated%20injuries%20and%20illnesses) (visited Nov. 15, 2024) (VA Office of Rural Health).

[64] VA Office of Rural Health; *see, also,* Lee, L., "PTSD and Aging," 30 PTSD Research Quarterly 4, National Center for PTSD, Behavioral Science Division, and Boston University School of Medicine, at 2 (2019).

[65] "Create a Place Where Veterans Can Feel at Home," Foundation for Rural Service (https://www.frs.org/programs/grant-program/virtual-living-room) (visited Nov. 15, 2024).

In addition to so-called "traditional" telehealth services that rely on synchronous video connections, the VA is engaging XR applications, citing studies finding sustained results and "significant reductions" in PTSD, anxiety, and depression.[66] As of August 2023, the VA expanded its use of immersive XR technology from ten to more than 2,000 locations.[67] The VA also published an "Immersive Playbook" to introduce prospective users to technology, use cases, and resources to facilitate acquisitions of related talent and technology.[68] Its recommendations include advice on procuring XR technology for at-home use as well as cautionary counsel to consider cybersecurity implications as remote devices collect and transmit health care data.[69]

5. AI Use Cases

AI use in telehealth is expected to focus on disease management rather than treatment of acute conditions. Deep learning of patients' history combined with application of reports relevant to the patient's condition will enable identification of trends and correlations that can aid patient care management and avoid unnecessary hospital visits and costs.[70] Wearables and other sensors can track movement, meals, vital signs, and other data that can be analyzed on an individual patient or large population basis. This can aid broad epidemiological efforts as well as targeted treatments based on the patient's genetic bases. Deep learning assists physicians with medical image recognition; radiologists can rely on AI to triage images for review.[71] AI tools are expected to aid physicians in the formulation of individualized patient care plans. These, too, are valuable benefits in rural areas for patients who lack access to specialists, as well as for physicians who can rely on tools to rapidly diagnose and recommend draft care plans for subsequent specialist review.

B. OVERCOMING POTENTIAL BARRIERS

1. Perspectives and Cost

Although telehealth and teletherapy are not viewed as replacements for in-person care, they can be critical complements, particularly when used to supplement shortages or lack of access to providers in rural areas. Sensor-based and other self-management devices can provide valuable add-on capabilities to improve care management and provide physicians and other caregivers with greater visibility and insight into patient conditions. The success of telehealth ultimately relies on physician and patient education and receptiveness to telehealth strategies. About two-thirds of doctors and patients agree that telehealth is more convenient for patients; about one-

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[66] VA Immersive at 13 (internal citations omitted).

[67] "Expansion of Immersive Technology in VA Medical Centers and Facilities from 2019-2023," Veterans Health Administration (https://www.innovation.va.gov/hil/views/immersive/immersive.html) (visited Nv. 19, 2024).

[68] See, "VA Immersive Playbook," Veterans Health Administration (2024) (https://www.innovation.va.gov/hil/assets/documents/va-immersive-playbook-summer-2024-508-public.pdf) (visited Nov. 19, 2024).
[69] Id. at 11.

[70] Bohr and Memarzadeh at Sec. 2.1, p. 26.

[71] See, Bohr and Memarzadeh at Sec. 2.3.2, p. 35.

third of doctors found telehealth more convenient for physicians.[72] Less than half of doctors think they have sufficient technology.[73] Disincentives for patients may include affordability, access to technology, and digital skills, while physicians must manage reimbursements, electronic health records (EHRs), and patient satisfaction.

Age of user also factors into adoption among both physicians and patients. Younger physicians are more apt to incorporate telehealth into their practice.[74] And even as broadband adoption among senior citizens increases, XR modalities can be a new and foreign concept to many, particularly older patients. Overcoming accessibility barriers is important as disparities in telehealth engagement persist among elderly (and low-income) patients;[75] younger patients are more likely to adopt.[76] However, even while age may be perceived as a barrier to adoption, data indicate increasing adoption among senior citizens.[77] A 2023 Federal report reveals that telehealth usage rates are lowest among uninsured users and highest among patients covered by Medicaid and Medicare.[78] While this indicates that affordability (whether of healthcare, a broadband subscription, or equipment) remains a barrier, higher usage rates among Medicare-eligible users signals advancements in adoption among senior citizens. As regards affordability, it is not clear whether this is tied to medical fees, broadband service, or equipment costs: Notably, however, residential broadband internet access service pricing remained flat between 2018-2024, even while consumer prices generally increased about 26% over that period.[79] Accordingly, the

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[72] Cordina, *et al.* at 4.

[73] Cordina, *et al.* at 3.

[74] Callaghan, T., McCord, C., Washburn, D., Goidel, K., Schmit, C., Nuzhath, T., Spiegelman, A., Scobee, J., "The Changing Nature of Telehealth Use by Primary Care Physicians in the United States," Journal of Primary Care and Community Health, Vol. 13:1-9, at 1, 4, and 6 (2022).

[75] *See,* Lee, E.C., Grigorescu, V., Enogieru, I., Smith, S.R., Samson, L.W., Conmy, A.B., De Lew, N., "Updated National Survey Trends in Telehealth Utilization and Modality (2021-2022), Office of Health Policy, U.S. Department of Health and Human Services, HP-2023-09, at 12 (Apr. 19, 2023) (HHS Report). Broadband adoption rates among users 65 years and older continue to increase among older and low-income users. *See,* "Internet, Broadband Fact Sheet," Pew Research Center (Jan. 31, 2024) (https://www.pewresearch.org/internet/fact-sheet/internet-broadband/?tabItem=d5edf003-5858-4269-89c5-f2889ecf7951) (visited Sep. 26, 2024). For a discussion of broadband adoption trends and narrowing gaps among adopters and non-adopters, *see* Seidemann, J., and Barboza, R., "Rural Imperatives in Broadband Adoption and Digital Inclusion," Smart Rural Community (2021).

[76] Ong *et al.* (2024) at 11.

[77] Michelle Faverio, "Share of Those 65 and Older Who Are Tech Users Has Grown in the Past Decade," Pew Research Center (Jan. 13, 2022) (https://www.pewresearch.org/short-reads/2022/01/13/share-of-those-65-and-older-who-are-tech-users-has-grown-in-the-past-decade/) (visited Nov. 25, 2024).

[78] HHS Report at 5.

[79] Karras, A., Kamber, P., Santorelli, M, "Broadband Prices in Context," Advanced Communications Law and Policy Institute, New York Law School (Sep. 19, 2024) (https://broadbandexpanded.com/posts/pricegrowth) (visited Sep. 26, 2024).

cost of medical care itself and related telehealth peripherals may be a larger affordability barrier than the price of broadband internet access service.

Rural physicians and other healthcare providers can leverage telehealth and XR modalities to facilitate connections to distantly located physicians to support care management of acute and chronic conditions, as well as to enable access to training and continuing education resources. Medical students graduating during the COVID pandemic rated VR training as useful for 77% of assessments, 81% of treatment options, and 94% of diagnostics.[80] In one study, students who trained with VR simulators demonstrated greater improvement than students training with conventional practices.[81] Telehealth can support consultation and supervision for acute and traumatic care and enables remote supervision of surgery, or "telesupervision."[82] VR enables interactive demonstrations at a distance, can increase peer support, and can reduce feelings of isolation among remote rural healthcare providers. Practitioners (and healthcare system administrators) can accordingly leverage telehealth for continuing education and training, as well as recruiting and retaining providers for rural areas.

While many sources point toward telehealth's contributions to improved health outcomes and efficiencies in patient management, rural hospitals (and individual physicians) must maintain systems to support both in-person and virtual care. Financial officers in rural hospitals have noted that telehealth operations must be able to generate revenues that, in combination with revenues from onsite services, can cover the sunk costs of both virtual and onsite services.[83] While telehealth can decrease staffing needs, a 2019 study reported that cost was the biggest barrier to telehealth deployment in rural hospitals.[84] Data indicate that hospitals with little competition and fewer patients with private insurance will be slower to implement telehealth solutions.[85] A 2022 study revealed that most rural hospital CFOs viewed telehealth as either revenue neutral or negative.[86] This perspective arose from observations that the "downstream benefits" of substantial upfront telehealth investments, including technology and redundant

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[80] Ong, *et al.,* (2021) *citing* De Ponti, R., Marazzato, J., Maresca, A., Rovera, F., Carcano, G., Ferrario, M., "Pre-Graduation Medical Training Including Virtual Reality During COVID-19 Pandemic: A Report on Students' Perception," BMC Medical Education (2020).

[81] Bohr and Memarzadeh at Sec. 2.3.3.1, pp. 37, 38.

[82] *See,* Perle, J.G., Zheng, W., "A Primer for Understanding and Utilizing Telesupervision with Healthcare Trainees," Journal of Technology in Behavioral Science (2023).

[83] *See,* Uscher-Pines, L., and Sousa, J. L., "Financial Impact of Telehealth: Rural Chief Financial Officer Perspectives," American Journal of Managed Care (Dec. 2022) (Uscher-Pines *et al.*).

[84] Zachrison, K., Boggs, K., Hayden, E., Espinola, J., Camargo, C., Jr., "Understanding Barriers to Telemedicine Implementation in Rural Emergency Departments," Annals of Emergency Medicine (2022) (doi:10.1016/j.annemergmed.2019.06.026).

[85] Uscher-Pines *et al.* at 3 (internal citation omitted).

[86] *Id.* at 4.

systems, are difficult to quantify. Rural hospital administrators also cited cultural factors that favor in-person interactions.[87]

2.   Cybersecurity

Data privacy and security is critical in the healthcare environment. Healthcare is a data rich sector, generating about 30% of global data volume. This amounts to about 50 petabytes of data annually, of which about 97% is unused.[88] Patient data is a prime example of personally identifiable information (PII) that is addressed in other sectors, and privacy standards as contemplated across numerous other industries can be viewed as applicable to healthcare, including the right of patients to refuse data sharing; right to withdraw data; right to modify inaccurate data; and the right to be forgotten. The exercise of these rights, however, could affect the efficacy of healthcare epidemiology that relies on extensive use of personal health information from broad populations to create tailored healthcare solutions for individual patients. Chronic disease management relies on personalized solutions,[89] and the efficacy of those solutions derive from the wealth of collective data and medical experience. For these reasons, data scrubbing might not be an effective or practical approach for epidemiological purposes where long-range data and trends covering years, if not decades, must be studied. Accordingly, safeguards that assure protections such as those envisioned by the Consumer Technology Association (CTA), including opt-out and anonymization[90] and alongside robust and rigorous cyber protections, will be critical to extracting from healthcare data the full force of collected information. Federal agencies, as well, including the Department of Homeland Security (DHS) Cybersecurity and Infrastructure Security Agency (CISA) are providing resources to healthcare providers, including toolkits and guidance for vulnerability assessments.[91]

IV.   **IMPLEMENTATION AND RURAL CASE STUDIES**

Rural broadband providers play an integral role in rural vitality and can support increased awareness and adoption of telehealth solutions. The positive impact of broadband on economic

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[87] *Id.* at 7.

[88] Linnie Greene, "How Healthcare Data Technology is Leveraged by Leaders," Arcadia (Sep. 6, 2023) https://arcadia.io/resources/healthcare-data-technology#:~:text=Hospitals%20produce%20an%20average%20of,for%20healthcare%20will%20reach%2036%25 (visited Nov. 19, 2024).

[89] Facchinetti, *et al.,* at 1.

[90] "Guiding Principles for the Privacy of Personal Health Data," Consumer Technology Association (2021) (final-cta-guiding-principles-for-the-privacy-of-personal-health-and-wellness-information.pdf) (visited Nov. 19, 2024).

[91] *See,* "CISA Services: Federal Cybersecurity Resources for Telehealth," Northwest Telehealth Resource Center (Nov. 14, 2024) (https://telehealthresourcecenter.org/resources/webinars/cisa-services-federal-cybersecurity-resources-for-telehealth/) (visited Nov. 18, 2024).

indicators including employment, entrepreneurship, and housing values has been demonstrated.[92] These are key components in building thriving and sustainable rural communities for which healthcare access is a vital ingredient. XR-enabled telehealth requires rates in the tens of Mbps and latency of approximately 10-20ms.[93] As described above, telemedicine is a valuable tool for managing both chronic and acute conditions and can be deployed to address internal medicine, emergency medicine, and behavioral health. Telemedicine has also been implemented to support geriatric specialists in nursing homes and assisted living facilities, including those with long-term care and memory units. Broadband-enabled tools can enable patients and clients experiencing non-emergency medical events to remain in the facility or home without the need to transfer to a hospital or urgent care facility. Education, however, remains a key factor in building acceptance and adoption of telehealth. A rural broadband provider observed, "[It's] not a technology barrier, but that's kind of that social barrier where a lot of people don't know that telehealth is available."[94]

To increase adoption, rural broadband and health care providers can consider strategies that address needs on a sequential, prioritized basis. These may include identifying particular demographic communities or patient populations who would benefit from telehealth deployments. Internet service providers (ISPs) and medical providers can then balance those criteria against costs and ease of implementation to "start small and grow from there." Initial successes can pave the way, subsequently addressing more complex or costly needs. Solutions can start with supporting assisted diagnostics. By way of example, a small rural school district might find utility in outfitting school nurses with connected peripherals (stethoscopes, otoscopes, ophthalmoscopes, etc.) and establishing connections to regional care centers. This enables nurses or other school faculty to connect students to doctors for real-time diagnoses and advice. Alternatively, smaller districts that cannot fund a nurse at each school could create a telehealth kiosk that enables students' private consultations with distantly located licensed nurses or physicians using connected devices. Darien Telephone Company (Darien, Georgia) worked closely with Coastal Community Health and local leaders to establish the Tiger Clinic at a local public elementary school. The connected clinic enables any district child or teacher to obtain telehealth consults, a critical service in a community that has no hospitals or large healthcare centers; the closest hospital is 40 miles away. Funding to launch the school-based site was provided by the healthcare provider and a combination of public and private grant support. Users

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[92] *See,* Weinstein, A., Erouart, M., Dewbury, A., "Broadband Connectivity: The Role of Broadband in Rural Economic Growth and Resilience," Center on Rural Innovation (2024) (finding 23% higher business growth, 10% higher self-employment growth, and 44% higher GDP growth in rural counties with high rates of broadband adoption) (https://ruralinnovation.us/resources/reports/report-the-role-of-broadband-in-rural-economic-growth-and-resilience/) (visited Nov. 20, 2024), *and* Whitacre, B., "The Fibre Broadband Housing Premium Across Three U.S. States," 11 Regional Studies Association 1, 38-62 (2023) (finding fiber broadband premiums in residential real estate values of 1%-9% and estimating a $36 billion increase in housing values with ubiquitous fiber broadband deployments) (https://doi.org/10.1080/21681376.2024.2305951) (visited Nov. 20, 2024).

[93] *See,* "Future Network Requirements for Extended Reality," Ericsson Technology Review at 9, 10 (2023) (https://www.ericsson.com/496150/assets/local/reports-papers/ericsson-technology-review/docs/2023/future-network-requirements-for-xr-apps.pdf) (visited Nov. 18, 2024).

[94] Johnston, M., Leitner, B., Seidemann, J., *Rural Telehealth* [Conference Session], 2023 Fall Conference, NTCA–The Rural Broadband Association, Boston (Sep. 27, 2023).

cite benefits for parents whose children can receive non-emergency treatment close to home, as well as follow-on benefits for students whose teachers can obtain on-site medical consults without the need to replace planned lessons with a substitute teachers. The clinic is especially valuable in the community that has high poverty rates as it enables parents to avoid missing work for children's appointments.[95]

For home use, digital literacy is a key factor in encouraging adoption. In Floyd, Virginia, locally operated ISP Citizens Telephone Cooperative (Citizens) works with local health care systems to support outreach efforts at community centers. These services address all local community demographics including the elderly and low-income users and provide training on computers and tablets for healthcare applications. Noting that equipment affordability remains a barrier for some users, the company sponsors the provision of a free tablet or laptop to users who complete digital navigation training. In addition to healthcare and job search training, Citizens incorporates cybersecurity and safety in its curricula. These services are offered to the community at no cost to the user.[96]

Skyline Membership Corp. of West Jefferson, North Carolina leveraged a grant to deploy a broadband-enabled surveillance solution at a not-for-profit assisted living facility. The senior center serves residents 55 years and older and supports clients with medication management, meal preparation, and assistance accessing medical care. The internet-based installation, which also covers both assisted living and memory loss units, enables caregivers to monitor otherwise "unwitnessed falls, patterns of wanderings, and attempted elopements." The project was conceived when an ISP executive was visiting a relative at the facility and noted how the company's technology could help the center advance its capabilities.[97] This outcome mirrors observations of other rural broadband providers who emphasize that trust and openness are key factors in building successful and sustainable relationships. These can begin with relatively simple introductory meetings to determine where ISP and hospital geographic service areas overlap; an introduction to the technological capabilities of the rural ISP; and a presentation of the involvement and community support the rural broadband provider engages as part of its normal and ordinary course of business. Following these principles, a rural ISP in Wisconsin worked closely with a health care system to develop a comprehensive strategy that addresses device access and affordability as well as navigators from the ISP and healthcare industries to assist new users.[98]

V.   **CONCLUSION**

Telehealth is transforming the future of healthcare. Beyond peak pandemic use, innovative technologies including XR platforms and AI-driven care management are rapidly reshaping medical access and treatment. For rural communities, telehealth breaks down traditional barriers, connecting patients to distantly located specialists and other providers. XR modalities for

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[95] A. Spinks, personal communication (Dec. 3, 2024).

[96] L. Saltus, personal communication (Nov. 22, 2024).

[97] "2017 Annual Meeting Report," Skyline Membership Corp., West Jefferson, N.C., at pp. 15-17 (2017); K. Shepherd, personal communication (Nov. 26, 2024). Skyline leveraged a Smart Rural Community Challenge grant to support this effort.

[98] G. Johnson, personal communication (Nov. 15, 2024).

interventions including physical, occupational, and mental health therapies offer immersive experiences that transcend physical limitations. These strategies also support aging-in-place for older users and are being explored by the VA for use in their healthcare offerings. Robust broadband connectivity is necessary to take full advantage of these platforms that promise improved patient outcomes and provider efficiencies. As broadband connectivity expands, telehealth stands poised to deliver unprecedented patient outcomes and provider efficiencies, turning what once seemed like science fiction into an accessible and personalized life-changing realities.

About NTCA–The Rural Broadband Association: *NTCA–The Rural Broadband Association is the premier association representing approximately 850 independent, community-based telecommunications companies that are leading innovation in rural and small-town America. NTCA advocates on behalf of its members in the legislative and regulatory arenas, provides training and development, publications and industry events, and an array of employee benefit programs. NTCA's members are leading the IP evolution for rural consumers, delivering solutions that make rural communities vibrant places in which to live and do business. Because of their efforts, rural America is fertile ground for innovation in agriculture, economic development, education, health care, and other vital services. Visit us at* www.ntca.org.

About Smart Rural Community: *Smart Rural Community*[SM] *is an initiative of NTCA–The Rural Broadband Association. Smart Rural Community promotes rural broadband networks and broadband-enabled applications that enable innovative agricultural, economic development, education, healthcare, and other vital services. Smart Rural Community administers award and best practices programming as well educational resources that investigate issues relating to rural broadband deployment, adoption, and use. For information, please visit* www.smartruralcommunity.org.

Additional Smart Rural Community Resources: Smart Rural Community resources include white papers, toolkits, and infographics and can be found at www.smartruralcommunity.org.

Schadelbauer, R., "Anticipating Economic Returns of Rural Telehealth," NTCA–The Rural Broadband Association (2017).

Seidemann, J., "Beyond Rural Walls: Identifying Impacts and Interdependencies Among Rural and Urban Spaces," NTCA–The Rural Broadband Association (2015).

Seidemann, J., "BOLD: Broadband Opportunities for Leadership Development," National Rural Education Association and NTCA–The Rural Broadband Association (2023).

"Broadband as a Bridge from Heritage to the Future," Joshua Seidemann, Editor, Smart Tribal Community/NTCA–The Rural Broadband Association (2022).

Seidemann, J., "From Fiber to Field: The Role of Rural Broadband in Emerging Agricultural Technology," NTCA–The Rural Broadband Association (2021).

 Seidemann, J. "Key Point Indicators for Rural Economic Development," National Rural Economic Developers Association and NTCA–The Rural Broadband Association (2024).

Seidemann, J., "Labor and Workforce Development in the Rural Telecom Sector," NTCA–The Rural Broadband Association (2022).

Seidemann, J., "Rural Broadband and the Next Generation of American Jobs," NTCA–The Rural Broadband Association (2019).

Seidemann, J. and Barboza, R., "Rural Imperatives in Broadband Adoption and Digital Inclusion," NTCA–The Rural Broadband Association (2021).

"Steel Sharpens Steel: A Conversation About Regional Thinking for Rural America," Joshua Seidemann, Editor, NTCA–The Rural Broadband Association (2017).