Review

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Leveraging Digital Health for Sustainable Care: Advancing Telemedicine, Climate Change Mitigation, and Global Health Equity

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Abstract

Objectives: This narrative review describes the role of digital health in addressing climate change adaptation, mitigation, insight, and equity. We survey existing evidence and efforts and identify high-value opportunities. Methods: A comprehensive review of recent literature was conducted, focusing on the intersection of digital health technologies, climate adaptation, and mitigation strategies. Results: Digital health technologies have emerged as powerful tools in addressing climate change. Healthcare organizations are investing in digital health to reduce greenhouse gas emissions, develop adaptive strategies for climate-related health impacts, and address emerging challenges like climate-driven migration. This approach can enhance sustainability, improve patient care, and contribute to global health security. Conclusions: While digital health offers significant potential in combating climate change, challenges remain in reducing the healthcare sector's greenhouse gas emissions and bridging the digital divide. Future research should prioritize developing more energy-efficient AI models, improving the resilience of digital infrastructure to climate events, and integrating climate considerations into health informatics. The field must also address the ethical implications of AI in climate decision-making and ensure equitable access to digital climate solutions globally.

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Mary, a 58-year-old African American woman with chronic obstructive pulmonary disease (COPD) lives in Altadena, a suburban area of Los Angeles California affected by the devastating wildfires that occurred in January of 2025. As the fires approached her neighborhood, Mary was forced to evacuate quickly, leaving behind her medications and hard-copy medical records.

Upon reaching a temporary shelter, Mary began experiencing increasing wheezing and anxiety due to the stress of evacuation and poor air quality. Her daughter, a volunteer nurse at the shelter, checked her vital signs and determined she was not in acute danger. With Mary's permission, she helped her mother use her smartphone so she could connect to her pulmonologist at the nearby healthcare facility. The nurse was able to assist Mary in downloading the health system's app in the Apple Store, setting up her account, and then messaging her pulmonologist's office. An appointment was set up within hours. Through a secure video call, the specialist assessed Mary's condition and prescribed appropriate medication, which was electronically sent to a nearby

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pharmacy. The pharmacist, able to access Mary's medication history through the digital health system, safely dispensed the necessary inhalers and oral steroids.

Throughout her stay at the shelter, Mary started to use her smartphone to be up-to-date. She downloaded a wildfire tracker app that provided the latest information on the wildfires with instant notifications. She also started to use an air pollution health app that was able to give her real-time alerts and recommendations on deep breathing exercises to help control her symptoms.

Climate change, marked by rising temperatures, altered weather patterns, and more frequent extreme events, poses a serious threat to global health. Climate change has been historically recognized as able to amplify existing health inequities by disproportionately affecting vulnerable communities[1]. Vulnerable communities are often referred to as those of low-income, marginalized racial groups, the elderly, disabled individuals, indigenous communities, and residents of developing nations. Ultimately, the climate change impacts can end up disrupting or even displacing entire communities.

Climate change is an ongoing and accelerating crisis, characterized by rising global temperatures, increasingly extreme weather events, and other environmental changes. For the first time in all of history, global near-surface temperatures are likely to temporarily exceed 1.5 C above pre-industrial levels before 2028 under present policies[2]. Sea temperatures are also simultaneously rising. Temperatures in Europe are rising at a rate twice as fast as the global average, while recent decades have seen unparalleled warming, heat waves, droughts, and water shortages. The effects of such changes have been devastating: heat-related mortality, loss of agricultural harvests, and expanded areas suitable for infectious disease transmission. With the risks projected for even half-degree increments of warming, addressing climate change could not be more urgent.

Climate change poses significant threats to human health and well-being. With the number of natural disasters and extreme weather events increasing in frequency and intensity over the past few decades, the most vulnerable of patients are susceptible to these climate impacts. They face increased risks of respiratory and cardiovascular diseases, heat-related illnesses, and vector-borne diseases[3-5]. Climate change also impacts mental health, leading to increased stress, anxiety, and trauma related to these events[3,6].

The healthcare sector itself is a major contributor to climate change, responsible for 8.5% of U.S. greenhouse gas emissions and up to 4.6% of global emissions[7]. At COP28, the United Nations Climate Change Conference that was held in Dubai, a significant milestone was reached when the first-ever Health Day was declared on December 3rd of 2023. One hundred and twenty-three countries subsequently signed on to the COP28 United Arab Emirates Declaration on Climate and Health, emphasizing the need for governments around the world to prepare healthcare systems for climate-related impacts[8]. The inclusion of Health Day marked a major shift in recognizing health as a driving force in climate action, spearheading the development of climate-resilient, sustainable, and equitable health systems[8].

Digital health encompasses a broad spectrum of technologies designed to facilitate patient care, data collection, and information sharing within and external to healthcare systems. These technologies range from formal and informal electronic health services to sophisticated tools for communication, data management, predictive analytics, remote patient monitoring, and mobile applications[9]. The implementation of these technologies extends to both healthcare professionals and consumers, supporting clinical care delivery, health management, and overall well-being, while also addressing broader healthcare access needs. These digital health technologies (including artificial intelligence-driven health applications) are already demonstrating their effectiveness in reducing clinical carbon emissions while improving patient care and health system resilience[10,11]. A recent systematic review found that the magnitude of greenhouse gas emissions savings attributed to telemedicine consultations varies widely, ranging from 0.70 kg to 372 kg of carbon dioxide equivalent (CO_2e) per consultation[12]. Remote patient monitoring can enable early detection of climate-sensitive health conditions, improving adaptation to changing disease patterns. Additionally, digital platforms can provide valuable data for climate health research and inform targeted interventions for

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vulnerable populations[13]. By leveraging telehealth, remote patient monitoring, and other patient-centric digital tools, healthcare systems can significantly reduce travel-related emissions and resource consumption associated with in-person care[10].

The rapid evolution and widespread adoption of these technologies have outpaced the development of formal frameworks governing their use in natural disasters, thus making it challenging to accurately forecast the impact of these technologies[9]. Despite the underlying vulnerabilities of digital health technologies to climate-induced challenges, they nevertheless are being optimized to facilitate enhanced coordination between first responders, healthcare professionals, and the affected populations. Moreover, with real-time analytics, authorities can efficiently deploy personnel and distribute medical supplies based on need.

Advancements in digital health offer promising opportunities to systematically address climate impacts at scale through adaptation, mitigation, insight generation, and equity promotion in healthcare systems worldwide. This review examines current evidence and initiatives, highlighting key opportunities for leveraging digital solutions to enhance climate resilience, reduce greenhouse gases, improve data-driven decision-making, and ensure equitable access to health services in the face of evolving environmental challenges.

Climate Adaptation: Climate adaptation in human systems, as defined by the Intergovernmental Panel on Climate Change, is "the process of adjustment to actual or expected climate and its effects, to moderate harm or exploit beneficial opportunities"[14]. For healthcare systems, adaptation strategies are crucial for moderating the harmful health effects of climate change and ensuring the continuity and quality of operations. These strategies take on various forms, addressing surge capacity and continuity of health care during natural disasters and the care of climate-change-related illnesses, including infectious disease outbreaks, heat and cold exposure illnesses, malnutrition, and smoke inhalation. Digital health and telehealth technologies play a crucial role in healthcare climate adaptation. These technologies are instrumental in augmenting prevention or early intervention of climate-related illness, aiding individuals, communities, and health care providers in minimizing harm. They are also essential for ensuring continuity of care and increasing capacity during surges in demand for health care services during extreme weather events and natural disasters.

Preventing or Limiting Exposure. Both healthcare providers and consumers with smartphones can access a plethora of applications (apps) that provide real-time information and forecasting related to outdoor temperature and air quality. Heat and air quality alerts enable individuals to make adaptive choices. When employed by individuals and communities, these apps can be used to identify and avoid individual exposures to heat and air pollutants. Community events can be rescheduled, employers can implement telework for those eligible, and optional outdoor activities can be curtailed in the interest of public health. Individuals can relocate to safer locations when feasible. Additionally, healthcare providers can adapt their programs and services. For example, they can issue alerts and guidance to patients using patient portals and enable telemedicine appointments when it is safest to stay home. However, literature describing such climate-adaptive actions is sparse.

Some evidence indicates that individuals avert exposures in response to awareness of exposure risks. For example, a 2024 study showed reduced park and playground visitation during air quality events[15]. An earlier study in China showed that individuals reduce outdoor activities in response to increased air pollution[16]. Data from a bike-sharing service in Argentina indicates that there are decreases in outdoor cycling after heat warnings[17]. Additionally, multiple studies have related heat warnings to lower mortality. However, awareness of exposure risk may not always translate to action or improved outcomes. A 2013 systematic review indicated that people largely do not take action in response to heat warnings and noted that averting behavior is likely affected by costs and other barriers to action[18]. Additionally, a 2018 study determined that heat alerts are not associated with lower mortality in most US cities[19]. The authors point to the varied evidence for heat warnings and the potential importance of individual and community action plans. Centers for Disease Control (CDC) guidance notes that most people are aware of heat alerts when they are issued but may not change their behavior accordingly[20].

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Infectious disease surveillance. Through multiple mechanisms, climate change is causing an increase in mosquito-borne infectious diseases, including malaria and dengue fever[21]. Digital health approaches to surveilling, forecasting, and addressing increases in mosquito-borne disease are foundational to adaptation. The World Health Organization (WHO) considers surveillance to be a core malaria intervention[21]. The WHO views surveillance, which uses digital health technologies heavily, as fundamentally enabling investment, resource allocation, and evaluation of public health interventions. Additionally, digital health interventions have effectively improved treatment and supply-chain-related outcomes when managing malaria and other infectious diseases[22,23].

Natural disasters. Climate-related extreme weather events can potentially destroy communities and cause large-scale morbidity and mortality. These natural disasters trigger a surge in demand for health care services, even as facilities and infrastructure for providing health care may have been destroyed. Varied digital health technologies can be used to prepare for these natural disasters and during response and recovery.

Telemedicine has been applied in disaster response since the 1980s, and multiple formal telemedicine programs for disaster planning, response, and recovery exist[24]. In 2017, NATO established the Multinational Telemedicine System (MnTS), an emergency telemedicine program designed for emergency services and medical care across four nations in Eastern Europe. The MnTS accounted for both the communication systems and power sources needed to support telemedicine, as well as the necessary hardware and software in a single fully integrated system for use by emergency teams. Disaster telemedicine services can also be consumer-facing. In 2017, during Hurricane Irma, Nemours CareConnect provided pediatric telemedicine services directly to consumers without intermediation by disaster teams. Currently, there is an unprecedentedly high level of preparedness to use telehealth, with widespread adoption and user acceptance, due to its use during the COVID-19 pandemic. This makes telehealth a potentially powerful modality for delivering care in the wake of a natural disaster.

Telemedicine has special considerations in disaster scenarios. Connectivity can be poor in the wake of destructive natural events, and the use of telemedicine can be dependent upon the deployment of dedicated telecommunications resources (typically via the military or government) or the rapid restoration of power and telecommunications. In the future, as telemedicine and telehealth applications become increasingly dependent upon high bandwidth and integration of artificial intelligence (AI) powered features, their performance under limited bandwidth and low energy conditions may degrade. In the US, issues of reimbursement, credentialing, and licensure may restrict the use of telemedicine during natural disasters[25].

Digital health solutions are essential for individual, community, and governmental decision-making for climate adaptation. They play a prominent role in current surveillance and response efforts and offer early warning and risk assessment to individuals and communities. There's a need for more insight into the effective design of digital health applications intended to effect behavior change and how healthcare providers, systems, and communities can better leverage digital health technologies to prevent or limit harmful exposures. In planning for the use of telemedicine during natural disasters, interoperability and sharing of health information is essential. Additionally, digital health solutions must be able to perform under conditions of limited bandwidth and power.

Health Inequities and Climate Change: In the United States, areas with higher proportions of Black and Hispanic residents are typically hotter due to the urban heat island effects caused by limited tree cover. These communities also have much less access to technology such as air conditioning, which thereby increases their vulnerability to future heat waves. As a result, heat-sensitive illnesses, such as asthma and cardiovascular conditions, are much more prevalent in these populations[26]. These populations have also been shown to have Black women face much higher risks of preterm birth during heat waves compared to their White counterparts. Extreme weather events, such as Hurricane Harvey, resulted in Black residents in Texas reporting higher rates of post-traumatic stress and reduced access to healthcare following the natural disaster. Events like these effectively demonstrate

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how discrimination is often amplified by the health impacts of climate change, which in turn perpetuates inequity.

Role of Federally Qualified Health Centers (FQHCs) and the Advancement of the Digital Paradigm: FQHCs play a vital role as safety-net providers for millions of uninsured and medically vulnerable individuals who frequently encounter significant obstacles in accessing healthcare. These community-oriented clinics provide comprehensive primary care services to around 30 million people in the United States, the majority of whom are low-income, underinsured, or part of historically marginalized groups. In 2022, for the first time, comprehensive data were gathered from all US FQHCs, revealing positive screening rates for four key social risk factors: food insecurity, housing instability, lack of transportation, and financial pressure[27]. Telemedicine has proven to be a revolutionary solution for underserved populations, delivering substantial economic advantages to patients and their families. By removing the necessity for physical travel to healthcare facilities, telemedicine considerably alleviates the financial strain tied to obtaining medical care. For instance, telemedicine enables patients to avoid taking leave from work for medical appointments, thus safeguarding their income and job stability. Additionally, patients located in rural or underserved regions can save significant expenses on transportation, which can be particularly steep for those residing far from healthcare centers.

Greenhouse Gas Emissions Savings. Another benefit of telemedicine services is the reduction in the Greenhouse Gas Emissions related to travel within the healthcare sector. Retrospective analyses of patients participating in outpatient specialty consultations through telemedicine have shown a positive impact on emissions reductions[28,29] and travel expenses[30,31]. This research objectively evaluated the savings in terms of travel distance, time, and expenditure linked to the adoption of telemedicine.

However, FQHCs encounter several considerable obstacles in delivering comprehensive care to underserved populations. For example, a diabetes patient requires regular screening visits with various specialists to complete a thorough diabetic examination, including primary care, nephrology, podiatric care, and ocular assessments. Typically, specialized care is not available at FQHCs, necessitating clinics to arrange separate clinic appointments for patients to receive appropriate care at specialty clinics. Still, patients often face excessive delays in seeing specialists, potentially leading to disease progression and challenges in referral adherence[32]. Therefore, community-based screening programs, such as telemedicine or artificial intelligence diagnostic tools, may bring healthcare services closer to underserved populations, reducing the distance patients need to travel to complete a comprehensive diabetic examination.

Advancement of Artificial Intelligence (AI): AI, a digital health innovation, has the potential to enhance healthcare by improving quality, accessibility, and patient experience. FDA-approved diagnostic AI screening tools are proving to be a game-changer in efficiently screening patients for various diseases, including cancer and diabetic retinopathy (DR). These tools not only speed up the screening process but also provide outputs that can help clinics, such as FQHCs, to expedite patient care. But oftentimes these processes fail because there is no follow-up on a positive screening result (which can be attributed to healthcare system-specific and/or patient-specific factors). With quicker report turnaround times, specialist physicians can offer second opinions sooner, which may enhance patient compliance and possibly reduce travel-related emissions. Integrating AI-diagnostic tools to screen for DR can take place during the same primary care visit and has the potential to reduce healthcare's greenhouse gas emissions[33]. However, to the best of our knowledge, no studies have yet been conducted in the United States to evaluate the environmental impact of AI diagnostic tools in community clinics, particularly concerning travel-related greenhouse gas emissions. This gap may stem from inconsistencies in Medicaid reimbursement for AI diagnostic screenings across different states and insurers. In some cases, reimbursement may not be provided if a patient doesn't meet the standard threshold of more-than-mild risk for the disease[34]. Unfortunately, this situation hampers efforts to support early detection and preventive measures that are crucial for under-resourced patients. Addressing these issues could help reduce future federal expenses related to disability and

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pave the way for new billing frameworks that allow the effective implementation of AI tools in FQHCs, and possibly reduce healthcare organizations' travel emissions.

As of 2024, the Medicaid population is larger than the Medicare population[35,36]. FQHCs provide essential services to a large number of uninsured and medically vulnerable individuals who often struggle to access necessary specialty care. Acknowledging these health and social obstacles is the first step in improving screening implementation strategies, especially through AI point-of-care assessment in FQHC settings[37] compared to low levels of referral adherence from remote reading[38]. The critical intersection of social, structural, and environmental drivers of health can serve as a valuable data source to shed light on these challenges. Gathering grassroots data may enhance the accuracy of top-down modeling and allow for more detailed tracking of progress as health systems aim to reduce emissions.

Conclusions

Digital health technologies have continued to be at the forefront of tackling climate change and health inequity over the past decade. Healthcare systems, not just those in the United States, are increasingly employing more technologies, whether that be telemedicine, mobile health apps, or AI-driven solutions to improve patient care. Meanwhile, climate change has continued to perpetuate the effects of health inequity by disproportionately affecting vulnerable populations. Digital health tools ultimately aim to help mitigate these effects by using real-time health monitoring, climate-related disease surveillance, and remote patient care during extreme weather events such as the recent Hurricane Helene. Telemedicine has proven to be especially beneficial in times of natural disasters as it provides medical access even when traditional healthcare may not be available within the individual's vicinity. Digital health offers significant opportunities but further research is still needed to address potential ethical concerns and ensure digital equity. Overall, integrating digital health with climate action can strengthen global health security and advance sustainable healthcare practices.

References

1. Rizmie D and Psomas C. How does climate change amplify health inequities? [Internet]. 2023 [cited 2025 Jan 16]. Available from: https://www.economicsobservatory.com/how-does-climate-change-amplify-health-inequities.
2. van Daalen KR, Tonne C, Borrell C, Nilsson M, Lowe R. Approaching unsafe limits: Climate-related health inequities within and beyond Europe [Internet]. U.S. National Library of Medicine; 2023 [cited 2025 Jan 17]. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC10372306/
3. Conrad K. The Era of Climate Change Medicine-Challenges to Health Care Systems. Ochsner J. 2023 Spring;23(1):7-8. doi: 10.31486/toj.23.5033. PMID: 36936481; PMCID: PMC10016220.
4. Gordon IO, Mehta N, Isaacson JH, Khatri SB. How does climate change impact our patients? Cleve Clin J Med. 2023 Apr 3;90(4):221-226. doi: 10.3949/ccjm.90a.PMID: 37011955.
5. Romanello M, Walawender M, Hsu SC, Moskeland A, Palmeiro-Silva Y, Scamman D, Ali Z, Ameli N, Angelova D, Ayeb-Karlsson S, Basart S, Beagley J, Beggs PJ, Blanco-Villafuerte L, Cai W, Callaghan M, Campbell-Lendrum D, Chambers JD, Chicmana-Zapata V, Chu L, Cross TJ, van Daalen KR, Dalin C, Dasandi N, Dasgupta S, Davies M, Dubrow R, Eckelman MJ, Ford JD, Freyberg C, Gasparyan O, Gordon-Strachan G, Grubb M, Gunther SH, Hamilton I, Hang Y, Hänninen R, Hartinger S, He K, Heidecke J, Hess JJ, Jamart L, Jankin S, Jatkar H, Jay O, Kelman I, Kennard H, Kiesewetter G, Kinney P, Kniveton D, Kouznetsov R, Lampard P, Lee JKW, Lemke B, Li B, Liu Y, Liu Z, Llabrés-Brustenga A, Lott M, Lowe R, Martinez-Urtaza J, Maslin M, McAllister L, McMichael C, Mi Z, Milner J, Minor K, Minx J, Mohajeri N, Momen NC, Moradi-Lakeh M, Morrisey K, Munzert S, Murray KA, Obradovich N, O'Hare MB, Oliveira C, Oreszczyn T, Otto M, Owfi F, Pearman OL, Pega F, Perishing AJ, Pinho-Gomes AC, Ponmattam J, Rabbaniha M, Rickman J, Robinson E, Rocklöv J, Rojas-Rueda D, Salas RN, Semenza JC, Sherman JD, Shumake-Guillemot J, Singh P, Sjödin H, Slater J, Sofiev M, Sorensen C, Springmann M, Stalhandske Z, Stowell JD, Tabatabaei M, Taylor J, Tong D, Tonne C, Treskova M, Trinanes JA, Uppstu A, Wagner F,

 doi:10.20944/preprints202606.0303.v1

Warnecke L, Whitcombe H, Xian P, Zavaleta-Cortijo C, Zhang C, Zhang R, Zhang S, Zhang Y, Zhu Q, Gong P, Montgomery H, Costello A. The 2024 report of the Lancet Countdown on health and climate change: facing record-breaking threats from delayed action. Lancet. 2024 Nov 9;404(10465):1847-1896. doi: 10.1016/S0140-6736(24)01822-Epub 2024 Oct PMID: 39488222; PMCID: PMC7616816.

6. Walinski A, Sander J, Gerlinger G, Clemens V, Meyer-Lindenberg A, Heinz A. The Effects of Climate Change on Mental Health. Dtsch Arztebl Int. 2023 Feb 24;120(8):117-124. doi: 10.3238/arztebl.m2022.PMID: 36647584; PMCID: PMC10154789.
7. Commonwealth Fund. "How the US Health Care System Contributes to Climate Change. Available at: https://www.commonwealthfund.org/publications/explainer/2022/apr/how-us-health-care-system-contributes-climate-change. Accessed on 15 December 2024.
8. United Nations. COP28: The Climate Crisis is also a Human Crisis. Available at: https://news.un.org/en/story/2023/12/Accessed on 25 January 2025.
9. Lokmic-Tomkins Z, Borda A, Humphrey K. Designing digital health applications for climate change mitigation and adaptation. Med J Aust. 2023 Feb 20;218(3):106-110. doi: 10.5694/mja2.Epub 2023 Jan PMID: 36625463.
10. Usher K, Williams J, Jackson D. The potential of virtual healthcare technologies to reduce healthcare services' Greenhouse Gas Emissions. Front Public Health. 2024 May 16;12:1394095. doi: 10.3389/fpubh.2024.PMID: 38818441; PMCID: PMC11137209.
11. Oppelaar MC, Bannier MAGE, Reijers MHE, van der Vaart H, van der Meer R, Altenburg J, Conemans L, Rottier BL, Nuijsink M, van den Wijngaart LS, Merkus PJFM, Roukema J. Remote monitoring and teleconsultations can reduce greenhouse gas emissions while maintaining quality of care in cystic fibrosis. Front Digit Health. 2024 Oct 24;6:1469860. doi: 10.3389/fdgth.2024.PMID: 39512858; PMCID: PMC11540799.
12. Purohit A, Smith J, Hibble A. Does telemedicine reduce the carbon footprint of healthcare? A systematic review. Future Healthc J. 2021 Mar;8(1):e85-e91. doi: 10.7861/fhj.2020-PMID: 33791483; PMCID: PMC8004323.
13. Rahimi-Ardabili H, Magrabi F, Coiera E. Digital health for climate change mitigation and response: a scoping review. J Am Med Inform Assoc. 2022 Nov 14;29(12):2140-2152. doi: 10.1093/jamia/ocacPMID: 35960171; PMCID: PMC9667157.
14. Intergovernmental Panel On Climate Change (Ipcc). Climate Change 2022 – Impacts, Adaptation and Vulnerability: Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Internet]. 1st ed. Cambridge University Press; 2023 [cited 2025 Jan 6]. Available from: https://www.cambridge.org/core/product/identifier/9781009325844/type/book.
15. Mullan K, Avery T, Boise P, Leary CS, Rice WL, Semmens EO. Impacts of wildfire-season air quality on park and playground visitation in the Northwest United States. Ecol Econ J Int Soc Ecol Econ. 2024 Oct;224:108285.
16. Li Z, Folmer H. Air pollution and perception-based averting behaviour in the Jinchuan mining area, China. Ann Reg Sci [Internet]. 2023 [cited 2025 Jan 6];70(2):477–Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9296367/.
17. Rabassa MJ, Conte Grand M, García-Witulski CM. Heat warnings and avoidance behavior: evidence from a bike-sharing system. Environ Econ Policy Stud [Internet]. 2021 Jan 1 [cited 2025 Jan 6];23(1):1–Available from: https://doi.org/10.1007/s10018-020-00275-6.
18. Toloo G, FitzGerald G, Aitken P, Verrall K, Tong S. Evaluating the effectiveness of heat warning systems: systematic review of epidemiological evidence. Int J Public Health [Internet]. 2013 Oct 1 [cited 2025 Jan 6];58(5):667–Available from: https://doi.org/10.1007/s00038-013-0465-2.
19. Weinberger KR, Zanobetti A, Schwartz J, Wellenius GA. Effectiveness of National Weather Service Heat Alerts in Preventing Mortality in 20 US Cities. Environ Int [Internet]. 2018 Jul [cited 2025 Jan 6];116:30–Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5970988/.
20. National Center for Environmental Health (U.S.). Division of Environmental Hazards and Health Effects. Climate and Health Program., editor. Heat response plans : summary of evidence and strategies for collaboration and implementation. 1AD 20; Available from: https://stacks.cdc.gov/view/cdc/93705.

 doi:10.20944/preprints202606.0303.v1

21. Colón-González FJ, Sewe MO, Tompkins AM, Sjödin H, Casallas A, Rocklöv J, et al. Projecting the risk of mosquito-borne diseases in a warmer and more populated world: a multi-model, multi-scenario intercomparison modelling study. Lancet Planet Health [Internet]. 2021 Jul 1 [cited 2025 Jan 6];5(7):e404–Available from: https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(21)00132-7/fulltext.
22. Biemba G, Chiluba B, Yeboah-Antwi K, Silavwe V, Lunze K, Mwale RK, et al. Impact of mobile health-enhanced supportive supervision and supply chain management on appropriate integrated community case management of malaria, diarrhoea, and pneumonia in children 2-59 months: A cluster randomised trial in Eastern Province, Zambia. J Glob Health [Internet]. [cited 2025 Jan 6];10(1):Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7243069/.
23. Larocca A, Moro Visconti R, Marconi M. Malaria diagnosis and mapping with m-Health and geographic information systems (GIS): evidence from Uganda. Malar J. 2016 Oct 24;15(1):520.
24. Doarn CR, Latifi R, Poropatich RK, Sokolovich N, Kosiak D, Hostiuc F, et al. Development and Validation of Telemedicine for Disaster Response: The North Atlantic Treaty Organization Multinational System. Telemed E-Health [Internet]. 2018 Sep [cited 2025 Jan 6];24(9):657–Available from: https://www.liebertpub.com/doi/10.1089/tmj.2017.0237.
25. Litvak M, Miller K, Boyle T, Bedenbaugh R, Smith C, Meguerdichian D, et al. Telemedicine Use in Disasters: A Scoping Review. Disaster Med Public Health Prep [Internet]. 2022 Apr [cited 2025 Jan 6];16(2):791–Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8442996/.
26. Deivanayagam TA, English S, Hickel J, Bonifacio J, Guinto RR, Hill KX, et al. Envisioning environmental equity: Climate change, health, and racial justice [Internet]. U.S. National Library of Medicine; 2023 [cited 2025 Jan 16]. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC10415673/.
27. Nguyen KH, Giron NC, Cole MB. National Prevalence of Social Risk Factors at Federally Qualified Health Centers. JAMA Intern Med. 2024;184(8):980–982. doi:10.1001/jamainternmed.2024.1881
28. Patel KB, Gonzalez BD, Turner K, et al. Estimated Carbon Emissions Savings With Shifts From In-Person Visits to Telemedicine for Patients With Cancer. JAMA Netw Open. 2023;6(1):e2253788. doi:10.1001/jamanetworkopen.2022.53788
29. Dacones, Imelda, Colin Cave, Gregg L. Furie, Cory A. Ogden, and Jonathan E. Slutzman. "Patient Transport Greenhouse Gas Emissions from Outpatient Care at an Integrated Health Care System in the Northwestern United States, 2015–2020." The Journal of Climate Change and Health 3, (2021): Accessed April 11, 2024. https://doi.org/10.1016/j.joclim.2021.100024.
30. Dullet NW, Geraghty EM, Kaufman T, Kissee JL, King J, Dharmar M, Smith AC, Marcin JP. Impact of a University-Based Outpatient Telemedicine Program on Time Savings, Travel Costs, and Environmental Pollutants. Value Health. 2017 Apr;20(4):542-546. doi: 10.1016/j.jval.2017.01.Epub 2017 Mar PMID: 28407995.
31. Paquette, Shannon, and Judith C. Lin. "Outpatient Telemedicine Program in Vascular Surgery Reduces Patient Travel Time, Cost, and Environmental Pollutant Emissions." Annals of Vascular Surgery 59, (2019): 167-Accessed April 11, 2024. https://doi.org/10.1016/j.avsg.2019.01.021
32. Wylie-Rosett, Judith, Charles Basch, Elizabeth A. Walker, Patricia Zybert, Harry Shamoon, Samuel Engel, and Marjorie Cypress. "Ophthalmic Referral Rates for Patients with Diabetes in Primary-care Clinics Located in Disadvantaged Urban Communities." Journal of Diabetes and Its Complications 9, no. 1 (1995): 49-Accessed January 26, 2025. https://doi.org/10.1016/1056-8727(94)00005-9.
33. Wolf RM, Abramoff MD, Channa R, Tava C, Clarida W, Lehmann HP. Potential reduction in healthcare Greenhouse Gas Emissions by autonomous artificial intelligence. NPJ Digit Med. 2022 May 12;5(1):62. doi: 10.1038/s41746-022-00605-w. PMID: 35551275; PMCID: PMC9098499.
34. Blue Cross Blue Shield of Massachusetts. Medical policy: retinal telescreening for diabetic retinopathy. Accessed 25 March Available from https://www.bluecrossma.org/medical-policies/sites/g/files/csphws2091/files/acquiadam-assets/065%20Retinal%20Telescreening%20for%20Diabetic%20Retinopathy%20prn.pdf
35. Centers for Medicare and Medicaid October 2024 Medicaid and CHIP Enrollment Highlights. Available at: https://www.medicaid.gov/medicaid/program-information/medicaid-and-chip-enrollment-data/report-highlights/index.html. Accessed on 13 February 2025.

 doi:10.20944/preprints202606.0303.v1

36. Center for Medicare and Medicaid Monthly Enrollment. Available at: https://data.cms.gov/summary-statistics-on-beneficiary-enrollment/medicare-and-medicaid-reports/medicare-monthly-enrollment. Accessed on 13 February 2025.
37. Goldstein, J., Weitzman, D., & Abràmoff, M. (2022). 69-OR: Implementing Autonomous AI in a Federally Qualified Health Center (FQHC) for the Detection of Diabetic Retinopathy Improves Access to Care: A Pre–Post Comparison in the Southeastern U.S. Diabetes. https://doi.org/10.2337/db22-69-or.
38. Song, Ailin, Nicholas A. Johnson, Delaram Mirzania, Alexandria M. Ayala, Kelly W. Muir, and Atalie C. Thompson. "Factors Associated with Ophthalmology Referral and Adherence in a Teleretinal Screening Program: Insights from a Federally Qualified Health Center." Clinical Ophthalmology (Auckland, N.Z.) 16, (2022): 3019. Accessed January 26, 2025. https://doi.org/10.2147/OPTH.S380629. PMCID: PMC9480601 PMID: 36119392