

IFMSA Policy Document Rural Health

Proposed by the IFMSA Team of Officials
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Policy Statement

Introduction

Rural health, also known as rural medicine, is the interdisciplinary approach to health and healthcare delivery in rural environments. Rural health practice is inherently interdisciplinary, encompassing various fields such as wilderness medicine, geography, midwifery, nursing, sociology, economics, and the innovative applications of telehealth and telemedicine. Understanding rural health is crucial for medical students as future health leaders as it exposes them to various health issues, challenges, socioeconomic inequities, and interdisciplinary approaches typically encountered in rural settings. Hence, they must gain valuable skills and perspectives to address the unique needs of rural health to achieve equitable health outcomes for all.

IFMSA Position

The International Federation of Medical Students Associations (IFMSA) stands to raise awareness for achieving equitable health outcomes for all, including those residing in rural areas. As future health professionals, we strongly believe in the importance of improved access to healthcare in rural and remote areas to achieve Universal Health Coverage (UHC) and, therefore, attain Sustainable Development Goal (SDG) three by 2030. In order to achieve this, the socioeconomic inequities between rural and urban settings need to be addressed. Action on this disparity requires acknowledgement of factors including the social and structural determinants of health, access barriers (including distance, transportation and access to digital health technologies), and health workforce education & training programs, as they remain evidence-based measures to closing the gap for equitable access to healthcare in rural and remote areas.

Call to Action

Therefore, the IFMSA calls on:

The World Health Organization [WHO] and Non-Governmental Organisations [NGOs] to:

- Implement measures to reinforce the delivery of services in rural areas, encompassing not only health services but also those elements that are crucial determinants of health, as highlighted by the UN System-Wide Action Plan for the "Third United Nations Decade for the Eradication of Poverty 2018–2027" and the 2019 UN General Assembly resolution on "Eradicating rural poverty to implement the 2030 Agenda for Sustainable Development"
- Develop evidence-based frameworks that support the recruitment and retention of health workers in rural areas
- Ensure the equitable distribution of services at both national and global levels, aligning with the overarching goal of equitable health access for all, through policy and incentive structures, infrastructure development, digital health strengthening, sustainable financing, and community engagement

National, State and Local Governments, Ministries, along with Departments of Health and Departments of Education to:

- Develop policies and strategic frameworks that prioritise rural health coverage and enhancing working conditions for the rural health workforce;
- Implement multidisciplinary, collaborative healthcare services, including non-physician personnel, that focus on providing integrated and holistic healthcare services for rural community members;
- Promote and facilitate the implementation of policies that support rural communities access to healthcare and infrastructures;
- Establish guidelines to foster enhanced uses of digital technologies, disease surveillance and telemedicine, in conjunction with improved research and development into novel solutions to bridge inequalities in access to healthcare;

- Develop and implement infrastructure to support continuous professional development of medical professionals practising in rural locations through quality medical training and employment opportunities; and
- Collaborate with medical councils, associations, faculties, specialty colleges, and/or universities to increase provision of training opportunities in rural medical training across different medical specialities.

Medical Education Regulatory Bodies, Universities, and Medical Schools to:

- Ensure rural medical schools have adequate infrastructure and resources to provide quality medical education that meets the basic medical education standards depicted by medical regulatory bodies.
- Promote representation and ensure equitable access to medical education for students of rural origin and/or students who intend to practise medicine rurally;
- Embed , interprofessional/multidisciplinary community based education programs in rural settings within the curriculum of medical schools that employ the principles of social accountability.
- Integrate practical learning experiences, including rural medical placements, into the medical education pathway. These placements will provide invaluable exposure to the breadth of practice in rural settings, ensuring that the next generation of healthcare professionals are well-prepared to serve these vital communities.

The Private Sector to:

- Actively engage in public-private partnerships to support and invest in research and development of innovative solutions, technologies, and medical interventions that can contribute to effective delivery of healthcare services in rural settings.
- Utilise expertise, resources, and logistical capabilities to assist in the distribution of essential medical supplies, equipment, and vaccines, ensuring equitable access and coverage to rural communities.

Healthcare facilities to:

- Affiliate and establish partnerships with healthcare systems in urban settings in order to improve and optimise health care delivery in rural communities by offering their patients improved infrastructure, healthcare and travel resources that are more financially viable;
- Implement incentives for rural physicians including improved salary structures and more conducive living standards as a means to attract more physicians to undertake practice in rural settings;
- Integrate public health programs into primary healthcare delivery so as to educate rural community members about disease prevention, and health promotion.

IFMSA NMOs and medical students to:

- Advocate for greater inclusion and representation of students of rural origin and students who are studying in rural areas;
- Collaborate with medical education bodies to implement strategies to foster interest and leadership opportunities in rural health; and
- Conduct and participate in rural-health related, and capacity-building activities that promote interest in rural health, raise awareness of rural health inequity, and train students with adequate skills required for the breadth of rural practice.

Position Paper

Background information

Rural health is the health of people living in rural areas, who generally are located farther from health care facilities and other services than people living in urban areas [1]. Globally, 44.8% of the world's population lives in rural and remote areas [2].

Rural areas tend to have higher rates of people who do not have health insurance and who have limited access to health care services because many medical centres in rural areas are closing. [3].

There is inequity in health resource availability between rural and urban areas alongside socioeconomic differences which are a persistent global phenomenon. This is particularly apparent in low and middle-income countries. However, it is common to almost all countries and poses a major challenge to health systems worldwide [2]. While reducing the inequality in healthcare was a key goal of the World Health Organisation's 2010 recommendations on 'Increasing access to health workers in remote and rural areas through improved retention', a post-2015 review found that 56% of the global rural population lacks health coverage compared to only 22% of their urban counterparts. This inequity in healthcare between rural and metropolitan is multifactorial in causation.

A common issue that rural populations face is the accessibility of healthcare in terms of distance and transportation barriers. Further, the inequity is attributed to the fact that rural populations are frequently confronted with an 'informal' economy and self-employment and thus cannot generate sufficient income to afford quality healthcare services. Currently, there is an insufficient number of skilled professionals to provide necessary healthcare services in many rural and remote areas around the world [4]. Although half of the world's population lives in rural areas, only 23% of the global health workforce is deployed there. Indeed, an extra seven million health workers are needed to make up for this shortfall in rural areas across the world [5].

The health inequities experienced by rural populations result from adverse social and environmental determinants, as well as weaker health systems in rural areas. The importance of strengthening the provision of services in rural areas, including health services and those constituting important health determinants, has been highlighted in the UN System-Wide Action Plan for the "Third United Nations Decade for the Eradication of Poverty 2018–2027" and the 2019 UN General Assembly resolution on "Eradicating rural poverty to implement the 2030 Agenda for Sustainable Development" [6]

To conclude, compared to urban areas, rural communities tend to have higher poverty rates; a higher percentage of older adults, who are more likely to have chronic health problems; more residents without health insurance; less access to health care due to far distances; higher rates of substance use and substance use disorders, such as cigarette smoking, opioid and methamphetamine misuse; higher rates of chronic health problems such as high blood pressure and obesity; and, more exposure to environmental hazards, such as chemicals used for farming.

Discussion

1. Statistics on Health Disparities

Around 3.4 billion people, constituting nearly half of the world's population, reside in rural areas, with the majority concentrated in developing nations in Africa and Asia. It is anticipated that about 62 percent of the population in low-income countries will still inhabit rural areas by 2030 [7]. This highlights the enduring importance of rural health, encompassing the overall well-being of individuals in sparsely populated areas marked by agricultural landscapes, small towns, and remote communities. These areas, characterised by lower population density,

geographic isolation, limited healthcare access, and socioeconomic disparities, pose distinct challenges that significantly influence the health outcomes of their residents [3].

Significant health disparities persist between rural and urban populations, impacting life expectancy and overall health outcomes. While reducing the disparities and inequalities in healthcare was a key goal of the World Health Organisation's 2010 recommendations on 'Increasing access to health workers in remote and rural areas through improved retention' [8], a post-2015 review found that 56% of the global rural population lacks health coverage compared to only 22% of their urban counterparts. [9]

Rural residents face elevated mortality rates from leading causes, including heart diseases, cancers, unintentional injuries, chronic lower respiratory diseases, and strokes. The prevalence of chronic conditions is notably higher among rural adults, particularly in heart problems. Risky health-related behaviours, such as smoking, alcohol consumption, obesity, and physical inactivity, further compound existing health disparities. These disparities stem from factors like limited access to healthy foods, reduced opportunities for physical activity, and challenges in healthcare access, including shortages of healthcare workers and emergency facilities. Additionally, disparities in healthy food access persist, especially in low-income, minority, and rural neighbourhoods. Demographic characteristics, such as older age, lower incomes, and less education, contribute to the complexity of health disparities in rural communities. [10].

Contributing factors to rural health disparities are multifaceted. Geographic barriers, such as long travel distances to specialty and emergency care, impede timely access to healthcare services [11].

It was estimated that 736 million people lived on less than \$ 1.90 a day in 2015, with 80% of which lived in rural areas [12]. Socio-economic challenges, including higher poverty rates, limited healthcare access, and lower health insurance coverage, directly impact their health outcome. [13]

2. Health Disparities in Rural Communities

2.1 Non-Communicable Diseases

Noncommunicable diseases [NCDs] are the most common cause of death worldwide [14,15,16], and more than 90% of premature deaths from NCDs occur in low- and middle-income countries [17]. Health disparities are differences in health status when compared to the population overall, often characterised by indicators such as higher incidence of disease and/or disability, higher mortality rates, lower life expectancies, and higher rates of chronic pain [18]. Rural risk factors for health disparities include geographic isolation, lower socioeconomic status, higher rates of health risk behaviours, limited access to healthcare specialists and subspecialists, and limited job opportunities. Rural residents are also less likely to have employer-provided health insurance coverage [18].

Achieving universal health coverage, defined as ensuring that all people have access to essential health services without suffering financial constraints by 2030, is one of the key targets of the sustainable development goals [SDGs] [19, 20]. However, a global monitoring report released by the World Health Organization and World Bank reflects the situation of "poverty caused by illness" in the global population in 2017: [18] more than 122 million people were classified as "poor" [living on less than \$3.10 a day] due to health care expenditure; [19] about 100 million people were pushed into "extremely poor" [living on less than \$1.90 a day] because they have to pay for health care [3]. With the prevalence of chronic non-communicable diseases [NCDs] accompanied by accelerated population ageing, an increasing number of individuals worldwide will suffer from catastrophic health expenditure [CHE] in the future [21].

2.2 Environmental Health

Environmental health in rural areas is a multifaceted challenge influenced by structural factors. Rural communities face distinct environmental hazards, with exposure to chemicals used in farming, and it is estimated that 44% of farmers are poisoned by pesticides every year [22]. Such exposure can result in a range of health effects, including irritation of the skin, eyes, and respiratory tract. Moreover, it poses risks to the nervous and endocrine systems, with certain pesticides identified as potential carcinogens. [23] Furthermore, specific threats like abandoned uranium mines contaminate drinking water sources in the Navajo Nation, USA. [24]

Moreover, the impacts of climate change, including droughts, fires, and extreme heat, further exacerbate environmental risks in these areas [24].

Furthermore, rural areas face the issue of household air pollution. Approximately one-third of the global population, totaling around 2.3 billion people, relies on open fires or inefficient stoves fueled by kerosene, biomass, and coal, leading to harmful household air pollution. In 2020, household air pollution was associated with an estimated 3.2 million deaths, including over 237,000 child fatalities. Women and children bear a significant health burden due to their involvement in household chores, exposing them to pollutants. [25]

These risks, coupled with the limited availability of transportation options, limited access to the Internet, and a scarcity of healthcare facilities, compound the challenges faced by rural communities [25]. This combination of factors results in a disproportionate burden of physical environmental exposures across rural areas. [26].

2.3 Maternal and Child Health

Rural women experience poorer health outcomes and have less access to health care than urban women. Many rural areas have limited numbers of healthcare providers, especially women's health providers [27].

There are strong links between the social determinants of health — including structural discrimination and social inequities — and obstetric outcomes. Factors that influence maternal health status before and during pregnancy include racial disparities, insurance status, educational attainment, and median income level. Rural residents are more likely to be affected by social determinants of health that contribute to late-onset prenatal care. These include lower household incomes, lower educational attainment, higher rates of uninsurance, and higher rates of public insurance. [28]

Lack of care coordination. Rural women lack access to coordinated care, and specifically, coordinated maternal health services, from prenatal through postpartum care. With the closure of rural hospitals and obstetric units, rural women may experience challenges receiving coordinated care. Maternal healthcare in rural communities is provided by specialty providers, family physicians, advanced practice nurses, nurses, certified nurse midwives, community health workers, and doulas. [29]

Transportation barriers. Rural women face significant transportation barriers to maternal care, which may result in delayed prenatal care. Rural women may face long distances to appointments or lack transportation options. As a result of rural hospital closures, over half of rural women need to drive more than 30 miles to receive obstetric services, with some needing to drive 100 miles or more. [29]

2.4 Health Education and Literacy

Health education and health literacy are considered critical in forming the health and well-being of individuals, and their role in shaping rural health is undeniable. Health literacy encompasses the ability of individuals to access, understand, and use health information effectively. [30]. One of the challenges rural areas face is the low education level [31], as a study states that rural rates of illiteracy exceed urban ones nearly universally [32]. A low education level leads to worse overall health and shorter lifespan compared to higher-educated peers [33]. Moreover, many rural residents experience frequent challenges accessing and navigating the healthcare system and, in some cases, obtaining health information. Also, conditions associated with living in poverty, like health insurance status, often associated with more limited levels of health literacy, are prevalent in many rural communities [29]. Additionally, lack of broadband internet access in these areas limits access to health

information that might prove vital to a patient's well-being. [31]. All these factors lead to rural communities suffering from low health literacy rates.

3. Healthcare Access in Rural Communities

For healthcare to be considered accessible, it must meet the following criteria: availability, affordability, accessibility, acceptability, and quality [AAAQ] [34].

Approximately 2 billion people living in rural areas do not have access to basic healthcare [35]. While healthcare coverage is increasing globally, rural residents have less coverage than the national average [35]. According to the ILO, 56% of people living in rural areas did not have legal health coverage in 2015, compared to 22% in urban areas [36].

Interdisciplinary primary healthcare, including accelerated medically trained clinicians and community health workers, plays a crucial role in ensuring access to essential health promotion, prevention, treatment, rehabilitation, and palliative care services [37].

Geographic remoteness and a lack of public services impose transport barriers and financial strains on rural patients accessing primary, secondary, and tertiary care [37]. Distance was named as a barrier to accessing healthcare by 45% of women living in rural areas [38]. In addition to physical barriers, cultural perceptions, stigma, discrimination, and compromised confidentiality in healthcare providers due to personal relationships negatively affect acceptability [40].

A key issue in accessing healthcare in rural areas is the growing shortage of healthcare workers, which, according to the ILO, is 2.5 times higher in rural areas [36]. This challenge requires multifaceted intervention [37]. Having a rural background is strongly correlated with practicing in rural areas. This emphasises the importance of socially accountable student recruitment to medical and healthcare programs. Additionally, providing support for housing, favourable working conditions, clinical backup, continuous professional development, and career prospects all contribute to retaining healthcare workers in rural areas. Voluntary incentives, such as student loan relief, result in higher retention rates when compared to mandatory service in rural areas [40].

There is an evident lack of research on outcomes of interventions to increase access to healthcare in rural health, both concerning surrogates such as workforce retention and health outcomes. Thus, it is important to rigorously follow up on measures taken and to include rural populations in medical research [37].

4. Rural Health in Medical Education

Physicians born and/or raised in rural areas tend to work in rural facilities more frequently than those of an urban origin [41]. Besides their origins or previous education, medical students will benefit from rural-setting immersive learning experiences when witnessing skilled clinicians, fostering continuity of care, and developing close doctor-patient relationships [42]. Studies also show that when doctors train in rural areas, more of them decide to work in those areas later on, and this will consequently lead to better access to healthcare in rural areas [43,44]. This has been especially seen among family medicine and obstetric healthcare workers [45,46], and less likely in other areas such as surgery, but more studies have to be developed [48].

Many institutions are teaching digital health and other strategies that have been proposed as potential solutions to the disparities between urban and rural health [48,49].

5. Strategies to improve Rural Health

Remote areas often encounter challenges in healthcare delivery due to the residents' difficulties in accessing and navigating healthcare services [50]. These challenges are compounded by transportation difficulties [51]. Moreover, rural populations typically demonstrate lower levels of health literacy [52]. This lower health literacy profoundly affects individuals' ability to comprehend and apply health information, leading to poorer health outcomes and decreased utilisation of healthcare services [53].

Improving rural health demands innovative and holistic strategies that harness the power of digital health, prioritise research initiatives, and embrace mobile healthcare units [54]. Integrated approaches aim to overcome the unique challenges faced by rural communities, ensuring equitable access to quality healthcare and fostering long-term well-being [55].

5.1 Digital health

Digital health technologies offer a transformative avenue for overcoming geographical barriers in rural areas [56]. The World Health Organization [WHO] defines digital health technologies as: *“the field of knowledge and practice associated with the development and use of digital technologies to improve health”* and concrete that *“Digital health expands the concept of eHealth to include digital consumers, with a wider range of smart and connected devices. It also encompasses other uses of digital technologies for health such as the Internet of Things [IoT], advanced computing, big data analytics, artificial intelligence including machine learning, and robotics”* [57]. Telemedicine, especially relevant during the COVID-19 pandemic, accelerated due to increased funding, policy approvals, and collaborative research [58].

Artificial intelligence and machine learning [AI/ML] has matured, showcasing capabilities in disease detection [59,60], preventive medicine [61], and personalised health insights [62]. Wearable sensors, nanomaterial-enabled, record diverse health signals [63]. No matter the medical issues at hand, it's crucial to collaborate across different disciplines to make the most of digital health technologies [64].

Implementing new technologies in healthcare, like digital health, faces challenges such as low digital literacy and access issues, especially among older adults [65]. Poor app design and inadequate regulations can hinder technology adoption, impacting telemedicine and overall efficacy [66,67]. Concerns include data privacy, app accuracy, and the potential bias of algorithms [68,69]. Additionally, issues of equity, professional integrity, and interoperability must be addressed, emphasising the need for a careful, ethical, and cost-effective approach to integrating digital health technologies into global healthcare systems [69]. Despite the aforementioned challenges, when considering the negative and positive aspects, the overall assessment leans towards a more positive outlook [56].

5.2 Mobile unit model

Another tool that tends to limit the distance barrier and improve the quality of rural residents' lives, is mobile health units. Converted vans and small trucks travel to remote populations and serve health screenings, dental services, or even enrollment benefits, thus initiating preventative care, managing chronic diseases and addressing the disparities of social determinants of health. Additionally, mobile units have the potential to provide cost-saving benefits by promoting prevention and early diagnosis, as well as self-management of people's health [73,74]

6. Role of Youth and medical students in Rural Health

Youth have an important role to play in rural health and rural health advocacy. Research has shown that rural health services have a decreased propensity to address adolescent health problems. Studies have also shown that youth living in rural areas report lower levels of stress yet significant risk behaviours in areas such as sexual health, mental health, substance abuse and obesity. [74,75,76] This underscores the importance of including adolescent health preventive and curative services in rural areas. While prioritising youth health remains a challenge, there is a need for local youth health advocates to promote health service delivery to youth in rural areas. Youth can also play a role in designing adaptive local solutions including the use of technology to serve youth health needs [77]

Medical students can also contribute to rural health by undergoing formal and nonformal rural health training. A study shows that a health workforce is more likely to serve in rural areas if the personnel is born in a rural area and undergoes positive undergraduate and postgraduate graduate training in rural health [76]. This theory places great importance on the role of institutional training of a rural health workforce and the perspectives of medical students towards serving in rural areas.

7. Global Efforts on Rural Health

Rural health policy is present in select developed countries. There is a lack of information regarding rural health policy in developing countries, despite most of the world's rural population being in developed countries. Most developed countries focus on sub-national policies which regulate healthcare in specific regions as opposed to national policies. [79]

Some regulations used to promote rural health include outlining emergency and health services in rural areas to 'network' and streamline transport to medical care and integration of digital health services. Other regulations include focused training of health professionals in rural health, expanding insurance coverage for people in rural areas and providing fiscal support to rural hospitals and health centres. [79]

Research has shown that despite this work in the scope of rural health, inequalities in health outcomes continue to persist. [80,81,82] with the exception of a handful of developed countries. With almost 50% of the world's population concentrated in rural areas and two billion people in rural areas without adequate care, rural health financing falls short in the face of large demand. [83,84] The reasons for this difference have been attributed to deficiencies in health workforce maintenance, service delivery and quality, geographical considerations, lack of research and advocacy, cultural sensitivities and political bias. [85,86]

Studies have proposed social innovation as a way to deal with complex and compelling rural health challenges. This relies on the argument that rural health systems require efficient and considerate solutions, differing from those of urban areas [86,87]

Organisations rarely address rural health on a separate basis. This is possibly due to differences in the definition of 'rural' especially when defined through a variable metric [eg. Population]. The unwise use of this terminology may interfere with populations and health policies in case a rural area is treated as urban and vice versa. [88]

Health in rural areas is well considered in the global health agenda through goal 3.8 of the SDGs which is to achieve Universal Health Coverage [UHC] for all populations. The increased global focus on pursuing primary healthcare-focused health systems which encourage continuity of care and community participation will also indirectly develop rural health. [89]

References

1. Meltzer S. Rural Healthcare. Science Direct. 2008. <https://www.sciencedirect.com/topics/medicine-and-dentistry/rural-health>
2. Rural population [% of total population]: World Bank staff estimates based on the United Nations Population Division's World Urbanization Prospects: 2018 Revision. The World Bank; 2018 <https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS>
3. U.S. Food & Drugs Administration. Rural Health. [Internet]. Available at <https://www.fda.gov/consumers/minority-health-and-health-equity-resources/rural-health>
4. Alan Bruce Chater, Jim Rourke, Roger Strasser, Ian Couper, Steve Reid. The WONCA Rural Medical Education Guidebook. Gramado: WONCA; <http://www.globalfamilydoctor.com/site/DefaultSite/filesystem/documents/ruralGuidebook/Preface.pdf>
5. Global evidence on inequities in rural health protection: New data on rural deficits in health coverage for 174 countries. Geneva: International Labour Organization; 2015 <https://www.socialprotection.org/gimi/gess/RessourcePDF.action?ressource.ressourceId=51297>
6. WHO. Health Inequities Among People Living in Rural and or remote areas. Available at <https://www.who.int/activities/addressing-health-inequities-among-people-living-in-rural-and-remote-areas>. January 2024
7. Alieu, A. M. Implementing nationally appropriate social protection systems and measures for all: gaps and challenges facing rural area. 2019. February 27. https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2019/03/Andrew-Allieu_SP-for-rural-areas_22-Feb-18.pdf
8. WHO. Global Achievements 2023. [Internet] Available at <https://www.who.int/> January 2024
9. ILO. Social Protection Platform [Internet] Available at social-protection.org. January 2024
10. CDC. Rural Health: Preventing Chronic Diseases and Promoting Health in Rural Communities. [Internet]. Available at <https://www.cdc.gov/chronicdisease/resources/publications/factsheets/rural-health.htm>. January 2024
11. Buzza C, Ono SS, Turvey C, Wittrock S, Noble M, Reddy G, Kaboli PJ, Reisinger HS. Distance is relative: unpacking a principal barrier in rural healthcare. J Gen Intern Med. 2011 Nov;26 Suppl 2[Suppl 2]:648-54. doi: 10.1007/s11606-011-1762-1. PMID: 21989617; PMCID: PMC3191222. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3191222/>
12. FAO. 2019. FAO framework on rural extreme poverty: Towards reaching Target 1.1 of the Sustainable Development Goals. Rome. 56 pp. <https://www.fao.org/documents/card/en/c/ca4811en/>
13. McMaughan DJ, Oloruntoba O, Smith ML. Socioeconomic Status and Access to Healthcare: Interrelated Drivers for Healthy Aging. Front Public Health. 2020 Jun 18;8:231. doi: 10.3389/fpubh.2020.00231. PMID: 32626678; PMCID: PMC7314918. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7314918/>
14. World Health Organization Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013-2020. 2013; https://apps.who.int/iris/bitstream/handle/10665/94384/9789241506236_eng.pdf?sequence=1. Accessed April 20, 2020. [Ref list]

15. World Health Organization Noncommunicable Diseases. 2018; <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>. Accessed April 16, 2020. [Ref list]
16. World Health Organization Noncommunicable Diseases. 2018; <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>. Accessed April 16, 2020.
17. World Health Organization Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013-2020. 2013; https://apps.who.int/iris/bitstream/handle/10665/94384/9789241506236_eng.pdf?sequence=1. Accessed April 20, 2020
18. Rural Health Information Hub. Rural Health Disparities [internet]. Available at <https://www.ruralhealthinfo.org/topics/rural-health-disparities>
19. Evans DB, Etienne C. Health systems financing and the path to universal coverage. Bull World Health Organ. 2010;88[6]:402. <https://www.who.int/bulletin/volumes/88/6/10-078741.pdf> [published Online First: 2010/06].
20. Hogan DR, Stevens GA, Hosseinpoor AR, Boerma T. Monitoring universal health coverage within the Sustainable Development Goals: development and baseline data for an index of essential health services. Lancet Glob Health. 2018;6[2]:e152-e168. [https://www.thelancet.com/pdfs/journals/langlo/PIIS2214-109X\[17\]30472-2.pdf](https://www.thelancet.com/pdfs/journals/langlo/PIIS2214-109X[17]30472-2.pdf) [published Online First: 2017/12/13]
21. Fu, Xz., Sun, Qw., Sun, Cq. et al. Urban-rural differences in catastrophic health expenditure among households with chronic non-communicable disease patients: evidence from China family panel studies. BMC Public Health 21, 874 [2021]. <https://doi.org/10.1186/s12889-021-10887-6>
22. The global distribution of acute unintentional pesticide poisoning: estimations based on a systematic review. BMC Public Health [Internet]. Available at [biomedcentral.com](https://www.biomedcentral.com). January 2024
23. Human Health Issues Related to Pesticides. US EPA, Potential Health Effects of Pesticides. [Internet]. Available at [psu.edu](https://www.psu.edu). January 2024
24. Environmental Factor - December 2021: Rural health disparities influenced by structural factors, experts say. [Internet]. Available at [nih.gov](https://www.nih.gov). January 2024
25. WHO. Global Health Achievements. [internet]. Available at <http://who.int>
26. Marla Broadfoot. Rural health disparities influenced by structural factors, experts say. Environmental Factor. 2021 December [nih.gov](https://www.nih.gov)
27. American College of Obstetricians & Gynecologists [ACOG]. Health Disparities in Rural Women. [Internet]. Available at <https://www.acog.org/clinical/clinical-guidance/committee-opinion/articles/2014/02/health-disparities-in-rural-women>. January 2024
28. Rural Health Information Hub. Barriers to Improving Rural Maternal Health. [Internet]. Available at <https://www.ruralhealthinfo.org/toolkits/maternal-health/1/barriers>. January 2024
29. Rural Health Information Hub. Barriers to Improving Rural Maternal Health. [Internet]. Available at <https://www.ruralhealthinfo.org/toolkits/maternal-health/1/barriers>. January 2024

30. CDC. What is Health Literacy? [Internet]. Available at <https://www.cdc.gov/healthliteracy/learn/index.html>. January 2024
31. Tulan University, School of Public Health & Tropical Medicine. How to improve healthcare in Rural Areas. [Internet]. Available at <https://publichealth.tulane.edu/blog/how-to-improve-health-care-in->
32. Bailey, Gwen & Others. Literacy in Rural America: A Study of Current Needs and Practices. ERIC. December 1992. <https://eric.ed.gov/?id=ED357917>
33. Raghupathi, V., Raghupathi, W. The influence of education on health: an empirical assessment of OECD countries for the period 1995–2015. Arch Public Health 78, 20 [2020]. <https://doi.org/10.1186/s13690-020-00402-5>
34. CESCR General Comment No. 14: The Right to the Highest Attainable Standard of Health [Art. 12]
35. WHO guideline on health workforce development, attraction, recruitment and retention in rural and remote areas [Internet]. Available at <https://www.who.int/publications/i/item/9789240024229>. January 2024
36. Global evidence on inequities in rural health protection: new data on rural deficits in health coverage for 174 countries / Xenia Scheil-Adlung, [Ed.]; International Labour Office, Social Protection Department. - Geneva: ILO, 2015 [Extension of Social Security series ; No 47]
37. WHO guideline on health workforce development, attraction, recruitment and retention in rural and remote areas [Internet]. Geneva: World Health Organization; 2021. PMID: 34057827
38. Tracking Universal Health Coverage: 2023 Global Monitoring Report. Executive summary. Geneva: World Health Organization and International Bank for Reconstruction and Development. [Internet]. Available at https://reliefweb.int/report/world/tracking-universal-health-coverage-2023-global-monitoring-report?gad_source=1&gclid=CjwKCAiA4smsBhAEEiwAO6DEjYZGz9pEgK3Ej7ix6KKctDSirrdAh-3J_TmjZWRC08BjCq3Bq9CauBoC55kQAvD_BwE. January 2024
39. Douthit, S. Kiv, T. Dwolatzky, S. Biswas, Exposing some important barriers to healthcare access in the rural USA, Public Health, Volume 129, Issue 6, 2015, <https://pubmed.ncbi.nlm.nih.gov/26025176/> January 2024
40. Russell, D., Mathew, S., Fitts, M. **et al.** Interventions for health workforce retention in rural and remote areas: a systematic review. **Hum Resour Health** *19*, 103 [2021]. <https://doi.org/10.1186/s12960-021-00643-7>
41. Wade, M. E., Brokaw, J. J., Zollinger, T. W., Wilson, J. S., Springer, J. R., Deal, D. W., White, G. W., Barclay, J. C., & Holloway, A. M. [2007]. Influence of hometown on family physicians' choice to practice in rural settings. Family medicine, 39[4], 248–254. <https://pubmed.ncbi.nlm.nih.gov/17401768/>
42. Rourke J, Rourke LL. Chapter 16: Rural and remote locations. In: Dent J, Harden R, editors. A practical guide for medical teachers. 3rd ed. Edinburgh: Elsevier; 2009. p. 121-129. <https://tms.iau.ir/file/download/page/1632820874-a-practical-guide-for-medical-teachers-book.pdf>
43. Johnson, G.E., Wright, F.C., & Foster, K. (2018). The influence of rural outreach initiatives on medical students' inclination towards rural practice and future work placements: a comprehensive review. BMC Medical Education, 18(1), 196. <https://doi.org/10.1186/s12909-018-1287-y>

44. Goodfellow A, Ulloa JG, Dowling PT, et al. Predictors of primary care physician practice location in underserved urban and rural areas in the United States: A systematic literature review. *Acad Med.* 2016;91[9]:1313-1321. <https://pubmed.ncbi.nlm.nih.gov/27119328/>
45. Meyers, P., Wilkinson, E., Petterson, S., Patterson, D. G., Longenecker, R., Schmitz, D., & Bazemore, A. [2020]. Rural Workforce Years: Quantifying the Rural Workforce Contribution of Family Medicine Residency Graduates. *Journal of graduate medical education*, 12[6], 717–726. <https://doi.org/10.4300/JGME-D-20-00122.1>
46. Fredrickson, E., Evans, D. V., Woolcock, S., Andrilla, C. H. A., Garberson, L. A., & Patterson, D. G. [2023]. Understanding and Overcoming Barriers to Rural Obstetric Training for Family Physicians. *Family medicine*, 55[6], 381–388. <https://doi.org/1>
47. Watanabe, J., & Kotani, K. [2023]. Possible relationship between rural surgical rotations during a residency period and an increased number of general surgeons in rural areas: a systematic review. *Journal of rural medicine : JRM*, 18[1], 1–7. <https://doi.org/10.2185/jrm.2022-031>
48. Tudor Car, L., Poon, S., Kyaw, B. M., Cook, D. A., Ward, V., Atun, R., Majeed, A., Johnston, J., van der Kleij, R. M. J. J., Molokhia, M., V Wangenheim, F., Lupton, M., Chavannes, N., Ajuebor, O., Prober, C. G., & Car, J. [2022]. Digital Education for Health Professionals: An Evidence Map, Conceptual Framework, and Research Agenda. *Journal of medical Internet research*, 24[3], e31977. <https://doi.org/10.2196/31977>
49. Holly, L., Smith, R. D., Ndili, N., Franz, C., & Stevens, E. A. G. [2022]. A Review of Digital Health Strategies in 10 Countries With Young Populations: Do They Serve the Health and Wellbeing of Children and Youth in a Digital Age?. *Frontiers in digital health*, 4, 817810. <https://doi.org/10.3389/fdgth.2022.817810>
50. Mohd Rosnu, N. S., Singh, D. K. A., Mat Ludin, A. F., Ishak, W. S., Abd Rahman, M. H., & Shahar, S. [2022]. Enablers and Barriers of Accessing Health Care Services among Older Adults in South-East Asia: A Scoping Review. *International journal of environmental research and public health*, 19[12], 7351. <https://doi.org/10.3390/ijerph19127351>
51. Shaw, K. M., Theis, K. A., Self-Brown, S., Roblin, D. W., & Barker, L. [2016]. Chronic Disease Disparities by County Economic Status and Metropolitan Classification, Behavioral Risk Factor Surveillance System, 2013. *Preventing chronic disease*, 13, E119. <https://doi.org/10.5888/pcd13.160088>
52. Ford, J. A., Wong, G., Jones, A. P., & Steel, N. [2016]. Access to primary care for socioeconomically disadvantaged older people in rural areas: a realist review. *BMJ open*, 6[5], e010652. <https://doi.org/10.1136/bmjopen-2015-010652>
53. Campos L, Costa D, Donato H, Nunes B, Cruz EB. Implementation of digital health in rural populations with chronic musculoskeletal conditions: A scoping review protocol. *PLoS One.* 2023 Dec 22; <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0291638>
54. Walden A, Kemp AS, Larson-Prior LJ, Kim T, Gan J, McCoy H, Payakachat N, Ward W, Eswaran H. Establishing a digital health platform in an academic medical center supporting rural communities. *J Clin Transl Sci.* 2020 Apr 28;4[5]:384-388. doi: 10.1017/cts.2020.11. PMID: 33244426; PMCID: PMC7681125. <https://pubmed.ncbi.nlm.nih.gov/33244426/>

55. Cosgrave C. The Whole-of-Person Retention Improvement Framework: A Guide for Addressing Health Workforce Challenges in the Rural Context. *Int J Environ Res Public Health*. 2020 Apr 14;17[8]:2698. doi: 10.3390/ijerph17082698. PMID: 32295246; PMCID: PMC7216161. <https://pubmed.ncbi.nlm.nih.gov/32295246/>
56. Yeung AWK, Torkamani A, Butte AJ, Glicksberg BS, Schuller B, Rodriguez B, Ting DSW, Bates D, Schaden E, Peng H, Willschke H, van der Laak J, Car J, Rahimi K, Celi LA, Banach M, Kletecka-Pulker M, Kimberger O, Eils R, Islam SMS, Wong ST, Wong TY, Gao W, Brunak S, Atanasov AG. The promise of digital healthcare technologies. *Front Public Health*. 2023 Sep 26;11:1196596. doi: 10.3389/fpubh.2023.1196596. PMID: 37822534; PMCID: PMC10562722. <https://repository.ubn.ru.nl/handle/2066/297483>
57. Global strategy on digital health 2020-2025. Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IGO. <https://www.who.int/docs/default-source/documents/gS4dhdaa2a9f352b0445bafbc79ca799dce4d.pdf>
58. Petracca, F., Ciani, O., Cucciniello, M., & Tarricone, R. [2020]. Harnessing Digital Health Technologies During and After the COVID-19 Pandemic: Context Matters. *Journal of medical Internet research*, 22[12], e21815. <https://doi.org/10.2196/21815>
59. Ehteshami Bejnordi, B., Veta, M., Johannes van Diest, P., van Ginneken, B., Karssemeijer, N., Litjens, G., van der Laak, J. A. W. M., the CAMELYON16 Consortium, Hermsen, M., Manson, Q. F., Balkenhol, M., Geessink, O., Stathonikos, N., van Dijk, M. C., Bult, P., Beca, F., Beck, A. H., Wang, D., Khosla, A., Gargeya, R., ... Venâncio, R. [2017]. Diagnostic Assessment of Deep Learning Algorithms for Detection of Lymph Node Metastases in Women With Breast Cancer. *JAMA*, 318[22], 2199–2210. <https://doi.org/10.1001/jama.2017.14585>
60. Bulten, W., Kartasalo, K., Chen, P. C., Ström, P., Pinckaers, H., Nagpal, K., Cai, Y., Steiner, D. F., van Boven, H., Vink, R., Hulsbergen-van de Kaa, C., van der Laak, J., Amin, M. B., Evans, A. J., van der Kwast, T., Allan, R., Humphrey, P. A., Grönberg, H., Samaratunga, H., Delahunt, B., ... PANDA challenge consortium [2022]. Artificial intelligence for diagnosis and Gleason grading of prostate cancer: the PANDA challenge. *Nature medicine*, 28[1], 154–163. <https://doi.org/10.1038/s41591-021-01620-2>
61. Ibrahim, M. S., Mohamed Yusoff, H., Abu Bakar, Y. I., Thwe Aung, M. M., Abas, M. I., & Ramli, R. A. [2022]. Digital health for quality healthcare: A systematic mapping of review studies. *Digital health*, 8, 20552076221085810. <https://doi.org/10.1177/20552076221085810>
62. Allesøe, R. L., Lundgaard, A. T., Hernández Medina, R., Aguayo-Orozco, A., Johansen, J., Nissen, J. N., Brorsson, C., Mazzoni, G., Niu, L., Biel, J. H., Leal Rodríguez, C., Brasas, V., Webel, H., Benros, M. E., Pedersen, A. G., Chmura, P. J., Jacobsen, U. P., Mari, A., Koivula, R., Mahajan, A., ... IMI DIRECT Consortium [2023]. Discovery of drug-omics associations in type 2 diabetes with generative deep-learning models. *Nature biotechnology*, 41[3], 399–408. <https://doi.org/10.1038/s41587-022-01520-x>
63. Shajari, S., Kuruvinashetti, K., Komeili, A., & Sundararaj, U. [2023]. The Emergence of AI-Based Wearable Sensors for Digital Health Technology: A Review. *Sensors [Basel, Switzerland]*, 23[23], 9498. <https://doi.org/10.3390/s23239498>

64. Wong, B. L. H., Khurana, M. P., Smith, R. D., El-Omrani, O., Pold, A., Lotfi, A., O'Leary, C. A., & Saminarsih, D. S. [2021]. Harnessing the digital potential of the next generation of health professionals. *Human resources for health*, 19[1], 50. <https://doi.org/10.1186/s12960-021-00591-2>
65. Neter, E., & Brainin, E. [2012]. eHealth literacy: extending the digital divide to the realm of health information. *Journal of medical Internet research*, 14[1], e19. <https://doi.org/10.2196/jmir.16>
66. Martinengo, L., Van Galen, L., Lum, E., Kowalski, M., Subramaniam, M., & Car, J. [2019]. Suicide prevention and depression apps' suicide risk assessment and management: a systematic assessment of adherence to clinical guidelines. *BMC medicine*, 17[1], 231. <https://doi.org/10.1186/s12916-019-1461-z>
67. Scott Kruse, C., Karem, P., Shifflett, K., Vegi, L., Ravi, K., & Brooks, M. [2018]. Evaluating barriers to adopting telemedicine worldwide: A systematic review. *Journal of telemedicine and telecare*, 24[1], 4–12. <https://doi.org/10.1177/1357633X16674087>
68. Sujarwoto, S., & Maharani, A. [2023]. Facilitators and barriers to the adoption of mHealth apps for COVID-19 contact tracing: a systematic review of the literature. *Frontiers in public health*, 11, 1222600. <https://doi.org/10.3389/fpubh.2023.1222600>
69. Galvin, H. K., & DeMuro, P. R. [2020]. Developments in Privacy and Data Ownership in Mobile Health Technologies, 2016-2019. *Yearbook of medical informatics*, 29[1], 32–43. <https://doi.org/10.1055/s-0040-1701987>
70. Painter, J. T., Fortney, J. C., Austen, M. A., & Pyne, J. M. [2017]. Cost-Effectiveness of Telemedicine-Based Collaborative Care for Posttraumatic Stress Disorder. *Psychiatric services [Washington, D.C.]*, 68[11], 1157–1163. <https://doi.org/10.1176/appi.ps.201600485>
71. Stephanie W. Y. Yu, Caterina Hill, Mariesa L. Ricks, Jennifer Bennet, Nancy E. Oriol. The scope and impact of mobile health clinics in the United States: a literature review. *Int J Equity Health*; 2017; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5629787/>
72. Mobile Unit Model. Rural Health Information Hub; [Internet]. Available at <https://www.ruralhealthinfo.org/toolkits/services-integration/2/care-coordination/mobile-unit>. January 2024
73. 1. Alexa C. et al. Rural Adolescent Health: The Importance of Prevention Services in the Rural Community. *Journal of Rural Health*. Wiley Online Library. 2010, August 23. <https://onlinelibrary.wiley.com/doi/10.1111/j.1748-0361.2010.00319.x>
74. Boyd, Candice P et al. Harnessing the social capital of rural communities for youth mental health: An asset-based community development framework. *Australian Journal of Rural Health*. Wiley Online Library. 2008, July 9. <https://onlinelibrary.wiley.com/doi/10.1111/j.1440-1584.2008.00996.x>
75. Johnson, Frida et al. Rural–urban differences in health among youth in northern Sweden: an outcome-wide epidemiological approach. *International Journal of Circumpolar Health*. 2019, July 8. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7595226/>
76. Ahlin, C. H. et al. “There is no reward penny for going out and picking up youths”: issues in the design of accessible youth healthcare services in rural northern Sweden. NIH. 2019. February 04. https://www.google.com/url?q=https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6360772/&sa=D&source=docs&ust=1704160205916950&usg=AOvVaw1NBVJq_64VELgbZDv-PYoj

78. Strasser R. Learning in context: education for remote rural health care. *Rural and Remote Health*. [Internet]. Available at <https://doi.org/10.22605/RRH4033>. January 2024
79. Bernd Rechel, Aleksandar Džakula, Antonio Duran, Giovanni Fattore, Nigel Edwards, Michel Grignon, Marion Haas, Triin Habicht, Gregory P. Marchildon, Antonio Moreno, Walter Ricciardi, Louella Vaughan, Tina Anderson Smith. Hospitals in rural or remote areas: An exploratory review of policies in 8 high-income countries, *Health Policy*, Volume 120, Issue 7, 2016, <https://doi.org/10.1016/j.healthpol.2016.05.011>.
<https://www.google.com/url?q=https://www.sciencedirect.com/science/article/pii/S0168851016301270&sa=D&source=docs&ust=1704170605258020&usg=AOvVaw3NPYJu048lwtTqe-z7-wAx>
80. Schopfer DW. Rural health disparities in chronic heart disease. *Prev Med* 2021;152:106782. 10.1016/j.ypmed.2021.106782 <https://pubmed.ncbi.nlm.nih.gov/34499971>
81. Harrington RA, Califf RM, Balamurugan A, et al.. Call to action: rural health: a presidential advisory from the American heart association and American stroke association. *Circulation* 2020;141:e615–44. 10.1161/CIR.0000000000000753 <https://pubmed.ncbi.nlm.nih.gov/32078375>
82. Iglehart JK. The challenging quest to improve rural health care. *N Engl J Med* 2018;378:473–9. 10.1056/NEJMp1707176 <https://pubmed.ncbi.nlm.nih.gov/29385378>
83. Barclay L, Phillips A, Lyle D. Rural and remote health research: does the investment match the need? *Aust J Rural Health* 2018;26:74–9. 10.1111/ajr.12429 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3644212/>
84. WHO. Health Workforce. [Internet]. Available at <https://www.who.int/teams/health-workforce/health-workfor>. January 2024
85. Hulme A, Thompson J, Brown A, Argus G. The need for a complex systems approach in rural health research. *BMJ Open*. 2022 Oct 3;12[10]:e064646. doi: 10.1136/bmjopen-2022-064646. PMID: 36192093; PMCID: PMC9535183.
86. AIHW . Rural and remote health. Canberra: AIHW, 2020
87. Bautista-Gómez MM, van Niekerk L. A social innovation model for equitable access to quality health services for rural populations: a case from Sumpaz, a rural district of Bogota, Colombia. *Int J Equity Health*. 2022 Feb 14;21[1]:23. doi: 10.1186/s12939-022-01619-2. Erratum in: *Int J Equity Health*. 2022 Apr 20;21[1]:53. PMID: 35164775; PMCID: PMC8842957.
88. Mengyue Zhang, Janet W. H. Sit, Tingxuan Wang & Carmen W. H. Chan. [2023] Exploring the sources of cervical cancer screening self-efficacy among rural females: A qualitative study. *Health Expectations* 26:6, pages 2361-2373.
89. Jimenez G, Matchar D, Koh GCH, Tyagi S, van der Kleij RMJJ, Chavannes NH, Car J. Revisiting the four core functions [4Cs] of primary care: operational definitions and complexities. *Prim Health Care Res Dev*. 2021 Nov 10;22:e68. doi: 10.1017/S1463423621000669. PMID: 34753531; PMCID: PMC8581591.