HARVARD LAW SCHOOL

GLOBAL ACCESS IN ACTION

AI and Community Health Workers

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Physicians are scarce in most low and middle-income countries [LMICs]. In the member countries of the European Union, the number of doctors per 10,000 inhabitants ranges from 33 to 55.[2] In the U.S., the number is 36. By contrast, in both India and the Philippines, the number is 7. The situation in Africa is even more dire. In most countries on the continent, the number is less than 3. In several, it is less than 1.[3]

Until this extreme shortage is corrected, much of the burden of providing basic health care in LMICs will continue to be borne by community health workers (CHWs). Roughly speaking, these are lay health workers who:

1. live in the area they serve;
2. are primarily based in the community (as opposed to a health facility);
3. belong to the formal health system (i.e., are managed by the government or an NGO);
4. perform tasks related to health care delivery; and
5. have received organized training but may not have received formal or paraprofessional certification or tertiary education degree. [4]

Most CHWs operate in rural areas. Typically, they periodically travel from house to house, checking the health status of residents, identifying illnesses, and, when appropriate, providing advice, vaccines, or drugs. In Uganda, for example, CHWs are trained and deployed as follows:

> Using the Uganda MoH training guidelines, Community Health Workers (CHW/VHTs) are trained for 5 days during the initial training and later trained for

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[2] See https://data.oecd.org/healthres/doctors.htm.

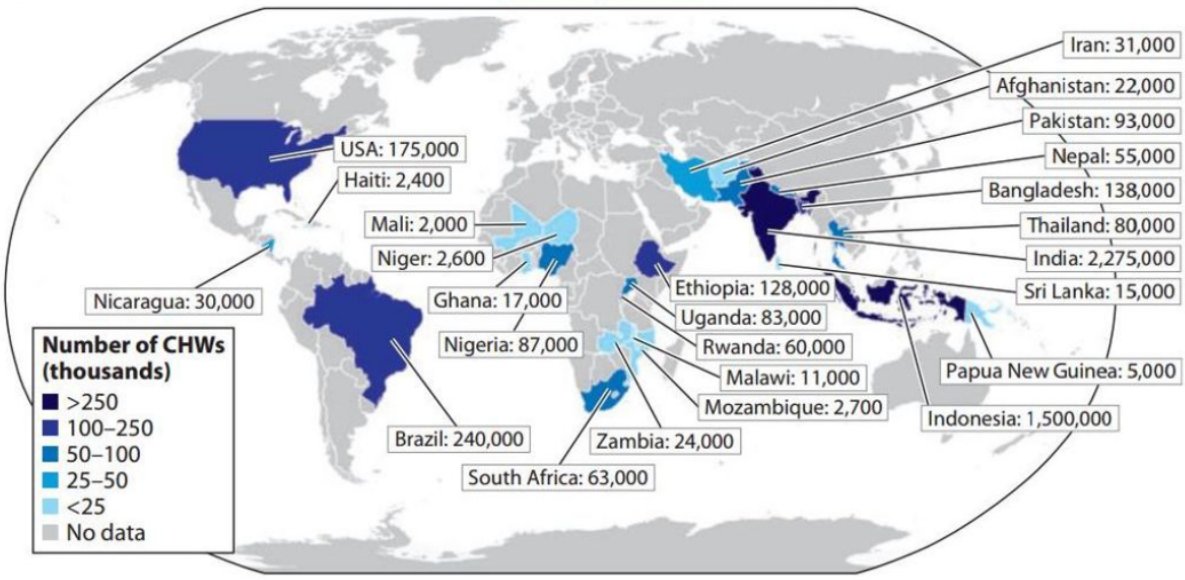
[3] The most complete and current data are available from the World Health Organization, at https://www.who.int/data/gho/data/indicators/indicator-details/GHO/medical-doctors-(per-10-000-population).

[4] Concept Note, "Community Health Workers," Brigham and Women's Hospital (2018), https://www.globalhealthdelivery.org/files/ghd/files/ghd-c11_chw_concept_note.pdf.

additional 5 days on the Integrated Community Case Management (ICCM) full package by the Uganda Ministry of Health National Training Staff. Community Health Workers in Uganda under the Integrated Community Case Management (ICCM) strategy are involved in testing for malaria using Rapid Diagnostic Test (RDT) kits, assessing and treating of pneumonia and diarrhoea, and other prevention and health promotion activities in the community under the supervision of trained health workers at the health facility in the catchment area.[5]

As the following map shows, in several LMICs, the networks of CHWs are large and provide crucial services to substantial portions of the population.[6]

Figura 2. Stima del numero di community health workers in alcuni paesi[3]



The care that CHWs provide is less comprehensive than that provided by doctors and nurses. However, most recent studies have concluded that its scope and quality are surprisingly high:

[5] Fred Bagenda et al., "Contribution of Community Health Workers to the Treatment of Common Illnesses among under 5-Year-Olds in Rural Uganda," *Malaria Journal* 21 (2022). See also Richard Kintu and Heather Lorenzen, "The Ugandan Journey to Integrating Community Health into Health Systems- a Case Study," *USAID*, https://pdf.usaid.gov/pdf_docs/PA00WR4J.pdf. Ministry of Health, "Uganda Launches the First Ever National Community Health Strategy," (2023), https://www.health.go.ug/2023/02/10/uganda-launches-the-first-ever-national-community-health-strategy/#:~:text=This%20strategy%20is%20anchored%20in,both%20rural%20and%20urban%20communities.

[6] Source: https://www.saluteinternazionale.info/2019/03/community-health-workers/. Other descriptions of the crucial roles played by CHWs in Africa can be found in Vickie Remoe, "Community Health Workers: The Unsung Heroes in Africa's Covid-19 Response," *Africa Renewal* (2021), https://www.un.org/africarenewal/magazine/january-2021/unsung-heroes-africa's-covid-19-response.; UNAIDS, "Two Million African Community Health Workers: Harnessing the Demographic Dividend, Ending Aids and Ensuring Sustainable Health for All in Africa," (2017), https://www.unaids.org/sites/default/files/media_asset/African2mCHW_en.pdf.

> Systematic reviews have concluded that CHWs can safely and effectively deliver health services as diverse as birth control injections; perinatal and neonatal care; case management and prevention of malaria, diarrhea, and acute respiratory infections; and HIV care management. There is also emerging evidence that CHWs can provide mental health care. Meta-analysis of moderate-quality evidence indicates that CHWs can, in comparison to usual care, increase the number of children whose immunizations are up-to-date; promote the initiation of exclusive breastfeeding; increase care seeking for pregnancy-related complications; and improve pulmonary TB cure rates. A Cochrane review using evidence from .randomized controlled trials assessed for quality, indicated that CHWs ultimately provide promising benefits in reducing child morbidity (*RR* = 0.86, 95% CI 0.7–0.99; *p* = 0.03), child mortality (*RR* = 0.75, 95% CI 0.55–1.03; *p* = 0.07), and neonatal mortality (*RR* = 0.86, 95% CI 0.75–0.99; *p* = 0.03) when compared to usual care. Modeling of health system investments in CHWs found that the return was as high as 10:1 when accounting for increased productivity from a healthier population, the avoidance of the high costs of health crises, and the economic impact of increased employment.[7]

The extraordinarily rapid improvement of artificial intelligence offers an opportunity to improve the quality of the diagnoses performed by CHWs. The following summary of one of the most promising of the AI initiatives makes the opportunity apparent:

> Google is taking a different approach with its LLM [Large Language Model] chatbot Med-PaLM, which pulls from a massive data set of real questions and answers from patients and providers, as well as medical licensing exams, stored in various databases. When researchers at Google tested Med-PaLM's performance on different "axes," including alignment with medical consensus, completeness and possibility of harm, in a preprint study, its answers aligned with medical and scientific consensus 92.6 percent of the time. Human clinicians scored 92.9 percent overall. Chatbot answers were more likely to have missing content than human answers were, but the answers were slightly less likely to harm users' physical or mental health.[8]

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[7] "Community Health Workers," supra note 4. See also Simon Lewin et al., "Lay Health Workers in Primary and Community Health Care for Maternal and Child Health and the Management of Infectious Diseases," *Cohrane Database of Systematic Reviews*, no. 3 (2010).

[8] Sara Reardon, "AI Chatbots Can Diagnose Medical Conditions at Home. How Good Are They?," Scientific American, March 31, 2023. For additional detail on Med-PaLM, see https://cloud.google.com/blog/topics/healthcare-life-sciences/sharing-google-med-palm-2-medical-large-language-model.; Karan Singhal et al., "Large Language Models Encode Clinical Knowledge," *Nature* 620 (2023).; Wes Davis, "Google's Medical Ai Chatbot Is Already Being Tested in Hospitals," *The Verge* (2023), https://www.theverge.com/2023/7/8/23788265/google-med-palm-2-mayo-clinic-chatbot-bard-chatgpt.; Google Press Release, "Our Progress on Generative Ai in Health," news release, March 19, 2024, https://blog.google/technology/health/google-generative-ai-healthcare/.

DxGPT, a less well-known diagnostic LLM developed by Open AI, has shown similar promise.[9]

Most CHWs already use smartphones to gather data concerning their patients and to assist them in suggesting treatments.[10] The potential utility of those devices could be much enhanced by equipping them with a sophisticated diagnostic AI application.

To be sure, adapting a medical AI system for use by CHWs would not be simple. Ideally, doctors familiar with the diseases in the countries in which the system would be deployed would be enlisted to refine the model. (Med-PaLM 2 has been refined by physicians in India (as well as the US and UK), but apparently not by physicians in any other LMIC.) In addition, the interface for the model would likely have to be modified to facilitate its use by CHWs using the smartphones that they routinely carry. The impediments created by sporadic connectivity would have to be addressed. Last but not least, a program for training CHWs to use the system would have to be developed and tested.

Deployment of the system would also have to be done slowly and cautiously. At a minimum, the following steps would be essential to ensure that the system was safe and effective:

(a) Testing the system in a hospital setting where patients are already under the care of physicians to ensure that the system's diagnoses at least match those of the physicians;
(b) Testing the system on a small scale in the field, where each CHW is accompanied by a physician, who stands ready to override the system's diagnoses whenever they prove misleading or incomplete;
(c) Deployment by unaccompanied CHWs in a small-scale pilot project.

The system would be refined after each of these iterations. Only if it proved consistently reliable would it be fully deployed.

Development and deployment of such a system would only be possible with the active collaboration and support of two parties: a company or institution already engaged in the creation of the diagnostic system; and the ministry of health of an LMIC. With respect to the former, the obvious candidates would be Google or OpenAI, but less high-profile enterprises might be more willing to participate.

With respect to the latter, the following three jurisdictions seem especially promising as potential collaborators: Uganda, the Philippines, and Kerala (in southern India). Robust networks of well-

[9] Information concerning DxGPT is available at https://dxgpt.app. A preliminary evaluation of its accuracy is available at Marina Alvarez-Estape et al., "Evaluation of the Clinical Utility of Dxgpt, a Gpt-4 Based Large Language Model, through an Analysis of Diagnostic Accuracy and User Experience [Not yet Peer Reviewed]," *MedRXiv* (2024).

[10] See, e.g., David Musoke et al., "Enhancing Performance and Sustainability of Community Health Worker Programs in Uganda: Lessons and Experiences from Stakeholders," *Global Health: Science and Practice* 9, no. 4 (2021). ("It also emerged that capacity building using technology (e.g., mobile devices) enabled CHWs to perform their roles better and offered benefits, including improved data quality (collection and reporting), helped learn new skills, and motivated and empowered CHWs. With technology and its benefits, stakeholders noted that community health work will continuously advance and can be enhanced if incorporated in the design of CHW programs. However, stakeholders were concerned about the cost implication as well as limited or no mobile phone network coverage in some rural communities, which challenged technology-based interventions and systems.")

trained CHWs are already in place in all three.[11] Whether the relevant ministries would be supportive and whether healthcare regulations in these jurisdictions would permit such a use of artificial intelligence remain to be seen.

Global Access in Action,[12] a nonprofit institute based at Harvard Law School, is currently exploring the potential for a project of this sort. As part of that process, we are trying to identify other organizations, companies, and universities that either are already pursuing similar ideas or would be interested in doing so.

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[11] See Warren Dodd et al., "Governance of Community Health Worker Programs in a Decentralized Health System: A Qualitative Study in the Philippines," *BMC Health Services Research* 21 (2021); Ministry of Health Republic of Uganda, "National Community Health Strategy," (2022); Hari Sankar et al., "The Role(S) of Community Health Workers in Primary Health Care Reform in Kerala, before and During the Covid 19 Pandemic: A Qualitative Study," *Frontiers in Health Services* 4 (2024).

[12] Information concerning GAiA can be found at https://globalaccessaction.org.

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