

Healthcare Reform as a Tool for Economic and Educational Improvements Across Africa: Introducing PROTUS as a potential socio-economic solution

Ava Wilson¹, Douglas Wilson¹

ourfuture@protushealth.com, protushealthandmanufacturing@gmail.com

PROTUS Health and Medical Manufacturing Solutions,
5 Nelson Street, Bradford, BD1 5AX, United Kingdom¹

Abstract. More than half of African countries are classified as low- to lower-middle income and face major healthcare challenges, including limited access to services, workforce shortages, and heavy dependence on imports for essential medical supplies. The continent has an estimated deficit of 2.3 healthcare workers per 1,000 people, while about 80% of equipment, 70% of medicines, and 99% of vaccines are imported annually. These indicators highlight the link between healthcare capacity, economic development, and skills shortages in Africa.

This paper introduces PROTUS, which proposes that healthcare reform through an integrated approach combining workforce development, localised manufacturing, and clinic expansion can promote economic and educational development. A critical review of literature, global health databases, and relevant science, business, and healthcare sources was conducted to assess the model's potential to strengthen health systems and broader development outcomes.

Findings show a positive relationship between stronger healthcare systems and improved tertiary education outcomes, alongside potential economic gains from healthcare reform. However, evidence on localised manufacturing in healthcare development remains limited. The study concludes that this integrated approach shows promise for advancing healthcare reform in Africa, with possible spillover effects on education and economic growth, though practical implementation is needed to fully evaluate its effectiveness.

Keywords: Africa, diaspora, healthcare, manufacturing, education

1 Background

1.1 Traditional Healthcare in African Nations

“Health” does not have a clear meaning. Definitions depend on scholarly or medical frameworks. Johannes Bircher defines health as “a dynamic state of well being characterized by a physical and mental potential which satisfies the demand of life commensurate with age, culture, and personal responsibility” (as cited in Awofeso, 2005). Huber and colleagues propose to re-define health as “the ability to adapt and to self manage” (Huber et al, 2011, pp. 1-2). Recently, Haverkamp et al (2020) define health as “the dynamic balance of physical, mental, social, and existential well-being in adapting to conditions of life and the environment” (Haverkamp, 2020, pp. 2-3). This paper will adopt the most commonly quoted definition of health which stems from the World Health Organization (WHO). WHO defines health as “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity” (World Health Organisation, 1948). Just as there are overlapping similarities but not homogenous definitions of “health”, there are overlapping similarities but not one homogenous culture of Africa. Africa is a continent of approximately 54 nations filled with a diversity of robust history, culture, and traditions, including indigenous healthcare. The purpose of this section is not to account for every form of indigenous healthcare. Instead, the purpose is to generally address traditional health practices in Africa, a brief description of its history, and why components of traditional medicine are still implemented today.

Traditional healthcare practitioners across Africa include herbalists, traditional birth attendants, bone setters, indigenous psychiatrists, and indigenous surgeons (Anaemene, 2014). In traditional African belief systems, health and religion are intricately connected and cannot be separated (Barnett, 2000, p. 205). Health is not confounded to healing the clinical nature of the illness but also the spiritual. As a whole, traditional African health practices range from clinical factors which include native herbs and skilled surgery to spiritual practices which include rituals (Doyle, 2022, p. 5). Historically, indigenous health practitioners used two major approaches to healing, the pragmatic and the symbolic. The pragmatic steps included examining, diagnosing, and treating patients. Symbolic aspects consisted of chants, incantations, or exorcisms (Barnett, 2000, pp. 204-205). Despite negative connotations, “specific writings about African medical practices, ranging from ancient Egypt to West Africa during the slave trade, describe examinations that revealed a solid understanding of both human anatomy and the symptoms of diverse diseases” (Barnett, 2000, p. 204).

Prior to the 19th century, western medicines from explorers, missionaries and colonists and traditional medicines from African practitioners coexisted with mutual curiosity and respect (Adamu et al., 2023, p. 2). In the 19th century, traditional medicine was stigmatised and outlawed as it was deemed as “witchcraft” (Abdullahi, 2011, p. 116) but most nations were not equipped to adopt forthcoming medical advances. “Eventually, most African countries gained independence in the 1960s, an era that saw rapid and diverse changes in governance and policies that affected all facets

of life, including the provision of healthcare services...In addition, the immediate postindependence period saw many of the countries migrating from a fee-for-service model to a cost recovery healthcare system model. This, among other factors, made Western biomedicine-based healthcare services unaffordable for many people of low socioeconomic status, further strengthening their dependency on traditional medicine..." (Adamu et al., 2023, p. 2).

1.2 Current Healthcare Challenges Facing African Nations and Their Solutions

This section serves to discuss prevalent healthcare issues currently facing Africa and some implemented solutions, especially those regarding dental care and medical manufacturing. This section also briefly describes similar healthcare challenges across the Diaspora including the Caribbean and Black Americans in the United States. The inclusion of these groups provides an academic background as to why shared experiences through healthcare challenges and approaches postulated by the authors may be a socio-cultural method to connect the Diaspora and mainland Africans.

1.3 Healthcare challenges in Africa

Africa faces a plethora of healthcare inequalities and disparities across the continent. Before analysing such factors, it is important to note the differences between these terms. Oftentimes, inequalities and disparities are used interchangeably to mean differences in outcomes; however there are subtle nuances regarding these terms. Healthcare inequalities are defined as avoidable differences in health outcomes between two groups or populations while healthcare disparities are defined as a particular type of health difference that is closely linked with social, economic, and/ or environmental disadvantage. Health disparities are said to adversely affect groups of people who have systematically experienced greater obstacles to health (Office of Health Improvements & Disparities, 2022). Because the purpose of this essay is not to analyse such differences, the authors will join these definitions under the umbrella term as "healthcare challenges". African nations have been actively working to develop their nations; however, the COVID pandemic of 2020 revealed the urgent need for governments to accelerate their projects. Overall, there are still pressing healthcare challenges shared across the continent of Africa.

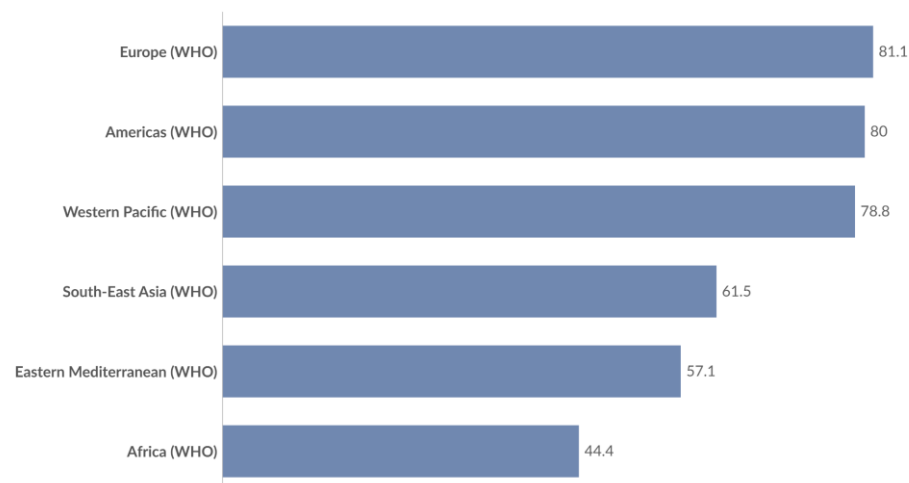
A major healthcare challenge that Africa faces is the disproportionate impact of infectious diseases such as tuberculosis and HIV/ AIDS (Gyapong & Machingaidze, 2023). Though cases are decreasing, malaria is still a significant public health challenge in this continent. Africa still carried the brunt of malaria cases in 2022 with 95% of cases and 94% of deaths globally (World Health Organization, 2025). African nations also have some of the highest maternal and child mortality rates in the world (Statistica, 2025). Though statistics have significantly decreased from 183 deaths per 1,000 live births in 1955 to 47 deaths per 1,000 live births in 2020, the rate is still quite high as compared to other nations such as England and Wales which has an infant mortality rate of 3.6 deaths per 1,000 live births (Armstrong, 2022; Office for National Statistics, 2025).

Africa also faces a major shortage of healthcare professionals. With a population of approximately 1.5 billion, Africa has a deficit of 2.4 million doctors and nurses with a rate of 2.3 healthcare workers per 1,000 people (Eastwood, 2009). Only four countries (Mauritius, Namibia, Seychelles, and South Africa) have surpassed the WHO health worker-to-population ratio (World Health Organization Africa, 2022). Lastly, African nations are at an extreme disadvantage pertaining to access to essential healthcare. WHO - Global Health Observatory's Universal Health Coverage (UHC) Service Coverage Index is a unitless scale of 0 (worse) to 100 (best) that measures the coverage of essential health services. Essential health coverage is based on "tracer interventions that include reproductive, maternal, newborn and child health, infectious diseases, non-communicable diseases and service capacity and access, among the general and the most disadvantaged population" (Our World in Data, 2025). Data ranging from 2000 to 2021 (see Figure 1) revealed that Africa had an average 44.4 access to essential healthcare which was the lowest compared to other regions (Our World in Data, 2025).

The Universal Health Coverage (UHC) Service Coverage Index, 2021



The Universal Health Coverage (UHC) Service Coverage Index is measured on a scale from 0 (worst) to 100 (best) based on the average coverage of essential services including reproductive, maternal, newborn and child health, infectious diseases, non-communicable diseases and service capacity and access.



Data source: World Health Organization - Global Health Observatory (2025)

OurWorldinData.org/financing-healthcare | CC BY

Fig. 1. “The Universal Health Coverage (UHC) Service Coverage Index is measured on a scale from 0 (worst) to 100 (best) based on the average coverage of essential services including reproductive, maternal,

newborn and child health, infectious diseases, non-communicable diseases and service capacity and access” (Our World in Data, 2025).

1.4 Dental care

Dental care is extremely limited in Africa. Dental care is often disregarded as an essential component of healthcare; however, persistent lack of dental treatment can lead to serious health issues. Grounded in extensive research, oral systemic health highlights the connections between oral health and overall body health. Some major health problems caused by poor oral health or untreated oral conditions may include cardiovascular disease, diabetes, high risk pregnancies, respiratory issues, kidney disease, and cancer (AAOSH, 2026). Limited infrastructure and funding have resulted in major dental disparities across Africa. Only 57% of African nations have developed oral health policies with targets and implementation strategies (Bhayat et al, 2025, p. 3). Currently, Africa has a high prevalence of dental diseases, periodontal diseases, and oral cancer (Bhayat et al, p. 2). On average, the dentist to population ratio is approximately 0.03 per 10,000 people across the continent (Bhayat et al, p. 3). Dental technicians range from 0.1 to 0.17 per 10,000 people across the continent (Bhayat et al, p. 3). Consequently, due to high equipment costs and out-of-pocket expenses, 70% of African governments spend on average just \$1USD/ year on oral care (Bhayat et al, p. 4).

Regions	Dentists Median (IQR)	Dental prosthetic technicians Median (IQR)	Dental Assistants and Therapists Median (IQR)
Northern Africa (n = 7)	1.77 (1.1, 4.98)	0.17 (0.08,.)	0 (0, 0)
Central Africa (n = 9)	0.03 (0.01, 0.16)	0.01 (0,.)	0.1 (0,.)
Southern Africa (n = 10)	0.16 (0.09, 0.45)	0.08 (0.03, 0.15)	0.2 (0.1, 0.5)
Eastern Africa (n = 14)	0.18 (0.06, 1.27)	0.04 (0, 0.11)	0.1 (0, 0.2)
Western Africa (n = 15)	0.03 (0.02, 0.15)	0.02 (0.01, 0.06)	0 (0, 0.1)

SD, standard deviation; IQR, Inter-quartile ratio.

Fig. 2. “Oral health workforce distribution across African regions per 10,000 population” (Bhayat et al, 2025, p. 3).

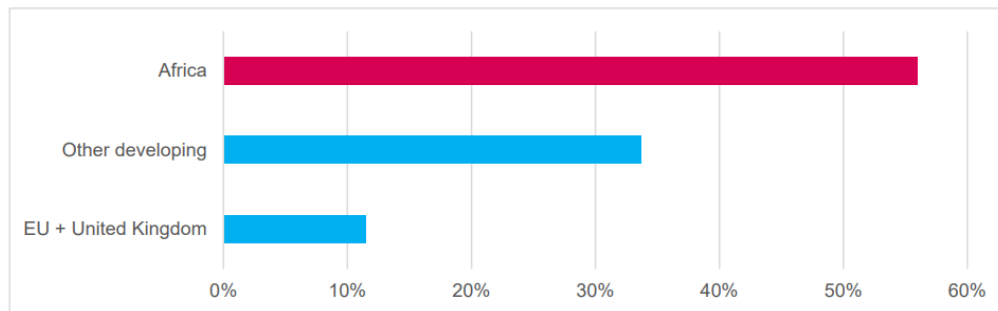
1.5 Medical manufacturing

Nations such as Kenya, South Africa, Zimbabwe, Senegal, and Ghana do manufacture medical and pharmaceutical goods which include syringes, vaccines, and personal protective equipment (Essien, 2024); however, African nations still heavily depend on imported and donated medical and pharmaceutical goods. Currently, African nations import 80% to 94% of medical supplies, 70% to 95% of pharmaceuticals, and 99% of vaccines (Kamara et al., 2024). Despite its heavy reliance on medical imports, Africa faces the most difficulty to import such goods as compared to other regions (see Figure 3). “Challenges occur most often because of inspections and custom ranges that apply

when sourcing medical products. While about one- quarter of the problems relate to the strictness of the measures itself, three- quarters are at least partially due to procedures that frequently involve delays. Administrative burdens, fees or informal payments, or problems stemming from the lack of facilities, also weigh in occasionally. More than 90% of these so-called procedural obstacles occur at home” (International Trade Centre, 2020, p. 5).

The COVID-19 pandemic magnified this disproportional reliance on imported and donated medical goods as many countries imposed export restrictions, impacting the flow of healthcare goods to African nations and exacerbating healthcare disparities in the continent (Essien, 2024). Since the pandemic, governments across Africa have been working diligently to develop and implement self-sustaining medical production. The African Development Bank supports local vaccine manufacturing in line with its 2030 Vision for the Development of Africa’s Pharmaceutical Industry (Mohammed, 2023) and the African Union has set a goal to locally source 60% of vaccines, medicines, and medical technology by the year 2040 (IFC, 2025b). Dr Abdu Mukhtar - the National

Coordinator of the Presidential Initiative for Unlocking the Pharmaceutical Value Chain - aims to increase the share in Nigeria’s locally produced pharmaceuticals, vaccines, and medical devices to at least 70% within the next 5 years (Abdulazeez, 2025) and Rwanda is aiming to establish a biotechnological sector for a homegrown pharmaceutical industry (IFC, 2025a). Overall, African nations are making strides to locally manufacture medical goods, but concerns must be given to other challenges such as deficits in healthcare professionals including dental care.



Source: ITC business surveys on non-tariff measures in 19 African and 47 other countries.

Fig. 3. “Evidence from ITC business surveys on non-tariff measures conducted in 19 African countries in 2010–2017 suggests that regulatory and procedural trade obstacles further complicate access to COVID-19-related products. More than half of all interviewed African importers

reported difficulties – a significantly higher share than in other regions”
(International Trade Centre, 2020, p. 5).

1.6 Diaspora Links: A similar case of healthcare challenges

Caribbean nations and Black Americans face comparable healthcare challenges. Data from 2016 (see Figure 4) showed that those aged 0-9 had the highest potential years of life lost for youth in the Caribbean. This age group accounted for a total of 14,082 per 100,000 deaths with communicable, maternal, neonatal, and nutritional - related diseases being the main cause (Caribbean Public Health Agency, 2019, p. 119). Black American women face poor prenatal, postnatal, and neonatal care. For example, between 2017 and 2019, Black American women died due to pregnancy- related issues at 39.9 per 100,000 births as compared to White American women at 14.1 per 100,000 births (Artiga, Hill, & Presiado, 2024). There is also a significant shortage of Black American doctors in the US, encompassing only 6.3% of primary care physicians (Nivet & Xierali, 2018), furthering economic and education gaps and the lack of cultural sensitivity which is a necessary component of healthcare.

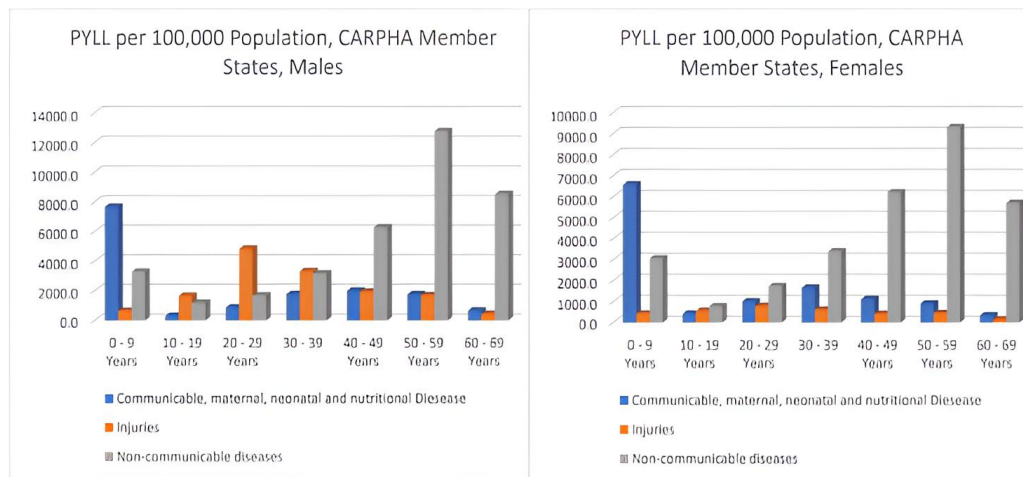


Fig. 4. Potential Years of Life Lost (PYLL) by age group, sex and health condition, CARPHA member states (Caribbean Public Health Agency, 2019, p. 119).

2 Hypothesized Solutions

2.1 Socio- Commercial Approach as a Potential Solution to Africa's Healthcare Needs

Africa requires major healthcare reform to stabilise this continent and governments are exerting significant efforts to achieve this shared goal. Still, external and innovative ideas such as those combining an economic, educational, and socio-cultural framework should be considered to potentially reshape, implement, and drive healthcare reform across Africa.

2.2 Overview of PROTUS

The authors postulate that an innovative approach is needed to aid in accelerating healthcare reform in Africa. The authors hypothesise that workforce development to increase the healthcare professional - to- population ratio; medical manufacturing to localise access to healthcare goods; and clinic construction to expand accessibility of essential healthcare needs may be a potential socio-economic answer to achieve healthcare reform in Africa. The authors have formulated this approach into a social, economic, and cultural- focused enterprise titled PROTUS Health and Medical Manufacturing Solutions. The social aspects of PROTUS are workforce development and clinic construction while the economic aspect is manufacturing. Workforce development encompasses training locals in entry level healthcare roles via apprenticeship programmes (with a focus to target youth) and upskilling healthcare professionals. As a social initiative, funding for implementation is expected to remain at a subsistence level until economic growth is realised. Culturally- speaking, the authors propose that this approach may aid in potentially bridging the gap between Africans and the Diaspora using an interdisciplinary method of culture, healthcare needs, and professional expertise. The authors hypothesize that the proposed approach can be applied to most emerging nations with current attention being those in Africa. The remainder of this section is a critical review of literature, global health databases and science, business, and healthcare sites to evaluate potential efficacy.

2.3 Workforce Development and Healthcare Reform

Education and healthcare play an intricate role that is often undermined. Higher education coincides with greater healthcare conditions while less education coincides with lower healthcare conditions. The evidence supporting the relationship between education and healthcare are cited from (Raghupathi & Raghupathi, 2020). Albeit one source, this article contains strong and reliable evaluations that should be acknowledged. Empirical data retrieved from the World Bank and 26 OECD (Organisation for Economic Co-Operation and Development) countries between 1999 and 2015 identified patterns in education and healthcare indicators. It is necessary to note that the data did not include African nations. Nonetheless, results indicated vital information that can be applied to support the approach to healthcare reform as proposed by the authors, specifically regarding the need for workforce development. The article examined 15 relationships between health outcomes and national statistics, 9 of which specifically evaluated the relationships between education and health outcomes which are presented below.

Analyses. (1) Analyses revealed an association of infant mortality rates with enrolment rates and education levels. In general, nations with increasing education and health status over time show decreases in infant mortality rates (Raghupathi & Raghupathi, 2020, pp. 5-6).

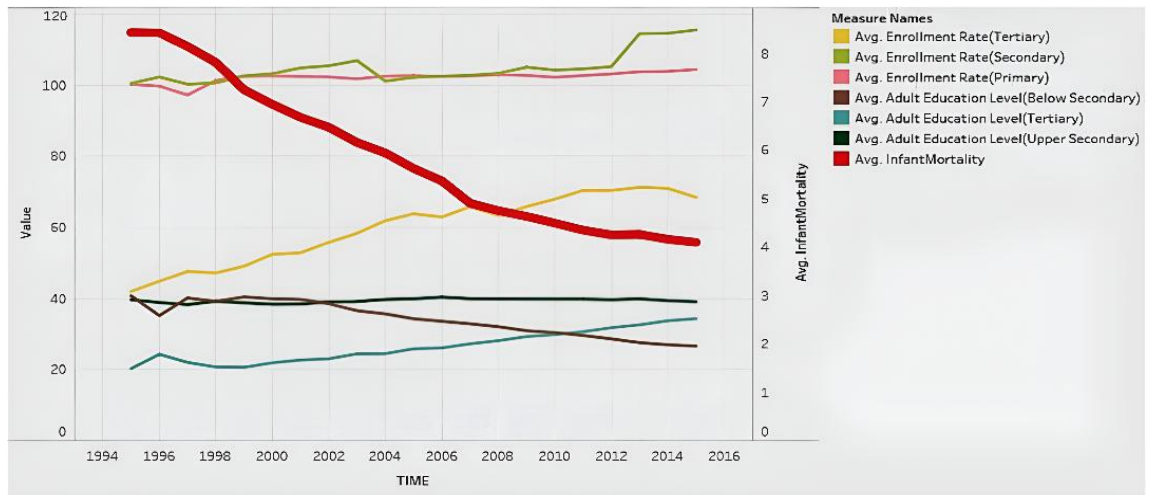


Fig. 5. Association of adult education levels (ratio) and enrollment rates (ratio) with infant mortality rate per 1000 people (Raghupathi & Raghupathi, 2020, pp. 5-6).

(2) Figures suggest an association of education outcomes with life expectancy at birth. Life expectancy at birth rises as tertiary adult-level education and tertiary school life expectancy go up; conversely, life expectancy at birth drops as NEET (not in employment, education, or training) goes up (Raghupathi & Raghupathi, p. 6).

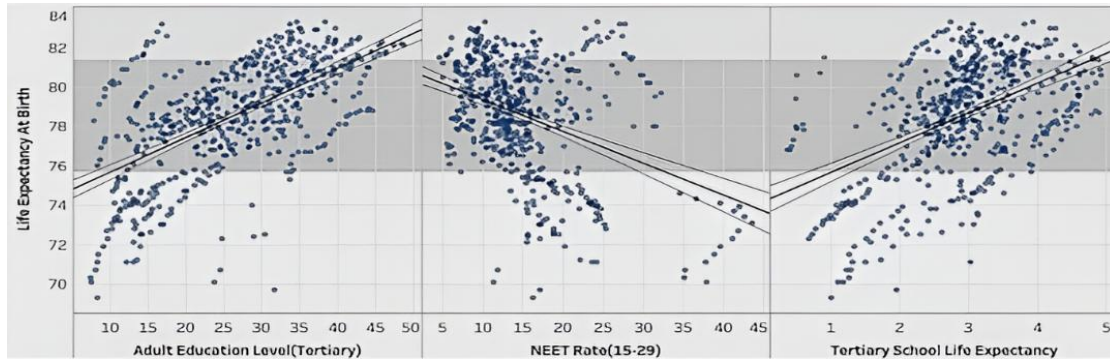


Fig. 6. Association of adult education level (tertiary), NEET rate, school life expectancy (tertiary), with life expectancy at birth (Raghupathi & Raghupathi, p. 6).

(3). Comparisons between tertiary enrollment rates with potential years of lives lost and the education level with potential years of lives lost were also evaluated. These comparisons revealed that with the rise of tertiary adult education level and tertiary enrollment rates, there was a decrease in the value and variation of the potential years of life lost. This analysis suggests that lower levels in education negatively impact a country's health situation in terms of premature mortality (Raghupathi & Raghupathi, 2020, p. 6).

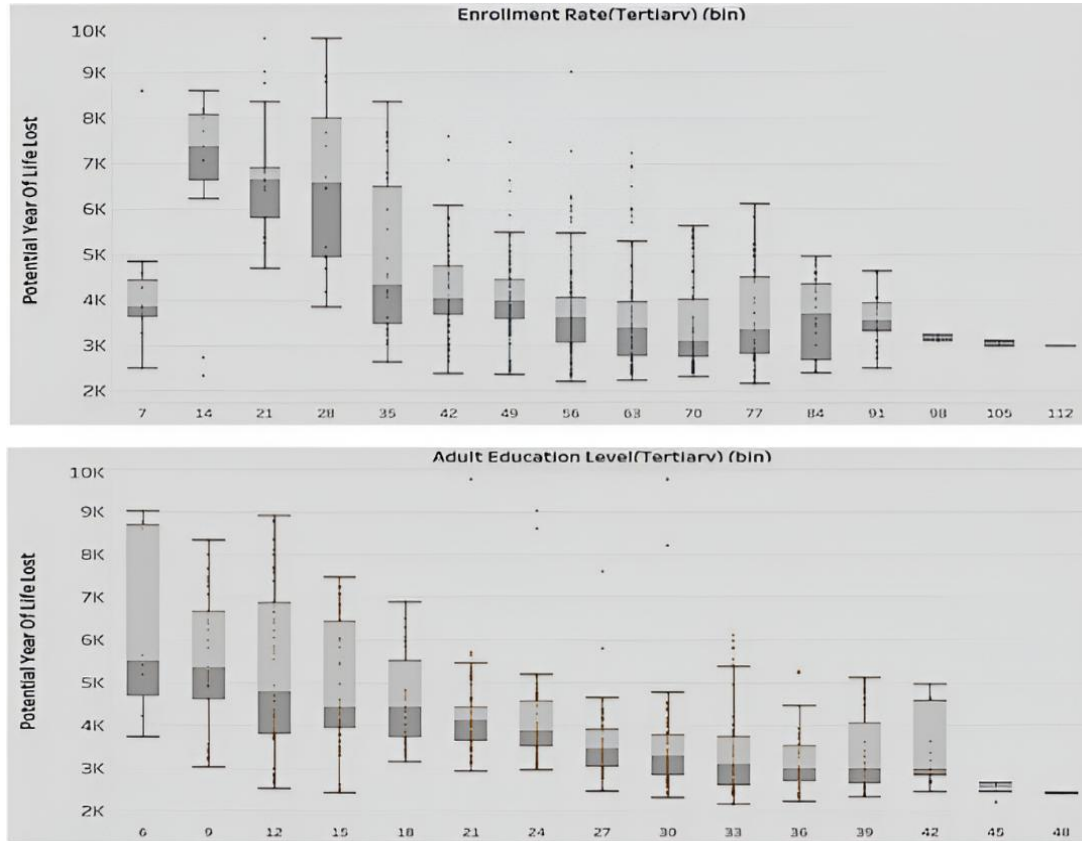


Fig. 7. Association of enrollment rate with tertiary enrollment rate depicted on the top graph, adult education level-tertiary level depicted on the bottom graph, Potential Years of Life Lost represented on the Y axis (Raghupathi & Raghupathi, 2020, p. 6).

(4) Analyses showed a positive association between child vaccination rates and tertiary enrollment and education, indicating that countries with high child vaccination rates tend to be better at tertiary enrollment and education levels. Therefore, countries that focus more on post-secondary education and enrollment may present a higher health awareness (Raghupathi & Raghupathi, 2020, pp. 6-7). Though many Africans and Diasporans are hesitant of vaccines due to historical and cultural reasons (Tawuya, 2024.; Casale & Somefun, 2025), vaccinations are a mandatory component of modern healthcare. Post-

secondary education such as apprenticeships included in the proposed approach analysed in this paper may help improve health awareness across Africa and the Diaspora, increasing knowledge and destigmatising the ideas associated with vaccinations.

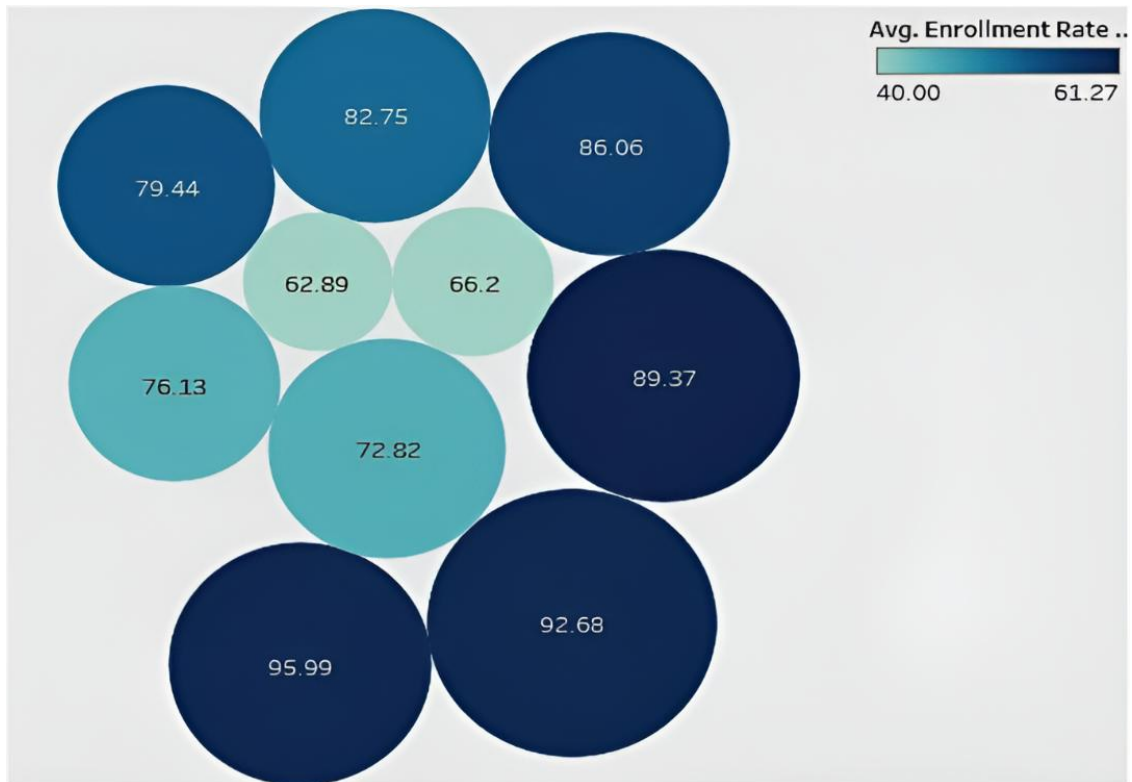


Fig. 8. Association of adult education at the tertiary level and enrollment rate at the tertiary level with child vaccination rates (Raghupathi & Raghupathi, 2020, pp. 6-7).

(5) Analyses represented in Figure 9 show that infant mortality and NEET rates in youth ages 15-19 and 20-24 move in the same direction: as infant mortality increases/ decreases, the NEET rate goes up/ down (Raghupathi & Raghupathi, 2020, pp. 7-8). This analysis again reveals the importance of health awareness and education not only to the general public but the necessity to target youth. Raghupathi & Raghupathi (2020) suggest that

“governments should decrease NEET rates through promotional programs that disseminate the benefits of being educated, employed, and trained...[and]...offer financial aid to public schools and companies to offer more resources to raise general health awareness in people (Raghupathi & Raghupathi, pp. 7-8). The approach proposed in this paper expands on these suggestions by providing education, training, and employment.

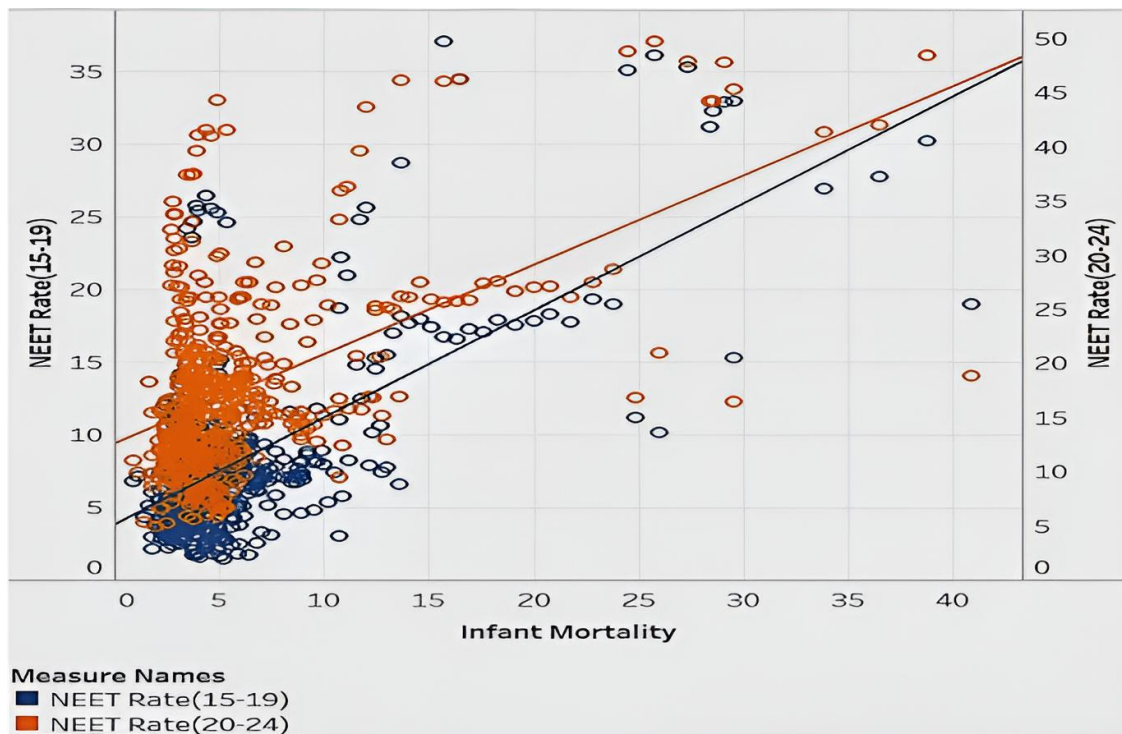


Fig. 9. Association of infant mortality rates with NEET rates ages 15–19 and NEET rates ages 20–24 (Raghupathi & Raghupathi, pp. 7-8).

(6) Another analysis revealed a relationship between adult education levels and healthcare expenditure. Countries with higher tertiary and upper-secondary education levels have high healthcare expenditure and countries with lower educational levels have lower healthcare expenditure (Raghupathi & Raghupathi, 2020, pp. 9-10). These results suggest that a higher healthcare expenditure should have a positive influence on education levels and that

improving national education levels should have a positive impact on public health by increasing health awareness.

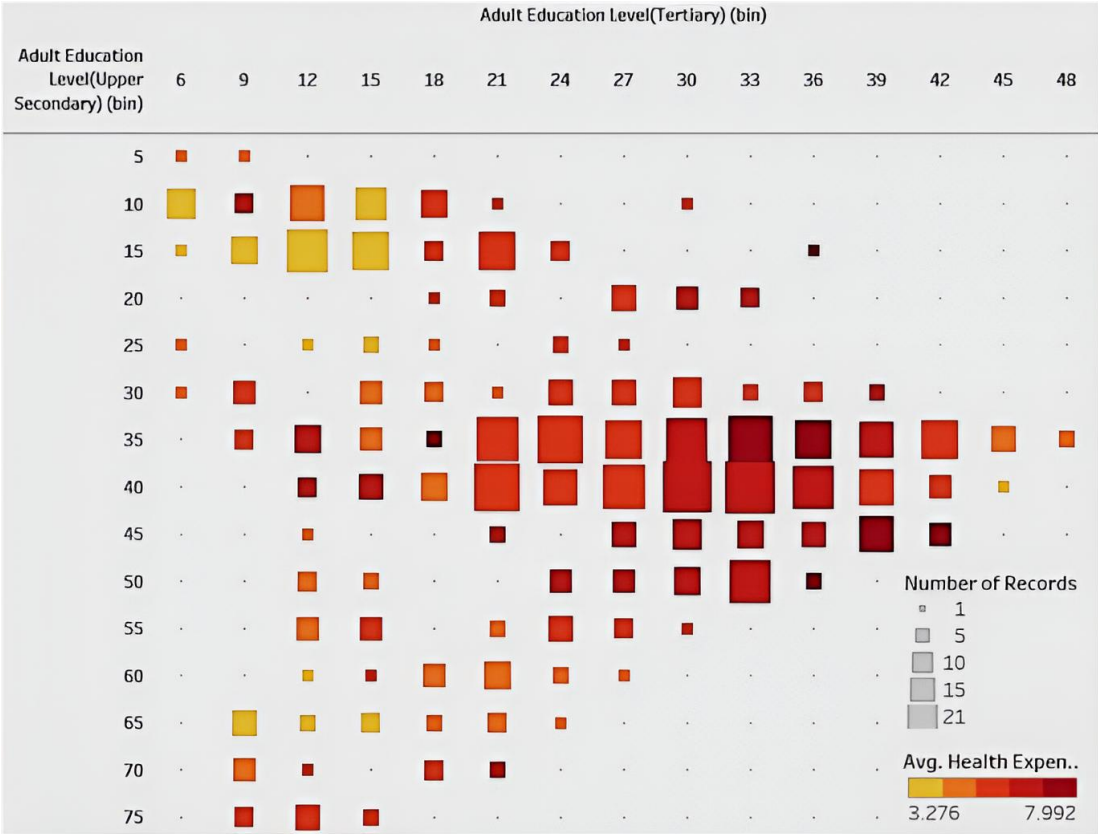


Fig. 10. Association of health expenditure and adult education at the tertiary & upper secondary levels (Raghupathi & Raghupathi, 2020, pp. 9-10).

(7) Though data was not consistent, an analysis of NEET and healthcare expenditure revealed that for the most part, countries with high healthcare expenditure had low NEET rates while countries with low healthcare expenditure had high NEET rates (Raghupathi & Raghupathi, 2020, p. 10).

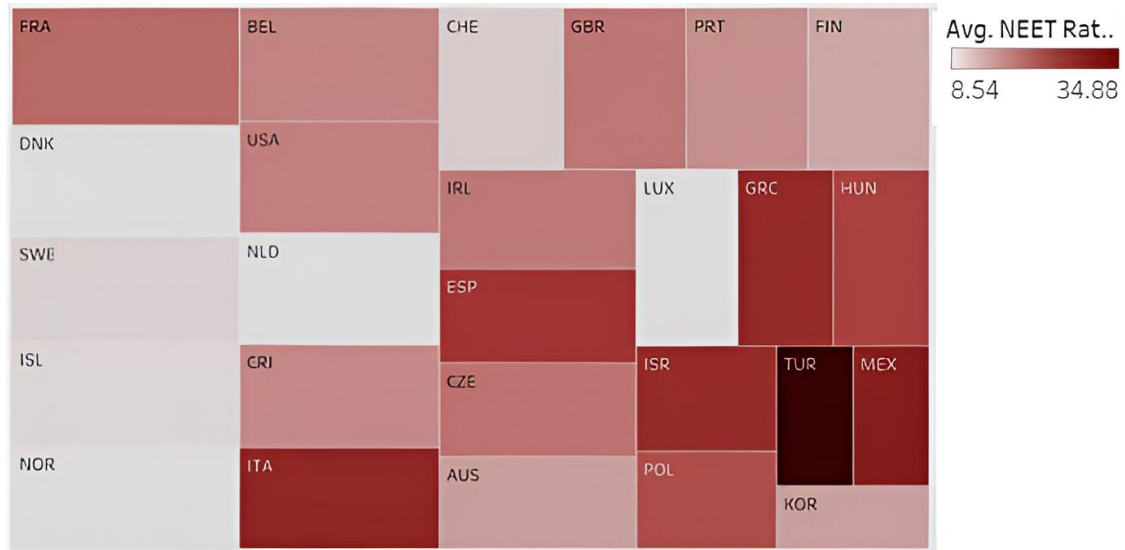
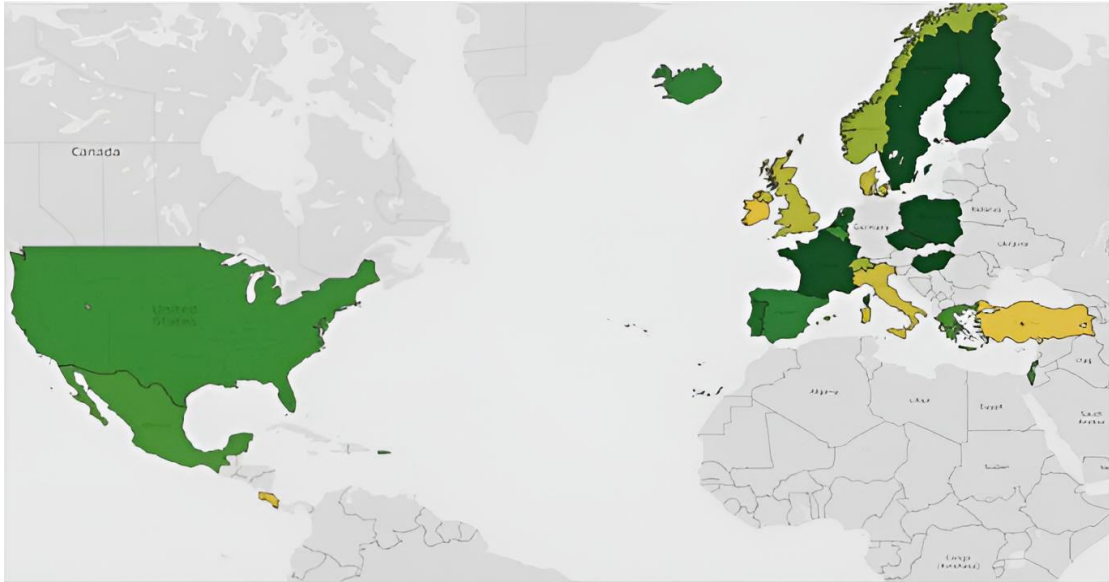
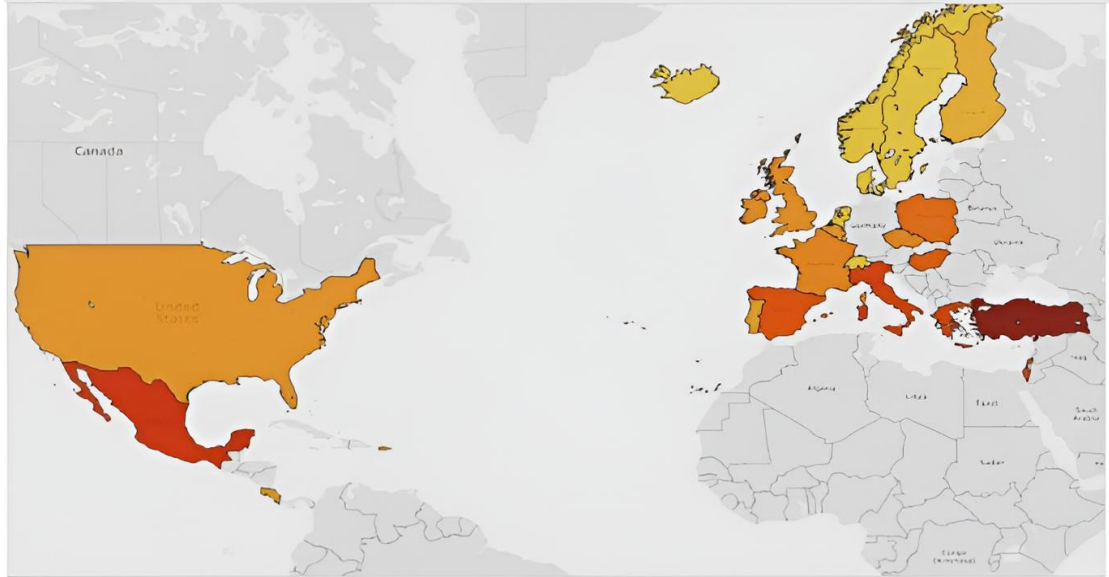


Fig. 11. Association between compulsory health expenditure and NEETRate by country and region (Raghupathi & Raghupathi, 2020, p. 10).

(8) An analysis comparing NEET and vaccination rates showed that countries with lower NEET rates have better vaccination rates. Results from this study reiterate the fact that health awareness at an early age is important both for education, public health, and the decrease of infant mortality rates (Raghupathi & Raghupathi, 2020, p. 12).



Avg. Rate of Child ...
92.000 98.000



Avg. NEET Rate(15-29) ...
10.00 30.00

Fig. 12. Association between child vaccination rates and NEET rates
(Raghupathi & Raghupathi, 2020, p. 12).

(9) Comparisons between average tertiary school life expectancy and healthcare expenditure reveal an increase between 1995 and 2015. An additional analysis reveals a continuous increase after 2015. Raghupathi & Raghupathi encourage governments to increase health expenditure to see positive effects in tertiary school life expectancy which is projected to have positive implications for national health (Raghupathi & Raghupathi, 2020, p. 15).

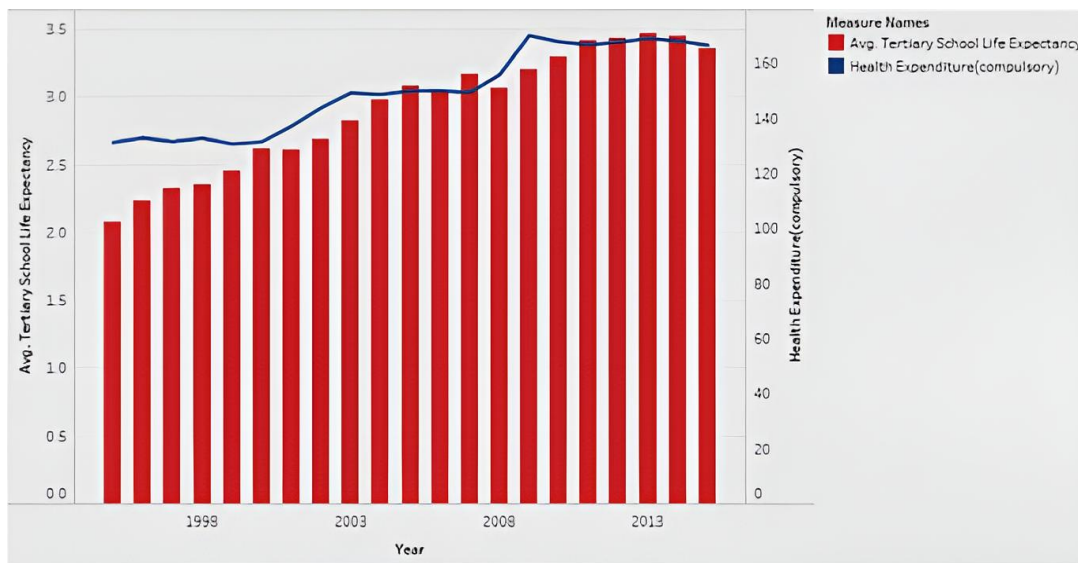


Fig. 13. Association between average tertiary school life expectancy
and health expenditure (Raghupathi & Raghupathi, 2020, p. 15).

Data from Raghupathi & Raghupathi (2020) identify and stress the inherent connection between tertiary education and modern healthcare. Concerning the proposed approach, education is not supplemental to healthcare reform. It is a required component. Based on the analyses, apprenticeships in entry - level healthcare positions and training in sectors such as manufacturing may result in increased health awareness, destigmatizations of vaccines, decrease in infant mortality

rates, decrease in premature deaths rates, increase in public health knowledge, and an overall decrease in NEET rates.

2.4 Upskilling professionals to modernise healthcare

Upskilling is vital to the healthcare sector. It refines healthcare services and outcomes and it improves the quality of life for both clinicians and patients. Clinical staff have the opportunity to develop their skills, empower themselves and learn new technology which promotes confidence in patient treatment (Indepth Research Institute, 2023). Upskilling specifically in marginalised nations with lower life expectancies teaches clinicians to use advanced medical systems that improve patient outcomes and enhance the productivity of healthcare practices (Lutz, 2024). Broadly speaking, upskilling is necessary for all employment sectors. Surveys showed that 71% of workers stated job satisfaction improved after completing an upskilling programme; 69% stated their overall quality of life improved; and employees who believe their company is invested in their growth and development are 3.7 times more likely to recommend their company as a good place to work (Holbrook, n.d.). Based on this research, it can be argued that upskilling is necessary to achieve healthcare reform in emerging nations. Upskilling refines clinical professionals' skills which enhances patient outcomes. Upskilling potentially improves job satisfaction and quality of life which is imperative for clinical professionals in Africa. As previously discussed, Africa has major healthcare shortages (Eastwood, 2009; Bhayat et al, 2025). Upskilling may teach clinical professionals social and mental health frameworks to help cope with work fatigue due to disproportionate staff-to-patient ratios.

2.5 Localised medical manufacturing may benefit developing nations

Vaccines, pharmaceuticals, and medical equipment are required for resilient and responsive healthcare systems. COVID has highlighted major issues with Africa's reliance on imported medical goods including high medication prices due to shipping, tariffs, and intermediaries; unreliable access such as supply chain delays; foreign exchange depletion as nations typically import goods from nations with stronger currencies; and limited emergency responses as seen through the pandemic. Dependency on imported medical goods results in less access to healthcare and vulnerability across Africa (*BioPharma, 2025, para. 1*). As highlighted in previous sections, African nations have been working diligently to resolve their dependence on imported medical goods. This section expands on why localised manufacturing may aid healthcare reform.

Foremost, medical manufacturing may give the nation a much-needed economic boost and enhance the nation's skillset through job diversification. Supply chains for medical technology products alone are diverse. It involves multiple stages and spans across multiple countries, relying on extensive use of outsourcing for materials, components, assemblies, and supporting services. Many medtech products also rely on rare materials and other subcomponents, further adding to the intricate process of medical manufacturing (*Medical Technology Strategy, 2024, para 29*). This intricate and wide process required for medical manufacturing may permit African nations to enter this global

market through specialised raw materials and skilled workforces, potentially allowing African nations to develop new business sectors that trade internationally. These new business sectors may foster job diversification and skills including technical and engineering support, policymaking, and quality control.

Localised medical manufacturing may also increase access to medical products. Though a clear relationship is not definitive, certain projects have shown positive connections between the two. For example, ISMC Ghana has reported that the establishment of a manufacturing facility and the production of essential medical devices has improved access to healthcare products for locals in this country (*M-Group, 2023, para. 7*). Though there are data relating to localised medical manufacturing and accessibility to such goods, data is sparse and mainly descriptive, revealing a paucity of literature (Kaplan, Ritz, & Vitello, 2011). Empirical data from possible implementation may support in understanding the dynamic between local production and access to medical products including but not limited to policy-making, pricing, strategies and procedures for greater beneficial outcomes for both governments and end users.

Most African nations import medical goods from nations with stronger currencies resulting in tariffs and high conversion costs, both of which are a strain on Africa's economy. Localised medical manufacturing may be a cost and time- effective solution for both governments and end-users. Localised medical manufacturing may lower prices due to reduced import costs and reduce wait times due to locally- sourced products. For example, some advantages of localising pharmaceuticals in Algeria included a 10% decrease in drug pricing (30% to 20%), custom duty exemptions on raw materials and ingredients, and a FAST-TRACK approval for local manufacturing within less than 12 months as compared to years approval for an import license (IQVIA, 2022, pp. 13-14).

Localised manufacturing may also aid in reducing waste across Africa. Though data pertaining to healthcare imports and its effect on Africa's waste were not found at this time, data reports a negative relationship between Africa's reliance on imports and its waste effects as a whole. Africa produces 5% and consumes 4% of the world's plastic (Massa & Archodoulaki, 2024, p. 2). Yet, a large part of the world's recycled plastic waste ends up in Africa (Massa & Archodoulaki, 2024, p. 1). To reiterate, no empirical data regarding waste specifically from imported medical goods were found; however, the above article from Massa & Archodoulaki (2024) pose important questions as to if donated medical equipment truly helps or harms African nations in the long run. Regardless, data from the article can suggest that localised medical manufacturing may reduce the accumulation of waste in Africa. Additionally, replicating methodologies hypothesized in this essay may support in documenting the relationship between medical imports and waste across the continent.

2.6 Clinical expansion and healthcare reform

Developed and renovated healthcare facilities are vital for modern care. The global average for inpatient bed density is 27 beds per 10,000 people while the average for the African region is 10 beds per 10,000 people (WHO, 2025). The dental ratio in Africa is 1:150,000 compared to 1:2,000 in industrialised nations (Northridge, Kumar, & Kaur, 2020, p. 515). Statistics from 2015 shows that in low and middle income nations such as those across Africa, 60% of deaths arose from poor quality of care (Kruk et al., 2018, p. 1196). Poor quality of care may also lead to amenable deaths in conditions such as cardiovascular disease, neonatal deaths, tuberculosis (Kruk et al., 2018, see Figure 5). “To provide quality health services required for universal health coverage, health facilities should be structured to meet health care needs and equipped with utilities such as electricity, water and skilled health workforce and also to construct or renovate primary health facilities that are able to offer quality services” (Alidina et al., 2020, p. 2). The above evidence shows that not only do African nations require a major increase in healthcare facilities, facilities must be modernised with equipment and healthcare professionals and staff must be trained on new methods of care and healthcare management. This subsection reveals the intricate roles that modern medical technology, healthcare training, and clinic accessibility play in healthcare reform, all of which are the combined approach proposed in this paper.

2.7 Benefits of connecting Africa and the Diaspora

Though legal requirements differ, African nations such as Ghana, Sierra Leone, Nigeria, South Africa, Gabon, Cape Verde, Zimbabwe, and Kenya offer varying forms of citizenship to the Diaspora (Passport Heavy, 2024). There are both cultural and economic reasons as to why the Diaspora may support healthcare reform in Africa. Many Diasporans want to return to the continent; however, lack of job opportunities and long regularisation procedures account for some reasons as to why they may hesitate to repatriate (Bruna, 2025). Job diversification and pro bono partnerships may influence the Diaspora to seek residence in Africa, whether partial, short term, or long term.

Next, support from the Diaspora may aid in accelerating healthcare reform via donations and knowledge exchange. A study quoted by Taylor & Francis (2023) suggested that Black American students’ reading and mathematics scores were higher when they had an ethno-racially matched teacher. These findings suggest that the Diaspora may play an integral role for the workforce development component of the proposed approach including apprenticeships, upskilling programmes, and English- language courses. Charitable donations from the Diaspora is a method that could potentially commence small- scale projects in native countries. Overall, support from the Diaspora may help African nations capitalize on their repatriation initiatives and Diasporans can seize the opportunity to live in the continent with charitable donations to support in advancing healthcare reform.

3 Potential Application: Burkina Faso

3.1 Burkina Faso: A potential application

This section serves to explain Burkina Faso's current healthcare situations and examine how the authors' proposed approach may aid in reforming healthcare in this nation and possibly implicating positive effects on its education and economy.

3.1.1 Background

The People's Republic of Burkina Faso- henceforth Burkina Faso- is located in the Sahel region of West Africa, a group of nations characterised by their semi-arid climate. Burkina Faso is a majority French-speaking nation though English is slowly rising among the younger generation. Burkina Faso has a population of approximately 23,142,199 people (World Factbook, 2025) where one third of its citizens reside in cities including the capitol, Ouagadougou. Ouagadougou is the economic, educational, and political hub of this nation. Approximately 28% of Burkina Faso's income relies on agriculture such as maize, sorghum, millet, and cowpeas; industry services such as cotton lint, soap, and cigarettes; and mining particularly in gold production (World Factbook, 2025; World Bank Group, 2025). As of 2023, Burkina Faso's top 5 exporting partners are UAE with 10%, India and Mali with 3%, Cote d'Ivoire with 2% and Switzerland with an overwhelming 72% (World Factbook, 2025). Burkina Faso is considered an impoverished nation. Ultimately, 40% of the population lives below the poverty line; and according to the 2025 Human Development Index, Burkina Faso is the third to the lowest development at 0.459 (World Population Review, 2025).

3.1.2 Current healthcare in Burkina Faso

Similar to most African nations, Burkina Faso also faces major healthcare challenges. As of 2020, WHO estimates that Burkina Faso has a ratio of 2 hospital beds per 10,000 people (Global Health Observatory, 2025). As of 2022, Burkina Faso's doctor to people ratio is 0.147 to 1,000 (Trading Economics, 2025). Burkina Faso has an infant mortality rate of 77.3 deaths per 1,000 live births (UNICEF, 2025). The nation has an extreme shortage of healthcare specialists with only 70 ophthalmologists and one children's eye specialist, (Borras, 2025). A 2021 interview from Dr Lamine Kollé revealed that only two surgeons serve the region of Kaya, a population of 163,000 and that on average, only 10 specialist surgeons per year graduate from the University of Ouagadougou (ALIMA, 2021). Currently, the traditional medicine sector is being incorporated into the modern healthcare system with traditional medicine practitioners being trained to recognise viruses such as malaria (*Burkina Faso health system*, 2025).

The United Kingdom's Foreign, Commonwealth, and Development Office (FCDO) states that medical facilities in Burkina Faso are very limited and for serious medical treatment, an evacuation to Europe is necessary (Foreign, 2025). The FCDO lists 8 doctors and medical facilities suitable for

British care, all of which are affiliated with the Burkinabé Ministry of Health. They are Centre Hospitalier Universitaire Yalgado Ouédraogo, Centre Médical International (CMI), Clinique El Fateh- Suka Paediatrics/ Gynaecology/ General Consultations, Clinique “Les Genêts”, Hôpital Blaise Compaoré, Polyclinique Internationale, Polyclinique Notre Dame de la Paix (PNDP), and Dr Rose Drabo (Foreign, 2025). Lack of suitable healthcare facilities is arguably a major hindrance to tourism in this nation.

Burkina Faso also faces major dental challenges. As of 2022, Burkina Faso has no existence of a national oral health policy, strategy, or action plan. 40.3% of children ages 1-9 years old have untreated caries in deciduous teeth and 27.5% of people ages 5+ have untreated caries in their adult teeth. 27.4% of people ages 15+ have severe periodontal diseases. As of 2018, Burkina Faso possesses 185 dental assistants and therapists, 91 dentists, and 2 dental prosthetic technicians (WHO, 2022).

3.2 Burkina Faso as a Potential Prototype

PROTUS has a potential contract with the Ministry of Health and is developing tailor-made solutions to target the nation's most urgent healthcare needs. Based on the critical review, it is plausible that the proposed approach analysed in this paper may aid in reforming healthcare and improving the education and economy in Burkina Faso if given the opportunity.

3.2.1 Nation's education and skillset

Comprehensive results from Raghupathi & Raghupathi (2020) reveal the intricate connection between education and healthcare. With implementation of the hypothesized approach, continuation, and expansion of apprenticeship programmes, Burkina Faso may potentially see results which include reduced infant mortality and premature death rates, increased life expectancy at birth, positive impacts on preventative care, increased adult healthcare expenditure, increased government healthcare expenditure, increased distribution of life expectancy at birth.

3.2.2 Independence through medical manufacturing

Through the establishment of localised medical manufacturing, Burkina Faso may expect to see diversified skill sets such as technical support and engineering, a growth rate in the medical device market that may exceed the current 9.60% projection rate (Bhandari, 2023, para. 2), a reduction in the 11.5% average tariff rate for used medical equipment imports (*Import and export requirements for used medical equipment in Africa, 2025*), a decrease in pricing for both governments and end users, and increased access to medical products.

3.2.3 Improve healthcare services and access to healthcare

As previously mentioned, Burkina Faso is detrimentally below hospital bed to population ratios and healthcare professionals to population ratios. Clinic expansion may increase access to essential healthcare needs, especially to those in marginalised areas of the nation. Apprenticeships and upskilling registered medical professionals may benefit Burkina Faso in two main ways. Firstly, registered professionals can learn advanced methods that enhance patient outcomes and refine professionals' knowledge and skill. Training can also include mental health support to help professionals cope with disproportionate staff-to-patient ratios. Secondly, more certified clinical professionals such as nursing and dental assistants acquired through apprenticeship programmes means expansion to wider regions, extending healthcare access particularly to those in Burkinabé villages. Enhanced skills, improved staff-to-patient ratios, and expansion to marginalised areas may improve health in Burkina Faso, potentially resulting in reduced infant mortality rates, premature death rates, and reduced cases in NCDs.

3.2.4 Improving the overall economy through diversifying jobs and reducing youth unemployment

Youth unemployment is a barrier to development in Africa (Devlin, 2013). Lack of jobs means youth do not have the opportunity to learn and cultivate skills (MATSH, 2023; Generation, 2026). Localised medical manufacturing should create new employment sectors for Burkinabé youth such as technical support, engineering, quality control, construction, warehouse and sale representatives as well as improving traditional markets such as agriculture, mining, and cotton production which are predominantly manual. Introducing low-tech mechanised skills like medical manufacturing can unlock additional job skills, possibly allowing Burkinabé youth to enter the global job market. The acquisition of low-tech medical manufacturing skills can be applied to artificial intelligence and other digital sector markets such as information technology and cybersecurity which are required to modernise healthcare systems and can also modernise traditional sectors in Burkina Faso (Chimboza, 2024). Only 8 of Burkina Faso's hospitals and healthcare professionals are deemed suitable by UK-standards (Foreign, 2025). An increase in certified healthcare staff and an expansion of modern health clinics may aid in improving Burkina Faso's economy through tourism. Increased access to suitable healthcare by western standards may reduce fears of early departure or lack of medical support upon an unexpected injury or illness, potentially building confidence to visit this nation.

3.2.5 Connecting the Diaspora

With English being a requirement to enter the global market, support from Diasporans may aid in advancing Burkina Faso's English-proficiency skills. A Diasporan alliance may also accelerate modernisation in the nation as Diasporans exchange knowledge and skills with local Burkinabé people. Additionally, Burkinabé people may feel more comfortable and retain more knowledge if they learn from teachers of similar ethno-racials groups.

4 Conclusion

4.1 Summary

Health is a complex term and implementation of healthcare systems are based on cultural, social, and economic factors. African nations traditionally relied on healthcare systems which connected clinical and spiritual methods. Colonisation and globalisation have required African nations to modernise traditional healthcare practices. Yet, adapting to modern systems has proven to be a complicated process, stemming from issues such as cultural resistance, prejudices, and economic instability. Africa currently faces many healthcare issues, such as disproportionate rates of infant mortality, major deficits in healthcare professionals, access to essential healthcare needs, and accessibility to essential healthcare goods; and the Diaspora - namely the Caribbean and Black Americans - face similar challenges. Governments across the continent are making concerted efforts to reform healthcare mainly through localised manufacturing, but other aspects of healthcare reform - such as education and Diaspora connections- should be considered.

The authors hypothesised that (1) an amalgamated approach of workforce development, localised manufacturing, and clinic expansion may aid in accelerating healthcare reform in emerging countries, particularly focusing on those in Africa, (2) healthcare reform through this approach may have positive effects on economies and education and (3) implementation could benefit African nations if given the opportunity, using Burkina Faso as a potential prototype. Academic literature, global health databases and science, business, and healthcare sites were critically reviewed to evaluate potential efficacy.

The review showed that (1) education and healthcare are interlinked. Countries with higher education levels have better national health conditions (Raghupathi & Raghupathi, 2020, p. 15); (2) healthcare reform via the proposed approach may aid in economic growth via increased employment rates through job diversification and potentially via tourism once healthcare systems are comparable to that of international standards; (3) clinic expansion is required for healthcare reform as poor quality of care can lead to patient complications and expansion can increase patient-to-healthcare ratios (Kruk et al., 2018; Alidina et al., 2020; Northridge, Kumar, & Kaur, 2020; WHO, 2025); and (3) healthcare reform may be a potential method to connect Africa and the Diaspora via education and training (Taylor & Francis, 2023). (4) Ultimately, there was a paucity in literature relating to benefits of healthcare and localised manufacturing (Kaplan, Ritz, & Vitello, 2011). (5) Though medical waste is not specifically addressed in Massa & Archodoulaki (2024), healthcare reform may potentially implicate waste reduction in Africa. Overall, the major limitation to this proposition is lack of implementation. The proposed approach is solely based on hypotheses where some aspects have been supported theoretically. Only implication can truly prove efficacy. The authors provide future implications below.

4.2 Future Implications

The authors conclude that workforce development and clinic expansion have been academically supported to aid in healthcare reform. Based on the above findings, the authors suggest the following future implications:

- (1) Workforce development and clinic expansion should be considered for implementation in the near future. Because African nations are at a universal disadvantage as compared to other regions, a strategic inception is vital for success.
- (2) The authors suggest that implementation begins at community levels. Governments, NGOs, and related stakeholders should partner with charities already operating in Africa to support such initiatives. Currently, the authors have partnered with Morgan Charitable Foundation, SEB Foundation, and Afriwinsun.
- (3) Links to Diasporans are the foundation to drive this initiative. Those considering implementing the proposed approaches should partner with Diasporans for donations and professional expertise to commence community- driven, small- scale projects.

The authors aim to reach Zimbabwe, Burkina Faso, Ghana, South Africa, and Kenya in 2026 with aims to deliver dental outreach, distribute education- related materials, and administer pre-registration courses to locals. These projects are all socially - driven to build a connection with these countries and to administer charitable work. During this time, the authors will document this process both to evaluate progress and for academic, social, or economic replication.

References

- [1] Abdulazeez, S. (2025). Nigeria set to end reliance on imported medicines. *The Guardian*. https://guardian.ng/features/health/nigeria-set-to-end-reliance-on-imported-medicines/#google_vignette.
- [2] Abdullahi, A. A. (2011). Trends and challenges of traditional medicine in Africa. *African Journal of Traditional, Complementary and Alternative Medicines*, 8(5S). <https://doi.org/10.4314/ajtcam.v8i5s.5>.
- [3] Adamu, A. A., Karamagi, H.C., Oduwale, E. O., Seydi, A.B.W., Sokona, S.Y., & Wiysonge, C. S. (2023). Scoping review of African health histories: a protocol. *BMJ Open*, 13(11), e075787–e075787. <https://doi.org/10.1136/bmjopen-2023-075787>.
- [4] Alidina, S., et al. (2020). Development and upgrading of public primary healthcare facilities with essential surgical services infrastructure: a strategy towards achieving universal health coverage in Tanzania. *BMC health services research*, 20(1), 218. <https://doi.org/10.1186/s12913-020-5057-2>.

- [5] Alliance for International Medical Action. (2021). Burkina Faso: Interview with Dr Kolle, a surgeon in Kaya. *ALIMA*. <https://alima.ngo/en/news/interview-burkina-faso-dr-kolle-surgeon-kaya/#:~:text=ALIMA%20has%20therefore%20come%20in,in%20Burkina%20Faso%20each%20year>.
- [6] American Academy for Oral & Systematic Health. (2026). 15 Diseases caused by poor dental hygiene. <https://www.aaoash.org/connect/15-health-issues-caused-by-poor-oral-health>.
- [7] Anaemene, B.U. (2014). Indigenous health practices in Africa. In *African Peoples, Culture and Civilisation* (pp. 77-85). Redeemer's University.
- [8] Armstrong, M. (2022). This is how Africa is reducing its child mortality rate. *World Economic Forum: Geographies in depth*. <https://www.weforum.org/stories/2022/04/infant-mortality-africa-safer-future/#:~:text=As%20Statista%27s%20research%20expert%20for,25%20as%20soon%20as%202050>.
- [9] Artiga, S., Hill, L., & Presiado, M. (2024). How present-day health disparities for Black people are linked to past policies and events. *Kaiser Family Foundation*. <https://www.kff.org/racial-equity-and-health-policy/how-present-day-health-disparities-for-black-people-are-linked-to-past-policies-and-events/>.
- [10] Awofeso, N. (2005). Redefining health. *Bulletin of the World Health Organization*, 82, 802.
- [11] Barnett, W. (2000). Medicine, science, and technology. In T. Falola (Ed.), *African Culture and Societies Before 1885*, (pp. 189-215). Carolina Academic Press.
- [12] Bhandari, R. (2023). Burkina Faso medical device market: Outlook, size, revenue, value, industry, growth, trends, segmentation, analysis, forecast, companies and share. <https://www.6wresearch.com/industry-report/burkina-faso-medical-devices-market#:~:text=Burkina%20Faso%20Medical%20Devices%20Market%20Size%20Growth%20Rate,for%20the%20Period%202021%2D2031>.
- [13] Bhayat, A., Foláyan, M. O., Mikhail, S. S., Ndembi, N., & Tantawi, M. E. (2025). Resources for oral health in Africa. *Frontiers in Oral Health*, 6. <https://doi.org/10.3389/froh.2025.1540944>.
- [14] BioPharma, D. (2025, June 30). *Why local pharmaceutical manufacturing is Africa's best bet for affordable healthcare*. Dei BioPharma Ltd. <https://www.deibiopharma.com/why-local-pharmaceutical-manufacturing-is-key-to-africas-healthcare-future/>.
- [15] Borrás, E. (2025). Burkina Faso's only eye doctor for children sees the trauma of both play and conflict. *AP News*. <https://apnews.com/article/burkina-faso-children-eye-doctor-health-e0abe5a5c44dbdafac755b9efb90180e>.
- [16] Bruna, S. (2025). 8 reasons why the Diaspora is not returning to Africa. *Diaspora Africaine Media*. <https://diasporaafricainemedia.com/en/8-raisons-qui-empêchent-la-diaspora-de-retourner-en-afrique/>.

- [17] *Burkina Faso health system*. Severe Malaria Observatory. (2025). <https://www.severemalaria.org/countries/burkina-faso/burkina-faso-health-system>.
- [18] Caribbean Public Health Agency. (2019). Healthy ageing in the Caribbean. In *State of Public Health Report*. CARPHA. <https://carpha.org/Portals/0/Publications/CARPHA-State-of-Public-Health-Report-2019.pdf>.
- [19] Casale, M. & Somefun, O.D. (2025). Vaccines: why these young Africans are hesitant about them and what might change their minds. *The Conversation*. <https://theconversation.com/vaccines-why-these-young-africans-are-hesitant-about-them-and-what-might-change-their-minds-249629>.
- [20] Chimboza, R. (2024). Unlocking Africa's potential: creating jobs for youth through tech. *African Business*. <https://african.business/2024/09/technology-information/unlocking-africas-potential-creating-jobs-for-youth-through-tech>.
- [21] Devlin, K. (2013). Reducing youth unemployment in Sub-Saharan Africa. *PRB*.
- [22] Doyle, S. (2022). *The History of African Development* [www.aehnetwork.org/textbook/Health in African History](http://www.aehnetwork.org/textbook/Health%20in%20African%20History). <https://www.aehnetwork.org/wp-content/uploads/2022/04/Health-in-Africa-for-AEHN-Handbook-FINAL-3-May-2022.pdf>.
- [23] Eastwood, J.B., Naicker, S., Rhule, J.P., & Tutt, R.C. (2009). Shortages of healthcare workers in developing countries--Africa. *Ethnicity and Disease*, 19(1 Suppl 1), S1-64.
- [24] Essien, U., Kamara, J., & Labrique, A. (2024). A new era for African health systems: Market shaping and the African Continental Free Trade Area (AfCFTA). *Public Health Challenges*, 3(2). <https://doi.org/10.1002/puh2.172>.
- [25] Foreign, C. & D. O. (2025, December 10). *Health - Burkina Faso travel advice*. GOV.UK. <https://www.gov.uk/foreign-travel-advice/burkina-faso/health>.
- [26] Foreign, Commonwealth, and Development Office. (2020). Burkina Faso: List of doctors and medical facilities. *GOV.UK*. <https://www.gov.uk/government/publications/burkina-faso-doctors-and-medical-facilities/burkina-faso-list-of-doctors-and-medical-facilities>.
- [27] Global Health Observatory. (2025). Beds, hospital beds (per 10,000 population). *World Health Organization*. <https://www.who.int/data/gho/data/indicators/indicator-details/GHO/hospital-beds-%28per-10-000-population%29>.
- [28] Gyapong, M. & Machingaidze, S. (2023). Africa's Complicated Path To Global Health Equity - Health Policy Watch. *Health Policy Watch*. <https://healthpolicy-watch.news/africas-complicated-path-to-global-health-equity/>.

- [29] Havercamp, S. M., Krahn, G. L., Murray, A.J., & Robinson, A. (2021). It's time to Reconsider How We Define Health: Perspective from disability and chronic condition. *Disability and Health Journal*, 14(4). <https://doi.org/10.1016/j.dhjo.2021.101129>.
- [30] Holbrook. J. (n.d.). *ROI of upskilling Entry-Level healthcare employees*. Stepful. <https://www.stepful.com/post/roi-of-upskilling-entry-level-healthcare-employees#:~:text=71%25%20of%20workers%20stated%20that,is%20incredibly%20effective%20as%20we ll.>
- [31] Huber, M., Knottnerus, J.A., Green, L et al. (2011). How should we define health? *BMJ*, 343(343). <https://doi.org/10.1136/bmj.d4163>.
- [32] *The impact of youth unemployment on economic growth*. (2026). Generation. <https://www.generation.org/news/the-impact-of-youth-unemployment-on-economic-growth/>.
- [33] *Import and export requirements for used medical equipment in Africa*. (2025). Radio Oncology systems. <https://www.oncologysystems.com/import-export-requirements-for-used-medical-equipment/import-export-requirements-for-used-medical-equipment-in-africa/>.
- [34] Indepth Research Institute. (2023). *Importance of upskilling in healthcare management*. Indepth Research Institute - Transforming People and Organizations in Africa Since 2003. <https://indepthresearch.org/blog/the-importance-of-upskilling-in-healthcare-management/>.
- [35] International Finance Corporation. (2025a). How IFC is powering Rwanda's Biotech Growth. <https://www.ifc.org/en/podcasts/audio-stories/2025/how-ifc-is-powering-rwanda-s-biotech-growth>.
- [36] International Finance Corporation. (2025b). World Bank Group approach to medical supplies manufacturing. <https://www.ifc.org/en/what-we-do/sector-expertise/health/world-bank-group-approach-to-medical-supplies-manufacturing#:~:text=Why%20is%20the%20local%20production,key%20raw%20materials%20for%20dru gs.>
- [37] International Trade Centre (2020). *Medical Industries in Africa: A Regional Response to Supply Shortages*. ITC, Geneva.
- [38] IQVIA ME CONSULTING. (2022). Localization of pharmaceutical manufacturing in Middle East and North Africa region. In *Localization in Middle East and North Africa Region* (pp. 3–31) [White Paper]. <https://www.iqvia.com/-/media/iqvia/pdfs/mea/white-paper/localization-of-pharmaceutical-manufacturing-in-middle-east-and-north-africa-region.pdf>.
- [39] Kaplan, W. A., Ritz, L. S., & Vitello, M. (2011). Local production of medical technologies and its effect on access in low and middle income countries: a systematic review of the literature. *Southern med review*, 4(2), 51–61. <https://pmc.ncbi.nlm.nih.gov/articles/PMC3471180/>.

- [40] Kamara, J., Essien, U., & Alain Labrique. (2024). A new era for African health systems: Market shaping and the African Continental Free Trade Area (AfCFTA). *Public Health Challenges*, 3(2). <https://doi.org/10.1002/puh2.172>.
- [41] Kruk, M., et al. (2018). High-quality health systems in the Sustainable Development Goals era: time for a revolution. *The Lancet. Global health*, 6(11), e1196–e1252. [https://doi.org/10.1016/S2214-109X\(18\)30386-3](https://doi.org/10.1016/S2214-109X(18)30386-3).
- [42] Lutz, A. (2024 September 23). *Upskilling professionals for sustainable healthcare in Tanzania*. Semien Healthcare Engineers. <https://www.siemens-healthineers.com202/perspectives/training-in-tanzania>.
- [43] Massa, G.M. & Archodoulaki, V.M. (2024). An Imported Environmental Crisis: Plastic Mismanagement in Africa. *Sustainability*, 16(2), 672. <https://doi.org/10.3390/su16020672>.
- [44] MATSH. (2023). Youth unemployment statistics in Africa in 2023. <https://www.matsh.co/en/youth-employment-statistics-in-africa/>.
- [45] Medical technology strategy. (2024). *GOV.UK*. <https://www.gov.uk/government/publications/medical-technology-strategy/medical-technology-strategy#:~:text=Medtech%20is%20a%20vital%20UK,of%20medtech%20products%20in%202021.&text=Figure%20%20illustrates%20the%20UK,4%2C190%20UK%20businesses>.
- [46] M-Group (2024). Transforming Local Economies: The Socio-Economic Impact of Medical Device Manufacturing - M-Group. *M-Group*. <https://mgroupholding.co/what-africa-imports-our-insights-on-manufacturing-and-investing-in-africa-5/#:~:text=By%20promoting%20domestic%20production%2C%20the,at%20info@mgroupholding.co>.
- [47] Mohammed, A. et al. (2023). Supporting the manufacturing of medical supplies in Africa: Collaboration between Africa CDC, partners, and member states. *Global Health: Science and Practice*, 11(5). <https://doi.org/10.9745/GHSP-D-23-00121>.
- [48] Nivet, M. & Xierali, I. (2018). The racial and ethnic composition and distribution of primary care physicians. *Journal of health care for the poor and underserved*, 29(1), 556–570. <https://doi.org/10.1353/hpu.2018.0036>.
- [49] Northridge, M. E., Kumar, A., & Kaur, R. (2020). Disparities in Access to Oral Health Care. *Annual review of public health*, 41, 513–535. <https://doi.org/10.1146/annurev-publhealth-040119-094318>.
- [50] Office for Health Improvement & Disparities. (2022). *Health disparities and health inequalities: Applying all our health*. Gov.uk. <https://www.gov.uk/government/publications/health-disparities-and-health-inequalities-applying-all-our-health/health-disparities-and-health-inequalities-applying-all-our-health>.
- [51] Office for National Statistics. (2025). Child and infant mortality in England and Wales. <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/childhoodinfantandperinatalmortalityinenglandandwales/2023>.

- [52] Our World In Data. (2025). *The Universal Health Coverage (UHC) Service Coverage Index*. Our World in Data. <https://ourworldindata.org/grapher/universal-health-coverage-index>.
- [53] Passport Heavy. (2024). Top 8 African countries offering citizenship to African Americans. <https://www.passportheavy.com/ph-blog/top-8-african-countries-offering-citizenship-to-african-americans#:~:text=South%20Africa%20has%20been%20at,free%20citizenship%20to%20Black%20Americans>.
- [54] Raghupathi, V. Raghupathi, W. (2020) The influence of education on health: an empirical assessment of OECD countries for the period 1995–2015. *Arch Public Health* 78, (20). <https://doi.org/10.1186/s13690-020-00402-5>.
- [55] Statista. (2025). *Countries with the highest infant mortality rate 2024*. <https://www.statista.com/statistics/264714/countries-with-the-highest-infant-mortality-rate/>.
- [56] Taylor & Francis. (2023). Young children develop better learning skills when taught by teachers of the same ethnicity, national US study suggests. <https://newsroom.taylorandfrancisgroup.com/young-children-develop-better-learning-skills-when-taught-by-teachers-of-the-same-ethnicity-national-us-study-suggests/#:~:text=Findings%20suggested%20that%20when%20students,Black%20students%20and%20Latin%20students>.
- [57] Tawuya, B. (2024). Vaccine hesitancy in the Black community. *The Africa Centre*. <https://www.africacentre.org.uk/blog/vaccine-hesitancy-in-the-black-community>.
- [58] Trading Economics. (2025). Burkina Faso: Physicians. <https://tradingeconomics.com/burkina-faso/physicians-per-1-000-people-wb-data.html>.
- [59] UNICEF. (2025). Burkina Faso: Key demographic indicators. <https://data.unicef.org/country/bfa/#main>.
- [60] World Health Organization. (1948). *Constitution of the world health organization*. World Health Organization. <https://www.who.int/about/governance/constitution>.
- [61] World Bank. (2024). *World Bank income groups*. Our World in Data. <https://ourworldindata.org/grapher/world-bank-income-groups>.
- [62] World Bank Group. (2025). The World Bank in Burkina Faso. <https://www.worldbank.org/en/country/burkinafaso/overview>.
- [63] World Factbook. (2025). Burkina Faso. [CIA.gov. https://www.cia.gov/the-world-factbook/countries/burkina-faso/#economy](https://www.cia.gov/the-world-factbook/countries/burkina-faso/#economy).
- [64] World Health Organization. (2022). Burkina Faso: Oral health country profile. https://cdn.who.int/media/docs/default-source/country-profiles/oral-health/oral-health-bfa-2022-country-profile.pdf?sfvrsn=3228b5dc_10&download=true#:~:text=17.0,unavailable.

- [65] World Health Organization. (2025). Malaria. *Regional Office for Africa*.
<https://www.afro.who.int/health-topics/malaria#:~:text=Malaria%20remains%20a%20significant%20public, resistant%20to%20certain%20older%20insecticides>.
- [66] World Health Organization Africa (2022). Chronic staff shortfalls stifle Africa's health systems: WHO Study. <https://www.afro.who.int/news/chronic-staff-shortfalls-stifle-africas-health-systems-who-study>.
- [67] World Health Organization Africa. (2025). Health inputs and processes. <https://aho.afro.who.int/atlas-inputs-and-processes/af?lang=pt#:~:text=1%20000%20population.-,4.6%20Health%20infrastructure,as%20the%20COVID%E2%80%9319%20pandemic>.
- [68] World Population Review. (2025). Human Development Index (HDI) by country. <https://worldpopulationreview.com/country-rankings/hdi-by-country#title>.