EVALUATION

IMPLEMENTATION RESEARCH TO EVALUATE THE GHANA HEART INITIATIVE (PILOT PHASE)

Final **Scientific Report**

DECEMBER 2023

THIS PUBLICATION WAS PRODUCED AT THE REQUEST OF THE DEUTSCHE GESELLSCHAFT FÜR INTERNATIONALE ZUSAMMENARBEIT GMBH (GIZ). **IT WAS PREPARED AND WRITTEN BY THE TEAM OF EVALUATORS / RESEARCHERS FROM THE HEIDELBERG INSTITUTE OF GLOBAL HEALTH, GERMANY, AND THE UNIVERSITY OF GHANA MEDICAL SCHOOL, GHANA**: RUPAL SHAH-ROHLFS, KAVITA SINGH, ELOM OTCHI, EMILIA UDOFIA, VALÉRIE R. LOUIS, ISAAC ADOMAKO, NANA AYEGUA HAGAN SENEADZA, NIKIAS HERZHAUSER, AFUA BOATEMAA OWUSU, JOHN TETTEH, DANIEL DEGRAFT-AMOAH, EUGENE KALLSON, VOLKER WINKLER.

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PREAMBLE FOR THE SCIENTIFIC REPORT:

This evaluation report exclusively examines the initial phase of the Ghana Heart Initiative, termed the Pilot Phase, and refrains from considering any supplementary interventions, including the deep-vein thrombosis component and both the first and second rollout phases. Furthermore, the economic assessment is confined to the budgetary constraints of the Pilot Phase alone, disregarding the comprehensive funding allocated for the entire project. The remit of the evaluation team was strictly limited to the evaluation of the Pilot Phase.

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ACRONYMS

ACLS	Advanced Cardiovascular Life Support
BCLS	Basic Cardiac Life Support
BP	Blood Pressure
CVD	Cardiovascular Diseases
CHAG	Christian Health Association of Ghana
CHPS	Community Based Health Planning and Services
DHIMS2	District Health Information Management System 2
EHR	Electronic Health Record
GAR	Greater Accra Region
GDMT	Guideline Directed Medical Therapy
GHI	Ghana Heart Initiative
GHS	Ghana Health Service
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH, German Society for International Cooperation
HAMS	Hospital Availability Management System
HFAS	Health Facility Assessment Survey
HIGH	Heidelberg Institute of Global Health
HSBB	Health System Building Blocks
IPD	Inpatient Department
IQR	Interquartile Range
KAP	Knowledge, Attitude, and Practice
KBTH	Korle Bu Teaching Hospital
LMICs	Low- and Middle-Income Countries
LHIMS	Lightwave Health Information Management System
MRR	Medical Record Review
NCD	Non-Communicable Disease
OPD	Outpatient Department
PES	Patient Exit Survey
RE-AIM	Reach, Effectiveness, Adoption, Implementation, and Maintenance
ToC	Theory of Change
UGMS	University of Ghana Medical School
WHO	World Health Organisation

DEFINITIONS

Health-facility survey	A type of survey (i.e., data collection) that is conducted at a health facility.
Health facility	A health facility is an infrastructure built and duly licensed by the Health Facilities Regulatory Authority (HEFRA) to take care of the healthcare needs of the citizenry.
Health workers/Service Providers	A health provider / worker is anyone who has received the required training from an accredited training institution, is duly licensed or recognised by an appropriate health professions regulatory body to provide healthcare service and is involved in the provision of healthcare either directly or indirectly in any health facility.
Medical records review	The process of retrieving and extracting relevant information of all files/folders related to a particular medical condition (i.e., CVD) of a patient.
Policymaker	A high-level professional who has been working within the health system and is involved in defining policy on GHI.
Patient	A patient is any individual who has a healthcare need (e.g., CVD condition) and visits a health facility for it (i.e., the need) to be addressed.
Patient experience	Patient experience encompasses the range of interactions that patients have with the healthcare system, including their care from health insurance plans, and from doctors, nurses, and staff in hospitals / health facilities, physician practices, and other healthcare facilities.
Patient satisfaction	Satisfaction is about whether a patient's expectations about a health encounter were met.

Executive Summary: Implementation Research to Evaluate the Ghana Heart Initiative (Pilot Phase)

In line with an implementation science approach, our evaluation aimed to assess the reach, effectiveness, fidelity, implementation process, and maintenance of the Ghana Heart Initiative (GHI). We also provide scientific evidence and cost considerations for scaling up the pilot phase of the GHI nationwide.

We sought to answer the following specific evaluation questions:

1. Has the GHI reached the target population?
2. Has the GHI produced the desired changes on quality of hypertension / cardiovascular disease (CVD) service delivery i.e., safety, effectiveness, timeliness, equitable, and patient-centered care and health outcomes?
3. Has the GHI obtained support from key stakeholders?
4. Has the GHI been delivered as planned (fidelity)?
5. Are the implementation approach and health system changes produced by the GHI sustainable?

The GHI was established with the idea that sustainable change in healthcare comes from local solutions that can be shared globally. The initiative aimed to enhance the early detection and management of hypertension and CVD in the Greater Accra Region (GAR). The programme started with assessing the equipment and barriers at selected health facilities, involving local stakeholders like the Ghana Health Service (GHS) to prioritise and address supply-side challenges. The GHS was chosen for implementation, and a "Governance Committee" guided the GHI team, which included government and academic representatives.

The programme monitored the entire CVD care process from screening to treatment and health system improvements. The GHI, launched in early 2019, was a collaboration involving GIZ, the Ministry of Health (MoH), GHS, and funded by Bayer AG. It aimed to empower healthcare workers, improve patient care, and influence policies for effective CVD management. The focus was on transforming the Ghanaian healthcare system's approach to managing CVD risk factors like hypertension.

Background

Cardiovascular diseases (CVD) pose a significant global health challenge, especially in low- and lower-middle-income countries (LLMICs). Hypertension, a modifiable risk factor, is closely linked to CVD-related mortality and disability. In LLMICs, several key drivers contribute to the burden of CVD, including insufficient physical activity, low fruit consumption, high processed meat intake, sedentary lifestyles, hypertension, diabetes, obesity, and smoking. Ghana, for instance, grapples with an alarming hypertension prevalence of 38%, marked by inadequate awareness (34%), treatment (32%), and control rates (2-12%). This higher prevalence of CVD also translates into a substantial economic burden on households, with more than 40-50% of households paying out-of-pocket expenses for health services and medications.

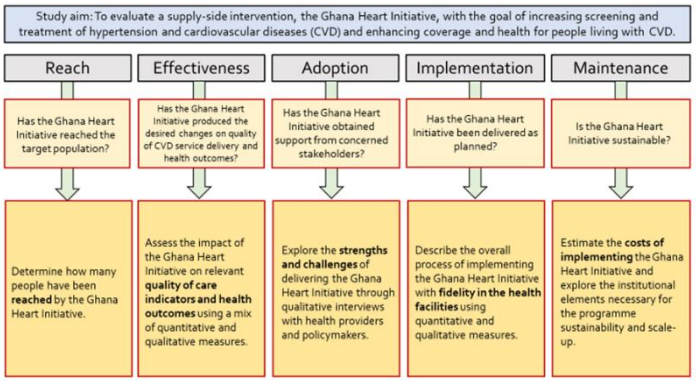
To underscore the critical importance of blood pressure management, a meta-analysis of randomised controlled trials revealed that lowering blood pressure reduces the risk of stroke and myocardial infarction by 35%-40%. Global uptake of proven cardiovascular disease prevention therapies, on the other hand, is suboptimal, with a 55% gap in treatment benefits as demonstrated in clinical trials vs real-world effectiveness. Multiple factors contribute to this gap, including the absence of standardised treatment guidelines, a shortage of trained healthcare personnel, inadequate infrastructure, and limited access to laboratory facilities. The challenge is compounded by the uneven distribution of healthcare workers, subpar infrastructure, and high treatment costs, leading to poor disease management and prognosis across the CVD care cascade. In an assessment carried out prior to the project launch by the GHI team among 85,612 outpatients, 0.43% were newly diagnosed with hypertension; of these, 83% began treatment, but only 5% achieved blood pressure control. This assessment further highlighted gaps in health worker knowledge, availability of equipment, CVD care management, standardised protocols, and limited representation of CVD indicators in the National Database (DHIMS2) for monitoring the performance of health service delivery. Given this backdrop, innovative healthcare delivery models for hypertension and CVD detection, treatment, and follow-up are urgently needed.

In response to these pressing needs and in the absence of available national standard guidelines, the Ghana Heart Initiative (GHI), launched in 2019, is a health-system intervention aimed at improving the early detection and management of hypertension and CVD in the Greater Accra Region (GAR). This collaboration between GIZ GmbH, the Ministry of Health (MoH), and Ghana Health Services (GHS) empowers frontline healthcare workers to better address patient needs and enhance the quality of care for CVD patients. The GHI not only aligns with sustainable development goals but also seeks to enhance risk assessment and CVD management within public health facilities in the GAR. The initiative also fosters international cooperation with the private sector, particularly the pharmaceutical industry. Rather than targeting individual patients, the intervention focuses on improving health service delivery by addressing risk factors and CVD management.

The GHI includes five main components: (i) stakeholder engagement and development of national guidelines for the management of CVD (available in hard copies and a digital app) and training material; (ii) training of healthcare workers coupled with coaching / mentorship visits; (iii) equipment supplies for the diagnosis and treatment of CVD; (iv) training of healthcare workers for the collection of facility-level data for programme monitoring; v) establishment of a 24x7 CVD support and call centre. The initial phase included equipment assessments and was guided by a "Governance Committee" consisting of representatives from the MoH, GHI, GHS, and academia. The programme monitored the entire care cascade, from screening to diagnosis, treatment to control, and health system improvements.

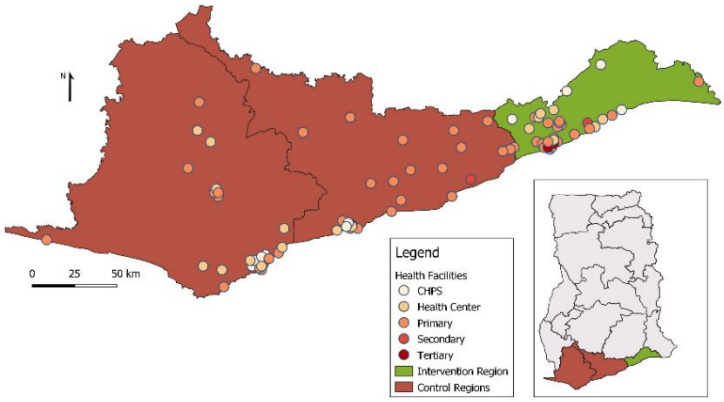
RE-AIM Framework

The evaluation of the intervention ("the GHI") is guided by an implementation science approach and employs the RE-AIM framework. This framework encompasses domains such as reach, effectiveness, adoption, implementation, and maintenance, along with costs and potential scaling to other regions in Ghana. It allows for a comprehensive assessment of GHI's effectiveness.



Methods

This study employed a mixed-method design to assess the effect of the GHI on health service delivery and quality of care for hypertension and CVD in Ghana. We utilised both quantitative and qualitative data sources to comprehensively analyse the effects of GHI implementation. The evaluation compared health facilities implementing GHI with control facilities based on care levels (primary, secondary, tertiary). The GHI's initial phase was introduced in the GAR, leading to intervention facilities in this region, while control facilities were selected from Central and Western Regions.



Study Components

This evaluation study primarily focused on facility-level research, employing a variety of data collection tools, including quantitative and qualitative methods. Four types of quantitative surveys were conducted at the facility level: health facility assessment, healthcare provider (knowledge, attitude, and practice), patient exit, and medical record reviews before and after the implementation of the GHI. Additionally, qualitative in-depth interviews were held with policymakers and health system stakeholders, accompanied by an economic evaluation from the health system perspective.

Indicator Selection

Indicators were chosen based on their theoretical relevance to GHI's theory of change and alignment with national and international CVD guidelines. These indicators spanned various aspects, including service quality, CVD service utilisation, coverage, and patient health status and satisfaction. Some indicators, such as timeliness and out-of-pocket expenditure (OOPE), although not directly influenced by GHI, were included to provide context and consider sustainability. The study aimed to assess GHI's effect on immediate outcomes (hypertension screening, diagnosis, prescription patterns), provider behaviour, patient-centered care, and the overarching objective of improving CVD health.

Findings

The findings are presented following the RE-AIM framework.

REACH

Within the framework of our evaluation, reach of the GHI is captured through: the number of facilities, providers, and patients that have been reached by the project at the health facility level in the GAR. Based on the data gathered the GHI reached:

41 **Health Facilities**

Trained, on average, **5 healthcare providers** per facility in hypertension management

78,840 patients per month who received hypertension and or CVD care across all GHI implementing facilities

- **The GHI has a wide reach in the GAR, but there is a heterogeneity in its implementation among the implementing facilities.** This highlights opportunities for alignment and improvement, with challenges related to the multicomponent intervention and COVID-19 delaying the delivery of essential equipment and the start of the training.

- **Equipment and Services:** The majority of facilities in the intervention region owned essential equipment, and diagnostic and laboratory services were more prevalent. GHI's direct provision of certain equipment contributed to differences between intervention and control facilities, with intervention facilities having a significantly higher number of fasting blood glucose tests.

- **Hypertension Services:** Both intervention and control facilities were dedicated to addressing hypertension. **Intervention facilities achieved a slightly higher composite score for hypertension services, indicating the positive influence of GHI in equipment supply and training**.

- **CVD-related Services:** Intervention facilities stood out positively in the availability of CVD-related services, particularly electrocardiograms and renal function tests. While the composite score did not show a significant difference, this may be due to the limited sample size.

- **Laboratory Services:** Intervention facilities consistently provided laboratory services, notably offering a statistically higher number of fasting blood glucose tests due to GHI's provision of glucometers and strips.

- **Referral System:** Intervention facilities demonstrated a wide range of hypertension and CVD care options and improved referral practices, despite challenges. Referrals were significantly decreased since healthcare providers actively worked to reduce inappropriate referrals, with competent providers leading the way.

- **Patient Counselling and Care:** While less than half of patients received counselling on lifestyle behaviour, a large percentage were advised to adopt a healthy diet and engage in regular check-ups. Many providers in intervention facilities integrated lifestyle modifications with medication, promising improved patient care and CVD outcomes.

EFFECTIVENESS

Within the framework of our evaluation, effectiveness was measured by the effect of the GHI on relevant quality of care indicators, including process indicators.

- **Medication Availability:** Intervention facilities demonstrated better availability of essential blood pressure (BP) lowering medications, including beta-blockers, calcium-channel blockers, and diuretics**.**

- **Prescription Patterns - Outpatient Medical Record Review (MRR)**: Intervention facilities showed increased utilisation of beta-blockers; Statistically significant rise in the usage of triple combination therapy to improve compliance to hypertension therapy; Statin prescriptions substantially increased, indicating a focus on cardiovascular risk reduction. **Inpatient MRR:** The intervention facilities showed a higher usage of beta-blockers and diuretics; There was a statistically significantly higher utilisation of a dual combination of BP-lowering medications in the intervention facilities which is in accordance to the guideline recommendation to use fixed dual combinations; Similarly, there was a higher use of statins in the intervention facilities.

- **Blood Pressure Control: Intervention facilities successfully achieved controlled blood pressure (<140/90 mm Hg) in approximately 41.8% of patients**, while control facilities achieved this in 33.6% of cases. It is important to note that the national average for blood pressure control is between 5% and 7%. This clearly demonstrates that the intervention facilities are already performing better than the national average.

- **Care Delivery Processes**: Intervention facilities exhibited improved clinical practices, with higher proportions of patients having blood pressure measured; Post-GHI, these facilities displayed advancements in lipid and serum creatinine ('kidney function') testing, and support for healthy lifestyle practices.

- Healthcare providers exhibited diverse knowledge of CVD risk factors, stroke, heart attack symptoms, and treatment. **There was a statistically significant higher understanding of heart attack symptoms among providers in intervention facilities and a significantly higher number of patients were diagnosed with diabetes, stroke, and high cholesterol.**

- Majority of providers leaned towards balanced lifestyle modification and medication for hypertension/CVD care. A significantly higher number of patients visited the intervention facilities for control and follow-up of their BP and other CVDs.

- **Patient Experience**: Positive trends emerged in intervention facilities for provider-patient communication, provider choice, prompt attention, privacy, and shared decision-making.

- **Patient Satisfaction**: Patients attending intervention facilities reported statistically significantly higher satisfaction levels. Increased patient motivation to adhere to treatment plans and improved overall health and wellbeing.

ADOPTION

Within the framework of our evaluation, Adoption was measured by the number / percentages of healthcare providers who took part in the GHI and who report using the national CVD guidelines and equipment, and knowledge gained from training.

- **The GHI demonstrates extensive and consistent adoption** across healthcare facilities and healthcare providers, reflecting high to moderate levels of compliance in implementing activities such as adhering to national CVD guidelines, utilising equipment, and undergoing relevant training.

- **Improved Healthcare Provider Confidence**: Healthcare providers engaged in GHI activities reported notably increased confidence in their capacity to provide care for patients with hypertension and CVD.

- **Within the intervention facilities, there was a significantly higher utilisation of various guidelines, including the National CVD guidelines**, standard treatment protocols, recommendations from the American Heart Association and American College of Cardiology, as well as guidance from the European Society for Cardiology, among others. However, there is a lack of awareness of the Akomacare app (the digital version of the national CVD guidelines) and dissatisfaction among some users, warranting a closer examination of its usability and effectiveness.

- **Positive Perception of Training**: GHI's training initiatives received positive feedback from healthcare providers, with a majority reporting improved technical competence and knowledge related to hypertension and CVD screening, diagnosis, and management. The training materials and resources were widely regarded as valuable for clinical practice, generating interest in future training opportunities from the GHI.

- **The equipment supplied by the GHI garnered an average rating of 8.5 out of 10** from providers who utilised it, underscoring its substantial utility in the screening, diagnosis, and management of patients with high BP and/or CVD.

- A substantially larger proportion of healthcare providers in the intervention facilities identified barriers to their practice, including negative side effects from drugs, patients unable to afford medications, and a high prevalence of individuals dealing with hypertension or CVD. As previously mentioned, the number of cases involving hypertension and CVD observed by healthcare workers at intervention facilities during each outpatient clinic was notably elevated.

- **Systemic Challenges**: Challenges noted by the GHI programme team, healthcare providers, and policymakers often stemmed from broader weaknesses in the healthcare system. These included staff shortages, extended wait times at facilities, and incomplete dissemination of hypertension and CVD training to all providers, resulting in varying levels of adherence to the national CVD guidelines.

- **Attrition Effect:** The attrition of trained health personnel may have contributed to limited differences in the utilisation of national CVD guidelines, equipment, and training. The knowledge, attitude, and practice (KAP) survey's representation of only one-fourth of trained workers suggests a potential disconnect between training and practical implementation.

- Evident gaps in existing CVD care within the GAR have been identified. However, the process of implementing guidelines, training staff, and integrating equipment takes time. Notably, the adoption rate of any given innovation tends to start slowly before gaining momentum.

IMPLEMENTATION

Within the framework of our evaluation, implementation of the GHI is captured through facilitators and barriers of each component, and contextual issues using mainly qualitative methods.

- The enablers driving the successful implementation of the GHI project can be summarised as follows: **High-Level Project Governance:** The initiative's effectiveness is boosted by involving key stakeholders, including the Health Minister and the GHS. This national recognition elevates the project's importance and secures government support; **Integration Within Existing Systems:** Working within the framework of the national healthcare system enhances sustainability. Aligning the project with the existing infrastructure ensures long-term viability and relevance; **Non-Parallel Implementation:** The project emphasises integration rather than creating a separate system. Official letters from prominent health authorities lend credibility, emphasising the endorsement and facilitation of the initiative; **Ownership and Institutional Adoption:** The project's success is bolstered by institutional ownership, with healthcare service providers viewing the intervention as their own programme. Government endorsements and statements of responsibility ensure a sense of ownership and commitment. These enablers collectively contribute to the initiative's effectiveness by establishing a robust governance structure, ensuring alignment with existing healthcare systems, managing challenges associated with integration, promoting ownership among stakeholders, and emphasising non-duplicative efforts.

- **The initiative's achievements were substantial. Stakeholders at different levels demonstrated commitment and willingness to implement the programme's strategies**. The programme successfully integrated hypertension control into routine health services, resulting in increased BP measurement and improved compliance with treatment. Additionally, the district health information monitoring system (DHIMS2), was expanded to include non-communicable disease (NCD) data, contributing to better planning and decision-making. While some challenges persisted, such as limitations imposed by pharmaceutical industry financing and a need for continued pre-service training integration, the programme's achievements were noteworthy. It successfully aligned its goals with the health system's needs and secured buy-in from various stakeholders, illustrating its potential for improving cardiovascular health in Ghana.

- **Regarding integration into health facilities, interviewees explained that training is being scaled up across regions and facilities. Guidelines have been launched and are intended to guide practice.** They discussed integration efforts related to curriculum changes for medical professionals by the Council for Midwives and Nurses and the Medical Council to ensure better preparedness for handling NCDs. The development of an e-learning module for cardiovascular diseases and its integration into in-service training was also mentioned.

- **The GHI has faced several challenges at various levels, including bureaucracy, leadership commitment, human resources, stakeholder engagement, resource management, and alignment between plans and realities on the ground.** Overcoming these challenges requires addressing the bureaucratic processes, fostering stronger leadership buy-in, ensuring stable staffing, improving stakeholder coordination, improving equipment management, and managing expectations through effective communication.

MAINTENANCE

Evaluation of maintenance includes the following: Analysing the perceptions of health providers and policymakers who are introduced to the innovative approach and adapting the strategies.

- **The GHI programme in Ghana has been innovative in its national approach, emphasising the use of healthcare providers on the frontline for screening and treatment of CVDs**. It has also fostered partnerships between public and private sectors. Grantees have the flexibility to tailor the programme to local contexts, exploring novel services and structures such as launching a CVD Support and Call Center, e-learning courses, and developing the Akomacare app. Involving healthcare providers in CHPS compounds for CVD healthcare services was also examined.

- **Healthcare providers found GHI's training useful in managing hypertension and CVD patients, especially the hands-on component**. Trust in patient advice increased, and patients in intervention facilities felt more informed about their heart-related health condition. Patients in intervention facilities were also more satisfied with their healthcare than those in control facilities. However, there are threats to sustainability, including prioritising CVD in the health sector, funding, frequent attrition of healthcare workers, migration of experienced healthcare providers (including nurses), lack of accountability in the public sector, no medical superintendent under coercion to continue the programme, and the GHI struggles to incorporate CVDs into medical and nursing students' curriculums.

- **In summary, GHI is likely to make sustainable accomplishments due to acknowledging CVD and hypertension as a priority in Ghana's national health sector strategy and NCD policy**. However, technical proficiency of healthcare professionals remains limited, and notable geographic and socio-economic variation in access and utilisation of health services pose challenges for sustainability.

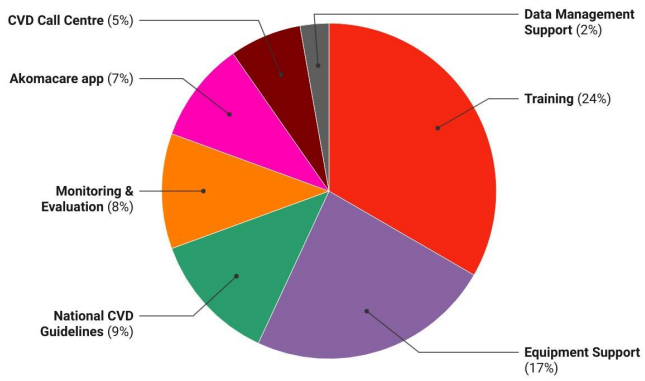
ECONOMIC EVALUATION

The evaluation adopted a health system perspective, considering costs from the GHS, MoH, and GIZ standpoint. It spanned the pilot phase from 2018 to 2022, segmented into design and implementation phases. An activity-based costing approach was employed to track all resources utilised, and seven activity clusters were identified for cost categorization.

Cost Analysis:

The evaluation reveals that the GHI incurred a total cost of 1,740,853 Euros. Design costs comprised 8.5% (148,558 Euros), while implementation costs made up 91.5% (1,592,295 Euros). Human resources constituted the foremost expense, followed by consumables, transportation, and room rental. Costs across activity clusters are meticulously presented, elucidating spending patterns.

FIGURE X: COMPOSITION OF IMPLEMENTATION COSTS



Budget Impact Analysis:

The evaluation undertook a budget impact analysis to gauge potential financial consequences. Three scenarios were considered:

1. **Scenario 1 – Comprehensive Approach:** This scenario covers all GHI activities, excluding only the national guidelines and Akomacare app, which have already been launched. Potential additional costs may arise for their long-term maintenance and updates, the frequency and timing of which are yet to be confirmed.
2. **Scenario 2 – Service Delivery Focus:** This scenario prioritises essential service delivery activities, such as healthcare provider training, equipment support, and CVD support through a call center. We assume that coordination and monitoring costs may be covered by parallel NCD programmes.
3. **Scenario 3 – Design and Expansion:** In addition to the activities in Scenario 1, this scenario accounts for costs related to the design phase and the possibility of strategic stakeholder engagement during the expansion or scale-up phase.

Key Insights:

- **Scaling GHI to 100% coverage under Scenario 3 would necessitate 2.4% of Ghana's total health budget, amounting to €26.7 million.** In Scenario 2, the cost would reduce to €10.7 million (1% of the budget), focusing on essential service delivery components.
- The GHI intervention holds a highly approach in addressing the escalating CVD challenge in low- and middle-income countries (LMICs).

Recommendation:

- Policymakers are advised to consider comprehensive scenarios for maximum impact, while also evaluating willingness to pay and prioritizing GHI as a crucial health intervention.

In summary, the economic evaluation of the GHI underscores its potential significance in combatting cardiovascular diseases. With detailed costing analysis, budget impact assessments, and strategic insights into cost-effective strategies, the evaluation equips policymakers and stakeholders with the necessary tools to make informed decisions about expanding and scaling up the GHI nationwide.

- **Cost Consideration:** Scenario 2 appears to strike a balance between coverage and cost, offering a more efficient option compared to Scenario 1 or 3.
- **Budget Impact:** All scenarios represent a substantial investment relative to Ghana's total health budget, with Scenario 3 being the costliest.
- **Coverage Levels:** The provided expansion coverage levels (100%, 80%, 60%, and 40%) can help assess the scalability of each scenario.
- **Comprehensiveness:** Scenarios 1 and 3 offer a comprehensive range of services, including data support, coordination, and evaluation, while Scenario 2 omits these additional components.

Ultimately, the choice between these scenarios depends on factors such as available resources, programme objectives, priorities, and the desired impact on healthcare delivery and cardiovascular disease management in Ghana.

ACHIEVEMENTS OF THE GHANA HEART INITIATIVE

The GHI is a health facility-based multi-component programme aimed at improving hypertension and cardiovascular disease care for both urban and rural populations. The programme faced challenges due to the Covid-19 pandemic and the country's weak health system. **Despite these obstacles, the GHI led to several achievements**:

1. **Increased Awareness and Stakeholder Engagement:** The GHI effectively raised national awareness about CVDs and the need for improved service delivery. It also facilitated engagement among relevant stakeholders.
2. **National Guidelines and Akomacare App:** The development of Ghanaian National CVD Guidelines and the Akomacare app was a notable achievement. These resources filled a gap in the organised management of CVDs for Ghanaian clinicians. The guidelines were launched by the MoH, and are now in mandatory use.
3. **Healthcare Worker Training:** Over 500 healthcare workers across different levels of care were trained in managing CVDs, including medical doctors, nurses and physician assistants at primary healthcare facilities. Despite staff retention challenges and attrition due to transfers and migration to other countries, intervention facilities demonstrated increased knowledge of stroke and heart attack symptoms, as well as CVD treatment. Continuous and comprehensive training for healthcare providers was emphasised.
4. **Equipment Procurement and Usage:** The programme successfully procured equipment for managing CVDs in over 40 facilities in the GAR. This resulted in improved utilisation of validated and calibrated equipment, particularly BP monitors and ECG machines, in intervention facilities.
5. **Prescribing Patterns:** Intervention facilities showed a higher utilisation of dual and triple combinations of BP-lowering medications compared to control facilities as recommended by the national CVD guidelines. This approach aims to improve medication compliance and prevent future adverse clinical outcomes and complications related to hypertension.
6. **Hypertension Screening and BP Control:** Hypertension screening improved, and there was an improvement in BP control within the intervention facilities. The establishment of GHS Wellness Clinics for hypertension screening aligned with the programme's goals.
7. **Patients consistently reported significantly higher satisfaction with service delivery at intervention facilities. This finding is probably a reflection of greater service availability and higher quality of service delivery, as depicted by some of our other quality of care process indicators.** Appraised together, our findings indicate that the GHI was ultimately successful in enhancing patient-centeredness by acting to improve health service delivery models.
8. **CVD Support and Call Center:** Efforts were made to establish a CVD Support and Call Center. Alongside, improvements were made in the data capture with additional CVD-related indicators for the District Health Information Management System 2 (DHIMS2). While there were indications of success, a comprehensive evaluation was limited.
9. **Effective project governance**, led by a dedicated committee, facilitated communication and collaboration among diverse stakeholders, securing crucial support from government officials and enhancing project visibility.
10. **Strong sense of ownership demonstrated by the MoH and GHS since the GHI was aligned with the government's objective / policy for CVD / NCD**, solidifying commitment and shared responsibility among stakeholders, which continues to drive sustained progress.

In summary, the GHI made substantial strides in increasing awareness, enhancing healthcare worker knowledge, improving equipment access, and promoting better management of CVDs, ultimately improving patients' satisfaction with health service delivery in Ghana. However, challenges and limitations, such as the complexities of assessing large-scale screening programme and addressing knowledge gaps among providers, also became apparent during the evaluation.

CHALLENGES AND RECOMMENDATIONS FOR IMPROVEMENT

The GHI programme has demonstrated considerable progress in creating a structured framework for the CVD sector in Ghana and integrating CVD management into Ghana's health sector. Despite challenges faced during implementation, credit is due to the implementers, providers, and policymakers involved. Efforts should be expanded to other regions in the country. The challenges and recommendations for advancing the GHI programme are as follows:

1. **High Mobility of Healthcare Workers and Training Retention**: Due to healthcare workers' mobility and the intervention's pilot nature, retaining training gains at the healthcare level where training occurred is difficult. Scaling up the GHI programme can help address this issue.

   Recommendation: Develop retention strategies, including non-financial incentives and professional development opportunities for healthcare workers. Partner with educational institutions and use the "*train-the-trainer*" approach for sustainable knowledge dissemination and retention.

2. **Monitoring Adherence to Treatment Guidelines**: After equipment delivery and training, monitoring healthcare workers' adherence to treatment guidelines and quality of care becomes challenging. Increasing supportive supervision and implementing clinical governance systems, such as audits, can ensure compliance with guidelines.

   Recommendation: Increase supportive supervision, conduct clinical audits, and leverage digital tools to ensure healthcare providers adhere to treatment guidelines.

3. **Reducing Out-of-Pocket Expenses (OOPE)**: Despite satisfactory service quality, CVD consultation, investigations, and medication costs remain high for individuals. Expanding health financing and social health protection schemes could cover more outpatient chronic care services.

   Recommendation: Advocate and lobby for subsidies to reduce out-of-pocket expenses for patients, especially in medication costs. Expand health financing programmes and consider covering opportunity costs to enhance financial accessibility.

4. **Effective Communication and Preferences**: Encouraging open communication between GHI implementers and healthcare providers is important. Addressing varying perceptions, particularly regarding technology use, can improve the adoption of tools like the Akomacare app. Considering provider preferences, even reverting to printed guidelines, can enhance effectiveness.

   Recommendation: Continuously monitor knowledge utilisation, establish feedback mechanisms, and refine digital tools while offering traditional options to accommodate diverse preferences.

5. **Balancing Supply and Demand**: GHI has focused on the supply side, but addressing CVD requires attention to demand. Encouraging early care-seeking through behavioural interventions, integrating these into the GHI, and transitioning to community-focused prevention strategies are important steps.

   Recommendation: Integrate behavioural interventions to promote early screening and healthy lifestyles into the GHI. Focus on primary prevention in communities and improve referral processes.

6. **Pandemic Preparedness**: The Covid-19 pandemic delayed GHI pilot phase components. This highlights the need for better readiness for future pandemics.

   Recommendation: Develop pandemic preparedness plans, transition to a hybrid funding approach, and explore sustainable funding mechanisms like subscription-based models to ensure programme resilience.

7. **Stakeholder Collaboration**: The NCD steering committee and the Technical Working Group for CVD, having been established, should take on a more active role in policy formulation and implementation. The ministry should coordinate the activities of the steering committee.

The GHI has made positive strides in improving CVD care in Ghana, and while challenges remain, the recommendations provide a roadmap for continued success.

IMPLICATIONS FOR POLICY

- The challenges concerning the mobility of healthcare providers and the historical problem of healthcare staff shortages highlight fundamental weaknesses in the Ghanaian healthcare system. These issues cannot be adequately resolved solely through the GHI programme itself. Instead, they demand more comprehensive policy interventions aimed at tackling their underlying causes.

- Similarly, even though the GHI programme might provide adequate resources to address immediate out-of-pocket expenses (OOPE), it remains crucial for policymakers to confront the persisting long-term issue of OOPE for CVDs. This issue continues to be a matter of public concern that necessitates attention. One way to address this is by broadening the scope of the health benefit package accordingly.

- Furthermore, prescription practices can be swayed by the reimbursement levels established by the National Health Insurance Scheme, which might necessitate re-evaluation. This can be tackled through the implementation of more effective strategies for strategic procurement. Such strategies empower healthcare providers to recommend and initiate certain modes of treatment at lower levels of care.

- The completeness and quality of clinical documentation, particularly concerning CVD, have been identified as falling short of the desired standard. This underscores the significance of timely intervention from GHS across all facilities, regardless of whether they employ manual or digital records. The adoption of digital documentation presents an additional challenge due to the heightened workload, underscoring the need for prompt GHS intervention once again.

- The MoH and GHS should explore alternative sources of funding, primarily domestically, to sustain the objectives of the GHI. The evaluation outcomes do not imply that this is currently in progress, thus posing a threat to the project's sustainability.

IMPLICATIONS FOR RESEARCH

- Exploring key indicators and establishing systematic processes based on past experiences is crucial. By devising a monitoring framework that hinges on these indicators, we can effectively foster a dynamic learning health system model.

- Forming cohorts: A strategic approach involving the creation of diversified cohorts encompassing healthcare facilities and their respective patients holds promise. Such an approach can offer a comprehensive perspective that facilitates meaningful insights and informed decision-making.

- It is imperative to conduct a thorough evaluation of the actual effectiveness achieved by the CVD Support and Call Center. This assessment will provide a clear understanding of its effectiveness and aid in making informed adjustments for optimal outcomes.

- Understanding user preferences for Electronic Medical Record design and Akomacare app usage offers actionable insights. This research initiative aims to improve user experiences, align product design with user needs, and enhance overall satisfaction.

- Our research spotlights the monitoring of DHIMS2 system progress, particularly in relation to CVD indicators. Leveraging this data-driven approach facilitates evidence-based decision-making, thereby advancing CVD management and healthcare system effectiveness.

Conclusion

The Ghana Heart Initiative (GHI) is a national programme aimed at improving hypertension and cardiovascular disease (CVD) care across public health facilities in Ghana. The pilot phase of the GHI targeted health facilities at all levels of care in the Greater Accra Region contributing to certain advancements in Ghana's national and regional health system, including medical equipment distribution, development of the first edition of the national CVD guidelines, healthcare provider training, launching the Akomacare app, mentoring and supportive supervision, and establishing a CVD Support and Call Center. In conclusion, the evaluation of GHI has not only provided a detailed assessment of the programmes effect, but has also shown possible ways forward to achieve greater hypertension and CVD control in Ghana. The achievements and lessons learned from GHI serve as a foundation for policymakers, stakeholders, and researchers to continue the journey toward enhanced CVD care and a healthier future for the people of Ghana.

EVALUATION PURPOSE AND EVALUATION QUESTIONS

EVALUATION PURPOSE

The aim of this evaluation has been to provide a thorough and scientifically rigorous assessment of the Ghana Heart Initiative. We have approached this evaluation through the lens of implementation science, focusing on capturing the implementation processes, outcomes, and associated costs of the intervention.

EVALUATION QUESTIONS

The specific **evaluation questions** that we have addressed are:

1) Has the Ghana Heart Initiative reached the target population?

2) Has the Ghana Heart Initiative produced the desired changes on quality of hypertension / cardiovascular diseases service delivery i.e., *safety, effectiveness, timeliness, equitable, and patient-centered care* and health outcomes?

3) Has the Ghana Heart Initiative obtained support from key stakeholders?

4) Has the Ghana Heart Initiative been delivered as planned (fidelity)?

5) Are the implementation approach and health system changes produced by the Ghana Heart Initiative sustainable?

BACKGROUND

This chapter starts by providing an overview of cardiovascular diseases in Ghana, then outlines the Ghana Heart Initiative (GHI), 'the intervention', the methodological approach to evaluation, and the challenges encountered.

CARDIOVASCULAR DISEASES IN GHANA

Cardiovascular diseases (CVD) are the leading cause of death globally, with a disproportionately higher burden (>80% age-standardised CVD deaths and DALYs) in low- middle-income countries (LMICs) [1]. Arterial hypertension, also called high blood pressure (BP), is a leading modifiable risk factor associated with CVD death and disability [2]. While the average age-standardised BP is declining in most high-income countries, it is increasing in LMICs with 32%-50% of adults estimated to have high BP in sub-Saharan Africa (SSA) [3]. Multiple studies have shown that the key drivers of CVD in LMICs include insufficient physical activity, low fruit intake, high consumption of processed meat and sedentary lifestyles associated with rising urbanization as well as rising prevalence of hypertension, diabetes, obesity, and smoking [4] [5]. Although hypertension is a largely controllable condition, its actual rates of awareness, treatment, and control are disappointingly low in SSA. Ghana is a lower middle-income country in SSA with an estimated hypertension prevalence of 38%, and sub-optimal hypertension awareness (34%), treatment (32%) and control rate (2%-12%) [6] [7] [8]. A 5-year review of autopsy cases (January, 2006 to December, 2010) at Korle Bu Teaching Hospital, the largest and leading supra-tertiary level national referral and teaching hospital in Accra has attributed 22.2% of all deaths to CVD [9]. In addition to the disease burden, CVD threatens to impose a notable economic burden in Ghana, with more than 40-50% of households paying out-of-pocket for health services and medications [10]. Although there is a National Health Insurance Scheme, it has traditionally covered outpatient visits to improve access for many people, with recent expansion to inpatient care coverage although some services at tertiary level hospitals are not included in the benefit package. Additionally, there are delays in reimbursement of claims to facilities that affect the health system's ability to provide timely management of hypertension and CVD [11].

Evidence from meta-analysis of randomized trials have shown that lowering BP reduces the risk of future stroke by 35%-40% and myocardial infarction by 20%-25% [12]. However, uptake of proven CVD therapies is sub-optimal globally such that there is a 55%-point gap in the efficacy of CVD treatment shown in clinical trials versus real world effectiveness [13] [14]. Several health system factors in the LMIC context ostensibly influence the poor uptake of CVD prevention therapies and access to care, including the lack of standardised CVD treatment guidelines, acute shortage and inequitable distribution of trained healthcare workers, insufficient health system infrastructure and distribution of healthcare facilities, profound lack of laboratory facilities, supplies, and equipment including sphygmomanometer, medication stock-outs and high treatment costs [15]. The management and prognosis of high-risk patients depend on well-staffed emergency rooms and critical care units, which are poorly designed and developed in SSA, including Ghana. Further, recent reports from Ghana indicate large gaps in provider training, patient education, and medication availability to manage hypertension [16]. Given the rising CVD burden and relatively lower rates of hypertension control in Ghana, well-designed innovative models of healthcare delivery are urgently needed for early detection, treatment and follow-up of hypertension and CVD [17].

INTERVENTION – THE GHANA HEART INITIATIVE

The Ghana Heart Initiative's (GHI) goal is to contribute to the sustainable development goals (SDGs), in particular SDG 3 (good health and wellbeing) and SDG 17 (stronger partnerships) by improving risk

assessment and management of CVDs at tertiary, secondary, and primary levels of care in public health facilities in the GAR, and through partnering with the private sector i.e. the pharmaceutical industry contributing to the increasing trend in international cooperation.

The first phase of the GHI, a three-year (2018-2020) programme funded by Bayer AG and implemented through the GIZ, was designed to improve risk assessment and management of hypertension and CVD in public health facilities and hospitals in the Greater Accra Region (GAR). Its primary objective was to improve prevention, detection or diagnosis, and management of CVD. The GHI includes five main components: (i) Stakeholder engagement and development of national guidelines for the management of CVD (available in hard copies and a digital app) and training material; (ii) Training of healthcare workers coupled with coaching / mentorship visits; (iii) Equipment supplies for the diagnosis and treatment of CVD; (iv) Training of healthcare workers for the collection of facility-level data for programme monitoring and the GHI programme team worked with the Policy, Planning, Monitoring and Evaluation Division of the GHS to include important NCD indicators including CVD in the District Health Information Management System (DHIMS2) to facilitate facility-level routine data collection and reporting; and (v) Establishment of a round the clock ("24/7") CVD support and call center.

PARTNERSHIP MODEL

The GHI was built with the premise that sustainable change comes from local solutions, but that lessons, approaches and best practices could be shared and applied across communities regionally, and globally. The programme started with a need's assessment of equipment in each site, which assessed sub-state prevalence and identified key barriers to improved outcomes. Findings were shared with local stakeholders including the Ghana Health Service (GHS) to prioritise and address supply-side barriers. The GHI then selected the GHS for implementation. The GHI programme team were supported and guided by the "Governance Committee" which included government representatives from the MoH and GHS, individuals from academia and the GHI. The program routinely monitored the cascade of care from screening to diagnosis, diagnosis to care and treatment, and treatment to control, as well as indications of health system improvement including delivery of equipment, health workers trained and rates of referral. This scientific evaluation report of the first phase of the GHI assesses improved hypertension and CVD care (screening, diagnosis, and management of hypertension and CVDs), relative to intervention and control groups, where those data were available.

The GHI was initiated in September 2018, and officially launched on 9th January 2019, introducing an innovative health system intervention to strengthen early detection, and management of hypertension and CVD across health facilities in the GAR. The initiative was implemented as a collaborative effort by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, MoH and the GHS and funded by the pharmaceutical company Bayer AG. The GHI ("the intervention") enables frontline healthcare workers to better address the needs of patients suffering from CVDs and communities and support advocacy and policy that promotes effective care for CVD. The intervention does not target the single patient but changes the quality of care given to the single patient, by changing the way the health system addresses the management of risk factors (such as hypertension) and CVD.

EVALUATION SETTING

Ghana is a lower-middle-income country with an average annual per-capita gross domestic product of 2,445.3 USD. The mortality from coronary heart disease in 2020 was 119.93 per 100.000 population, and the probability of dying from any of CVD, cancer, diabetes and chronic respiratory disease is 20.8%. The health system in Ghana is decentralized, pluralistic, and operates on an integrated three-tier (national, regional, and district) scheme and incorporates a community-level health delivery system

to support community-based primary healthcare. Most healthcare is provided by the government and is largely administered by the service delivery agencies under the MoH such as the GHS, teaching hospitals, and the private providers (self-financing, faith-based, and non-governmental organisations). Ghana reformed its National Health Insurance Scheme in 2003 with 40% of the population being enrolled and ~60% enrolled people are exempted from premium payments. Ghana is one of the first African nations to enact legislation and earmark financing for universal health coverage; a notable move towards health system strengthening and improved financial protection.

Accra is the capital of Ghana and is located in GAR, which is one of the 16 administrative regions, and has the highest population density. The GAR has 26 districts, including the Accra Metropolitan Assembly, and had a total population of 5.4 million in 2021. The pilot phase of the GHI was implemented in 41 health facilities located in five districts (Accra Metro, Tema Municipal, Ga East, Ga West, Dangme West and Dangme East). A health facility is an infrastructure built and licensed by the Health Facilities Regulatory Authority to take care of the healthcare needs of the citizens of Ghana.

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CONCEPTUAL FRAMEWORK

Our evaluation approach is multifaceted, aiming to comprehensively assess the effectiveness and potential scalability of the GHI ("the intervention") within the Ghanaian healthcare context. We leverage several frameworks and concepts to ensure a holistic understanding of the intervention's effects and sustainability.

Firstly, we employ the RE-AIM framework, aligning with our research questions. This framework serves as our guiding operational evaluation tool, providing a structured approach to collect both quantitative and qualitative data. RE-AIM helps us systematically evaluate the robustness of the GHI across various domains: reach, effectiveness, adoption, implementation, maintenance, related costs, and the potential for scaling up the intervention in other regions of Ghana.

Furthermore, our Theory of Change (ToC) development process incorporates insights from stakeholders to understand how the GHI induces changes in hypertension and CVD management within a real-world healthcare setting. This involves mapping out the pathways through which change is expected to occur, utilising the RE-AIM framework to assess whether and how these changes have taken place.

To structure our evaluation, we turn to the World Health Organization's (WHO) six health system building blocks (HSBB). These building blocks provide a comprehensive framework for analysing how GHI actions effect different facets of the healthcare system. By evaluating health system performance, clinical processes, care quality, and outcomes in these six areas, we gain a deeper understanding of the intervention's effects.

Additionally, we consider implementation outcomes such as fidelity, acceptability, and effectiveness using a conceptual ToC model from diverse user perspectives. This approach helps us discern why and how the intervention generates observed changes and supports our thinking about potential expansion and scale-up in similar contexts. It also aids in long-term implementation planning, highlighting factors that support sustainability and the achievement of the GHI's long-term goals.

To ensure our measurement of patient experience regarding healthcare quality is robust, we integrate the Institute of Medicine's (IOM) six domains of healthcare quality, known as 'STEEEP' (Safe, Timely, Efficient, Effective, Equitable, and Patient-centered), into our conceptual framework. This allows us to capture a wide array of quality-related domains and adapt them to the specific focus of the GHI.

Moreover, we assess the overall Ghanaian healthcare system by examining the interaction and interdependence across and within the HSBB, offering a holistic perspective. This evaluation not only identifies gaps in the system but also provides insights for scaling up and sustaining GHI activities across Ghana. We pay special attention to how the demand side of health services, involving patients, interacts with the GHI components to evaluate effectiveness, safety, and timeliness of patient-centered care.

Our objective is to illustrate the pathways through which the GHI operates to achieve its desired outcomes, particularly in terms of improving the screening, diagnosis, and control of hypertension and CVD. For a visual representation of our approach, please refer to **Figure 1**, which presents our conceptual framework, and **Figure 2**, outlining the specific research questions addressed under each

dimension of the RE-AIM framework. These figures are informed by our comprehensive understanding of the HSBB and the IOM's STEEEP quality framework. Together, they provide a clear roadmap for our evaluation of the GHI's effectiveness and potential for future growth in Ghana's healthcare landscape.

Figure 1 Theory of Change that Underpins the Evaluation of the Ghana Heart Initiative

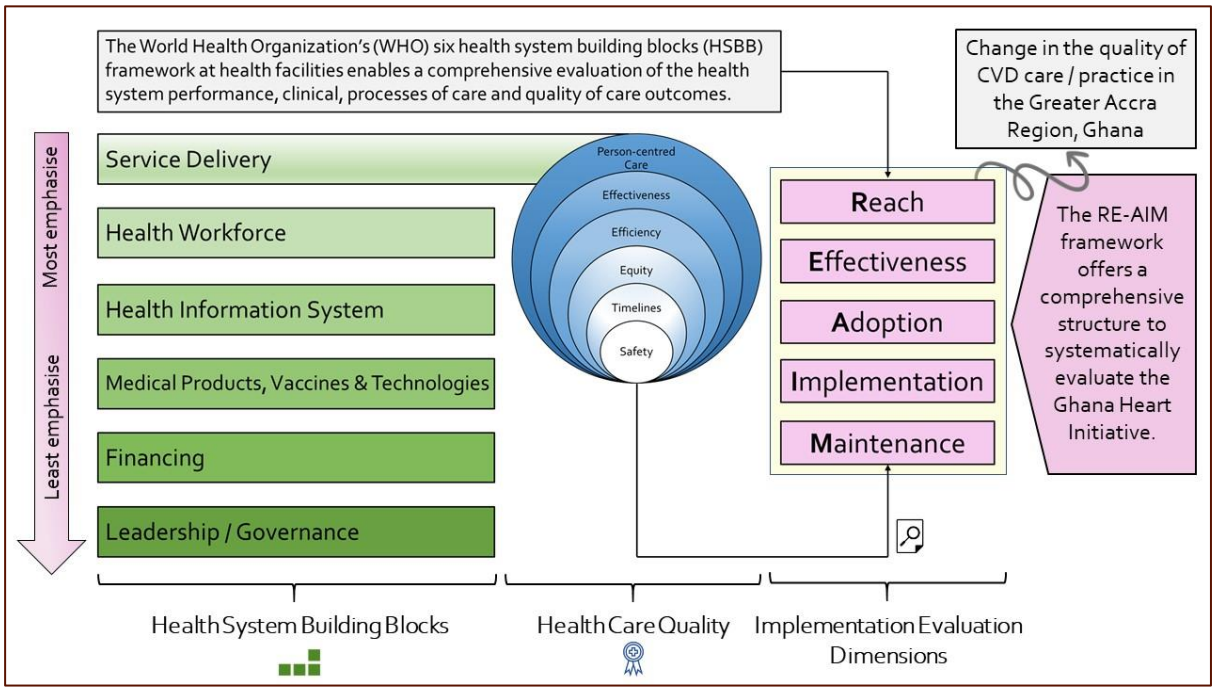
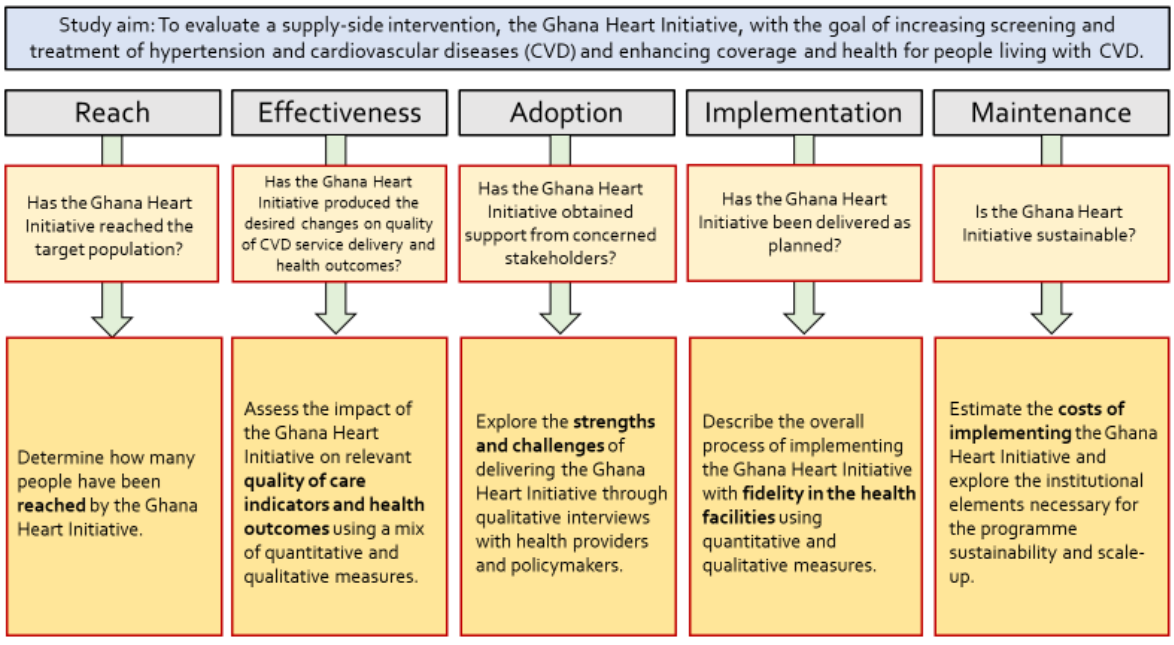


Figure 2 Overview of The Re-Aim Evaluation Framework



EVALUATION METHODS AND LIMITATIONS

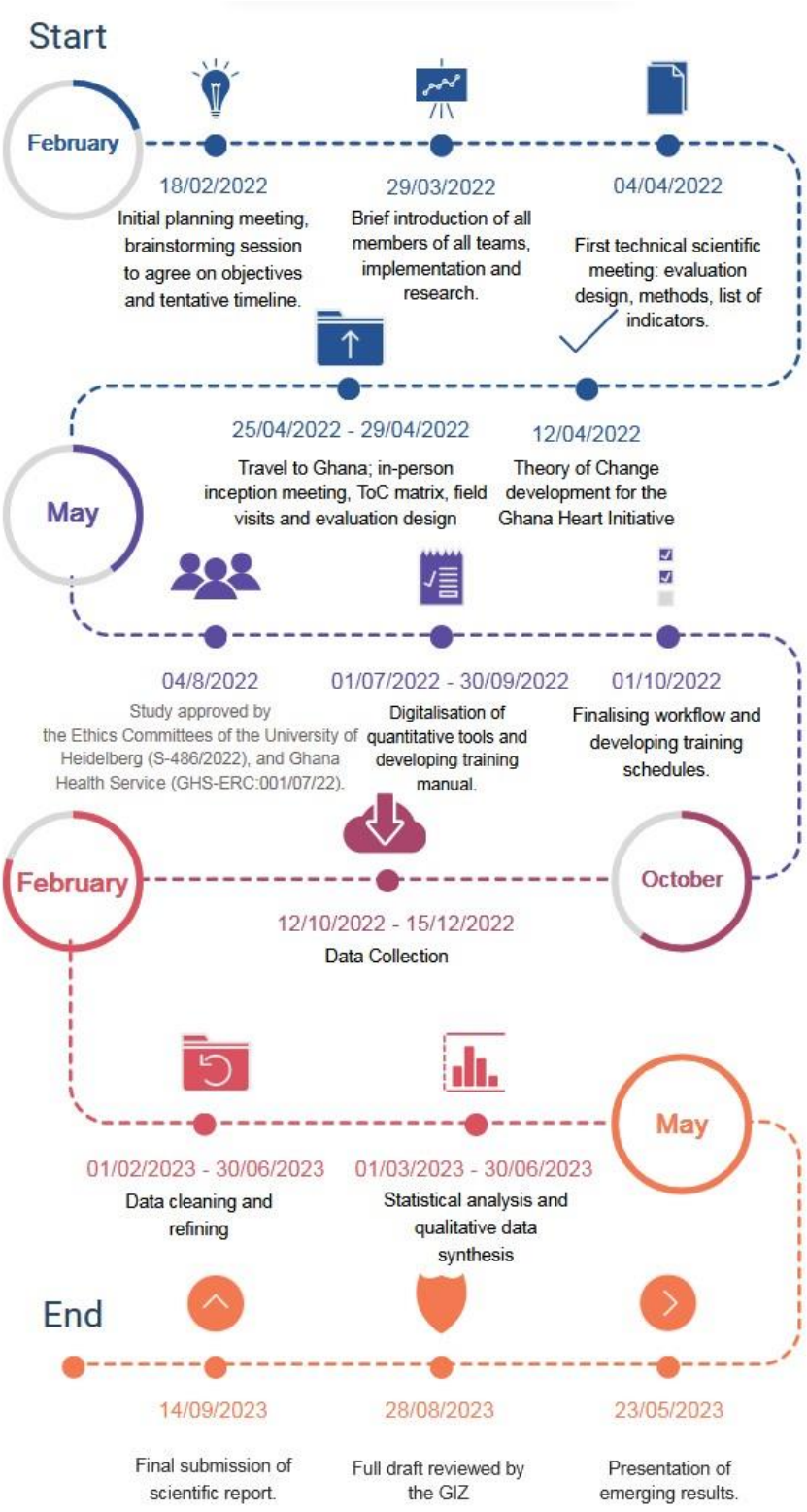
This section outlines the methods and data collection tools applied in this evaluation:

EVALUATION TIMELINE

HIGH and UGMS were involved as the GHI evaluation partners from February 2022; after the first phase of the programme had been rolled out.

Figure 3 below summarises the timeline and roles and responsibilities assumed by HIGH-UGMS for the evaluation of the GHI project.

Figure 3 Timeline of the Evaluation

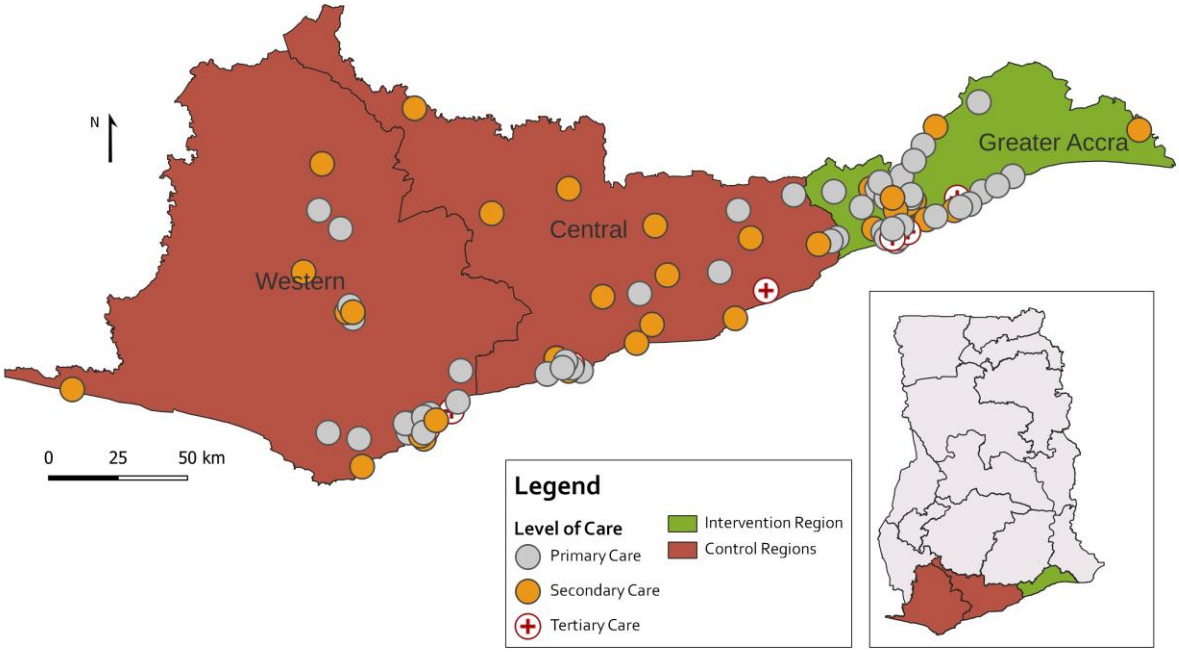


STUDY DESIGN

This study adopted a mixed-method design that involved multiple data sources. This approach with both quantitative and qualitative data collection allowed triangulation of results to investigate and interpret changes inducted by the GHI. A protocol paper describing in detail the design and rationale of the study has been submitted in May 2023 (https://www.researchsquare.com/article/rs-2893313/v1).

The evaluation study compared health facilities implementing GHI to matched control health facilities based on their level of care (primary, secondary, or tertiary). The first phase of the GHI was rolled out in the GAR; therefore, all intervention facilities were located in GAR while control facilities were selected in the neighbouring Central and Western Regions (**Figure 4**). The data on the facility level characteristics was obtained from the GHS and the Christian Health Association of Ghana (CHAG) Secretariat (the largest faith-based health service provider in Ghana) and we considered a large pool of potential 'control' health facilities from the Central Region and Western Region (**Figure 4**).

Figure 4 Intervention and Control Facilities Selected in Three Administrative Regions



STUDY COMPONENTS

This study is a facility-based study, collecting data at the facility level, except for interviews with policymakers and health system stakeholders. Various data collection tools are used in participating health facilities, including:

- Quantitative – 4 types of surveys collected at facility level:
  - Health facility survey;
  - Healthcare provider survey (knowledge, attitude, and practice);
  - Patient exit survey;
  - Medical record review before and after GHI implementation;
- Qualitative – interviews with policymakers and health system stakeholders
- Economic evaluation

INDICATOR SELECTION

We used the RE-AIM framework to evaluate the implementation of the GHI and chose outcome indicators accordingly.

Indicators were selected for the GHI evaluation based on the following criteria:

a. Theoretical relevance and alignment with the GHI theory of change. We selected outcome indicators to reflect areas where GHI, as implemented in GAR, could have been expected to produce change. We included indicators at different levels, namely indicators related to service quality (including perceived quality), to CVD service utilisation and coverage, and to patient health status. Our ambition was to document change attributable to GHI from the most immediate and expected (changes in hypertension screening, newly diagnosed patients with hypertension or CVD, prescription patterns for hypertension, provider attitudes and behaviour, and patient centered care and satisfaction) to the ultimate objective of the supply-side intervention (changes in CVD health).

b. The outcome indicators were as closely aligned as possible with national and international guidelines focusing on CVD, and aim to reflect how the facility or provider level determinants affect individual health behaviour and wellbeing.

c. Some of the indicators included, such as timeliness and out-of-pocket expenditure (OOPE), are not directly influenced by the GHI programme. These indicators have been added either because improving some aspects of the CVD care process may have impacted others (as in the case of *timeliness*) or because they are relevant to the contextualisation of findings/sustainability of the initiative (such as *OOPE*). Although GHI has no direct influence, it is an important input for informing health financing policy and ensuring the sustainability of GHI-induced programme activities. Our explanation is accompanied by a colour-coded system for clarity, whereby red indicates that the indicator is directly influenced by the GHI, and light yellow indicates that the indicator may not be directly influenced by the GHI programme (**Appendix: Table 2**).

Out of the full list of indicators (see Appendix: Table 2), we identified key indicators essential to the main outcomes expected from GHI (**Table 1**). Note that certain indicators (e.g. patient experience) are composed of multiple primary indicators (e.g. confidentiality, communication, choice of provider, prompt attention, basic amenities).

Table 1 Number Of (Key) Indicators with The RE-AIM Framework

Domain	Key Indicators	Total Indicators
Reach	**25**	42
Effectiveness	**20**	34
Adoption	**09**	11
Implementation	**04**	07
Maintenance	**11**	22
Overall	**69**	116

QUANTITATIVE STUDY COMPONENT

The quantitative evaluation component included the following quantitative tools (**Table 2**):

1. **Facility based structured survey**, including analysis of facility registries & clinical records, to capture indicators of quality-of-service delivery (input, process, outcome).
2. **Interviews with healthcare providers** assessing the knowledge, attitude, and practice regarding hypertension and CVD.
3. **Exit interviews with the patient** assessing the client's perception of the hypertension / CVD consultation or examination, as well as his / her recollection of the instructions that he / she received about treatment or preventative behaviour.
4. **Review of medical records** to capture indicators of quality-of-service delivery before and after GHI implementation.

Table 2 Overview of Quantitative Tools for Primary Data Collection

Tool	Information Collected	Intervention Facilities	Control Facilities	Time Perspective	
				Before Jun 2023	After Aug 2023
Health Facility Assessment Survey	To determine the existing infrastructure, human resources, availability of services for hypertension and CVD, availability of laboratory tests and diagnostics, medicines for hypertension and CVD treatment and health service delivery indicators related to hypertension and CVD.	✓	✓		
Healthcare Worker Survey	Part 1: To examine the knowledge, attitudes, and practices (KAP) regarding CVD and hypertension management.	✓	✓		
	Part 2: To examine the acceptability of the GHI from provider's perspective.	✓			
Patient Exit Survey	Patients asked post-consultation about the provision of care in the consultation to assess patient experiences and satisfaction with the hypertension or CVD related care received.	✓	✓		
Medical Record Review	To assess differences in hypertension and CVD care practices between intervention and control facilities.	✓	✓	✓	✓

QUANTITATIVE DATA COLLECTION TOOLS AND INDICATORS

The selection of service delivery, care processes, clinical and quality indicators was based on achieving optimal health service performance and guiding healthcare planning for continuous quality improvement based on the concept of the six domains of healthcare quality recommended by the Institute of Medicine (also referred as "STEEEP for Safe, Timely, Efficient, Effective, Equitable and Patient-centered) (**Table 3**).

Table 3 Health Service Delivery Evaluation: Domains, Indicators, And Tools

Domains	Process Indicators	Outcome Indicators	Sustainability Indicators
Safety	Number and proportion of sites having access to guidelines, equipment; Type of out-patient and emergency services available by facilities.	Prevalence of hypertension; Prevalence of CVD	Workforce appropriate (workforce adequate in volume and distribution); Equipment adequate.
Tools	Health facility survey; Key informant Interviews	Health facility survey; DHIMS2 dataset	Health facility survey; Key informant Interviews
Timeliness	CVD preventive and treatment services offered.	Total waiting time for physician consultations; Total in-person consultation time; Treatment received within 24 hours of CVD admission.	Workforce sustainability (staff retention per year, staff stability per year).
Tools	Health facility survey	Health facility survey; Medical record review (inpatient); Patient exit survey	Key informant interviews
Effectiveness	In the last 3 months: • No. of HTN patients seen; • No. of CHD patients seen; • No. of stroke patients seen; • No. of heart failure patients seen; • No. of hospitalizations by CVD conditions; • Average length of hospital stays (in days); • No. of acute emergency transfers related to CVD; • No. of referrals to higher facilities for CVD; • No. of referrals to lower health facilities for CVD.	In the last 3 months: • No. and proportion of patient diagnosed with hypertension; • Number and proportion of patients diagnosed with CVD; • Number and proportion of CVD patients prescribed evidence-based medicines; • Number and proportion of patients with BP<140/90; • Number and proportion of patients with LDLc <100 and <70 in those with CVD; • Number and proportion of patients who do not smoke.	Linkages – referral pathways (coordination of care across providers, specialist access); No. of referrals per year
Tools	Health facility survey; Medical record review	Health facility survey; Patient exit survey	Health facility survey; Key informant interviews
Patient centered care	No. of follow-up appointments.	Treatment satisfaction; Proportion of patients in regular follow-up.	Infrastructure (IT-internet access, equipment access, staff availability or shortage)
Tools	Medical record review (outpatient)	Health facility survey; Patient exit survey; In-depth interviews	Health facility survey; Key informant interviews
Efficiency and budget impact	Cost per service for: Outpatient Visit Emergency Visit Hospital Admission	Equity Proportion of patients receiving care by socio-demographic groups.	Governance and Leadership Description of governance structure and leadership.
Tools	Patient exit survey	Health facility survey: Patient exit survey	Key informant interviews

*BP = Blood pressure; CHD = Coronary heart disease; OPD = Out-patient department; CVD = Cardiovascular disease; HTN=hypertension; LDLc = Low density lipoprotein cholesterol; HMIS = Health management information system.

QUANTITATIVE SAMPLING AND INCLUSION CRITERIA

The facility manager and health information officer completed a health facility assessment survey at each participating facility. The provider KAP survey and exit survey were conducted at health facilities using convenience sampling. The team visited the facility to capture a non-random sample of healthcare providers and patients available on the day of the visit. This maximised the number of potential respondents to be interviewed, including all eligible patients exiting the facility and all healthcare providers present and available at the facility. The field work was timed to coincide with a hypertension/CVD clinic day, and pre-specified eligibility criteria were applied for quantitative evaluation.

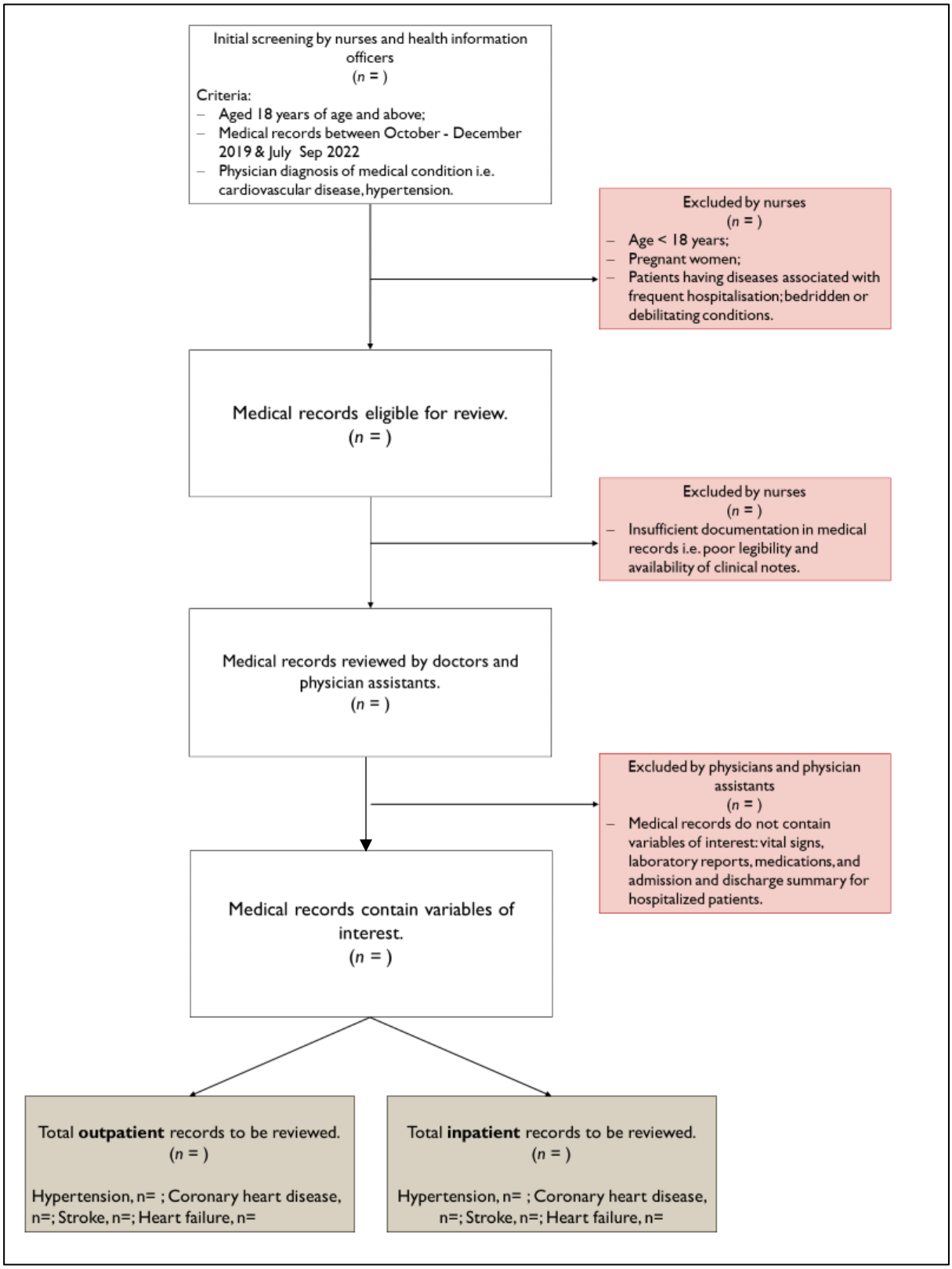
Pre-specified eligibility criteria were applied. For the provider survey, healthcare workers of both sexes, aged 18 and above, who are currently working in the facility for at least three months were selected. The survey excluded healthcare workers in managerial positions. The patient exit survey was conducted among those aged 18 and having a physician diagnosis of hypertension or other CVD conditions. The exclusion criteria included patients with frequent hospitalization, bedridden or debilitating conditions, advanced cancer, or end stage renal disease.

The medical record review involved examining clinical records for patients aged 18 and above with hypertension or CVD diagnoses. The review spanned from 2017 to 2022 and grouped patient records into two categories: pre- and post-GHI implementation; it excluded pregnant women, patients with frequent hospitalization, and those with bedridden or debilitating conditions.

The medical records of outpatient and inpatient folders at two cross-sectional timepoints before and after GHI implementation were reviewed, defined as **pre-GHI: 2018 – July 2020** and **post-GHI: August 2020 – 2022.** We considered medical records data collected until July 2020 as the pre-GHI period because effectively the training of healthcare workers on the national CVD guidelines started in August 2020. Also, the adoption of electronic health records (LHIMS, HAMS) at several of the intervention health facilities made it difficult to retrieve patient folders from 2018-2019 as the records were not stored properly after transition to the electronic system. Further, this negatively affected the lower number of pre-GHI OPD/IPD records available for analysis.

Eligibility of medical records were pre-specified based on confirmed diagnosis of hypertension or CVD, and complete medical records with at least data available on patient demographics (age, sex), medical history (confirmed case of hypertension or CVD), laboratory results (any test prescribed, or test reports reviewed), and medical treatment or prescription; it excluded pregnant women, patients with frequent hospitalization, and those with bedridden or debilitating conditions (**Figure 5**).

Figure 5 Selection of Medical Records in Health Facilities



STUDY OUTCOMES

The primary outcome measures that we assessed between the intervention and control facilities were: i) proportion of screened individuals for hypertension, ii) newly diagnosed patients with hypertension or CVD, iii) prescription of guideline directed medical therapy for hypertension and CVD, iv) BP control defined as <140/90 mmHg, v) provider knowledge and practice related to hypertension and CVD and vi) patient centered care and satisfaction. The study also assessed several secondary outcome measures including difference in total waiting time for physician consultation and physician acceptability of the GHI.

STATISTICAL ANALYSIS OF QUANTITATIVE DATA

Descriptive statistics were used to compare intervention and control facilities. Values were expressed as absolute numbers (percentages) for categorical variables and mean (standard deviation) for continuous variables. Composite indexes were computed for service delivery indicators of hypertension and CVD management and for provider's knowledge of CVDs.

All data analyses were performed using STATA 16.0 (Statacorp Texas). The chi-square test was used to compare control to intervention groups. Two-sided p-values < 0.05 were considered statistically significant.

QUALITATIVE STUDY COMPONENT

The study collected qualitative data through key informant interviews and in-depth interviews in the study areas. We used a maximum variation sample to ensure a diverse and representative sample of stakeholders, considering demographic variables such as age and occupation. Participants were selected from a sample of study facilities, with balanced representation by intervention group, site, and role. Semi-structured interviews were conducted with policymakers, health administrators, and trainers to assess implementation fidelity. In-depth interviews were conducted with healthcare providers and patients to explore their experience with the intervention. Participants were purposively selected to provide insights into CVD policy and GHI perspectives. Purposive snowball sampling was used to identify additional participants.

Data saturation was considered to determine the number of interviews. Interview guides were tailored to the participant's role and intervention arm with questions specifically about the GHI programme asked only in intervention sites. Local interviewers were recruited and trained to administer interviews in English and local languages as needed. Other data used for the analysis included annual reports and administrative data from the GHI programme team.

ANALYSIS OF QUALITATIVE DATA AND TRIANGULATION

We used each of the five RE-AIM constructs to code our qualitative data (i.e. interviews) for both latent and manifest content that reflected each theme. After establishing a-priori themes created from the interview guides, we manually coded transcripts based on these and other themes that emerged through the fieldwork and analysis process. From this coding we identified overarching concepts. Major themes along with issues that were not clear in the transcriptions were discussed among all researchers.

To ensure relevance and coherence of the findings, the qualitative results were interpreted in light of the quantitative results in a process of data triangulation.

ECONOMIC EVALUATION

We adopted a health system perspective, meaning that costs to enable rolling out the GHI were traced as incurred by the Ghana Health Service / MoH and its development partner, the GIZ, but excluding costs incurred by the patients in terms of health service utilisation. Economic costs were estimated in addition to financial costs, i.e., the full value of resources being used by any of the parties (MoH, GHS, GIZ) involved in implementation of the GHI was traced, whether reported in financial statements/study budget or not. We relied on Activity Based Costing (ABC), an approach that recognises the relationship between costs, activities, and products. Accordingly, all activities were mapped and related to the design and pilot implementation of the GHI. All resources being consumed by these activities were then traced and finally valued.

To collect data on resource consumption and unit costs, we used a mix of financial statements from implementing partners and key informant interviews. The main activities regarding GHI implementation comprised design, management, promotion, operations research, monitoring and evaluation (M&E), verification, and supply side activities. Aggregate cost information across specific micro-level activities were generated and then grouped into broad cost categories and analysis cost categories to link cost categories with main activities.

A descriptive cost analysis and budget impact analysis was carried out to inform the nation-wide scale-up of GHI as part of efforts towards achieving universal health coverage. The budget impact analysis was carried out to identify costs and resources required for expanding the GHI to all health facilities and care providers in Ghana. The budget impact analysis tracked the total and per facility costs of programme delivery using an ABC approach. Using this approach, all relevant human resources, materials and supplies, contracted services, travel and opportunity costs required to deliver the GHI components were captured by key activities.

ETHICS AND CONSENT

The study was approved by the Ethics Committees of the University of Heidelberg (S-486/2022), Ghana Health Service (GHS-ERC:001/07/22), and Korle Bu Teaching Hospital Institutional Review Board (KBTH-IRB 000109/2022). All interviewed participants in quantitative and qualitative data collection provided informed consent for the study and personal identifiers were removed before data sharing. Quantitative data from patient charts was extracted without needing informed consent. All gathered information was treated confidentially. No external party could identify participants in the presentation or discussion of the findings.

EVALUATION DESIGN NUANCES

This mixed-methods triangulation study is among the early endeavours to evaluate a comprehensive health system intervention for hypertension and cardiovascular disease (CVD) management in Ghana. The evaluation is rigorously designed, factoring in multiple data sources, minimizing biases using matched control health facilities, data triangulation using quantitative survey and qualitative interview data, and economic evaluation. In designing the evaluation of the GHI, with the goal of maximizing the validity and generalizability of our results, the following decisions were made:

1. To avoid contamination between the intervention and control groups, the data collection for control group facilities and participants was carried out by a separate team of trained field enumerators. However, in a real-world setting we cannot avoid spillover of intervention components to other regions since the national guidelines for the management of CVDs

were launched on 3rd August 2022 by the Ghanaian MoH and is available in the public domain and can be accessed via the Akomacare App (https://akomacare.org/download).

II. The data collection timepoints for medical record review before and after GHI implementation was prespecified in both the intervention and control health facilities to avoid any seasonal variations in the hypertension and CVD care outcomes.

III. Further, due to COVID-19 related disruptions, the distribution of the equipment to all the intervention facilities was delayed, and the launch of the 24x7 CVD Support and Call Center was delayed as well as staggered implementation of the data management support. All of this means that the combined intervention was delivered at the health facilities not at the same time and so differential effects across health facilities is expected.

IV. A strength of this study is that our customised survey questionnaires developed with Survey Solutions Designer, allowed the inclusion of interviewer's instructions which are visible to the interviewer in blue for each question as the interviewer progresses. This technical feature improved data quality and reduced data entry errors or missing values.

PRESENTATION OF FINDINGS

This evaluation adopts the RE-AIM implementation research framework to explore different dimensions of the GHI implementation. This framework considers five dimensions of interest when assessing implementation processes and outcomes as well as related costs. The relevant list of indicators selected from the various survey tools comprises: 1) health facility assessment survey (HFAS), 2) knowledge, attitude, and practice (KAP) survey among providers and acceptability tool, 3) medical record review – outpatient and inpatient (MRR-OPD/IPD), 4) patient exit survey as implemented in Ghana at the intervention and control health facilities are provided below under each of the five RE-AIM domains.

The findings and interpretation are presented according to the RE-AIM framework. Although the ultimate aim of this evaluation is to produce a holistic understanding of how the GHI influences health system capacity development and care delivery dynamics for hypertension and CVD management in Ghana, we have decided, for reasons of clarity, comprehensiveness and coherence, to integrate the quantitative and qualitative results together. Each domain chapter concludes with a summary/highlights box.

In line with the sequential order adopted in the methods chapter. After each set of quantitative indicators, we always integrate corresponding qualitative information, when available to support the quantitative results. We integrate a presentation of indicators with their discussion and after presenting each RE-AIM domain, we display a brief set of policy considerations/recommendations.

The primary outcome measures that we assessed between the intervention and control facilities were: i) proportion of screened individuals for hypertension, ii) newly diagnosed patients with hypertension or CVD, iii) prescription of guideline directed medical therapy for hypertension and CVD, iv) BP control defined as <140/90 mmHg, v) provider knowledge and practice related to hypertension and CVD and vi) patient centered care and satisfaction. The study also assessed several secondary outcome measures including difference in total waiting time for physician consultation and physician acceptability of the GHI.

We have compiled CVD-related data from various tools, including detailed information on hypertension/CVD care provided by providers and received by patients. For instance, the Health Facility Survey gathered data on the number of CVD patients at clinics, as well as specific conditions like coronary heart disease, stroke, and more. The Medical Record Review recorded physician-diagnosed CVD conditions, and we have summarised clinical outcomes for hypertension for the evaluation report. The Patient Exit Survey collected information on CVD care using layperson language.

From pages 163 to 169 (Appendix: Table 2) we display the **key indicators** (according to the RE-AIM framework) that we have included in the report. If the proportions i.e. N (%) and p-values for a given indicator are not indicated i.e. left blank, they can be found in the accompanying narrative.

Also, given the limitations of existing data, we were not able to examine prescription of guideline directed medical therapy (GDMT) for patients with hypertension and/or CVDs for inpatient and outpatient medical records. Therefore, we opted to analyse the prescription patterns and make broad comparisons between the intervention and control regions based on the treatment guidelines recommendations applicable for Ghana (consistent with other international guidelines for hypertension and CVD management). However, this enabled us to make some valid inferences regarding the underuse or overuse of guideline recommended medications for hypertension and CVD.

DESCRIPTIVE SAMPLE CHARACTERISTICS

NUMBER OF SURVEYS

The number of quantitative surveys collected are presented in Table 4. It displays the sample sizes for quantitative surveys conducted in three regions of Ghana: Greater Accra Region (GAR), Central Region (CR), and Western Region (WR).

Table 4 Number of Quantitative Surveys Collected from Each Tool

		Number of Surveys (Round 1)						
Survey	**Code**	**Intervention**			**Control**			**Total**
Health Facility Assessment	HFA	43§			55			98
Provider Knowledge, Attitudes, and Practices	KAP	156			367			523
Patient Exit Survey	PES	213			364			577
Medical records review (record dates):*		Pre	Post	All**	2019	2022	All**	
In-Patient Folder Review	IPD	22	135	157	55	173	230	385
Out-Patient Folder Review	OPD	184	315	506	207	490	701	1196
Collection Date – Round 1 (2022); Round 2 (2023)		Oct 12 - Nov 14, 2022			Nov 16 - Dec 7, 2022			

*Pre= before April 2020; post = Jul, Aug, Sep 2022; **includes some missing or out-of-bound dates

§ includes 4 different wards in KBTH, merged in subsequent analysis

OVERVIEW OF HEALTH FACILITY CHARACTERISTICS

Of the 44 intervention facilities originally planned for this analysis, 3 were excluded because did not receive the full GHI intervention or were not accessible (37 Military Hospital, no access; LA General Hospital, demolished; Trust Hospital, private and not trained for GHI) Additionally, a challenge arose in the Akpomanboi facility, a community-based health planning and services (CHPS) that functions without a compound (i.e. without physical structure), where the performing the health facility survey was not relevant. **The final analysis included 40 intervention and 55 control facilities, consisting of 11 CHPS compound, 13 health centers, 25 polyclinics, 38 district hospitals, 5 regional hospitals, and 3 tertiary hospitals that were sampled in this analysis** (**Table 5**).. Most health care sites were public sector facilities, followed by faith-based organizations and quasi-government health institutions / facilities. Intervention and control facilities differed somewhat in ownership. The variations in our data can be attributed to the non-random selection of the intervention region and the constraints we faced in finding an entirely unaffected "virgin" control region. Nevertheless, since CHAG and quasi-government health institutions / facilities essentially function as public healthcare providers, we do not expect formal differences in ownership to affect

our results. A significantly greater proportion of control facilities stored medical records electronically; however, services offered, including access to coronary care unit, did not differ significantly between groups (**Table 5**). The health workforce available was relatively similar at intervention and control facilities; however, the intervention facilities reported a greater number of physician assistants (**Table 5**). This is likely a consequence of our purposeful sampling, not an indication of equal healthcare in the nation.

For higher level facilities such as the Korle-Bu Teaching Hospital (KBTH), we sampled multiple relevant units and merged them all into one analytical unit for quantitative analysis. In the evaluation we have taken a data driven approach, and are presenting the entire sample of facilities (i.e. presenting the data by facility) and so we have included all the medical wards and polyclinic as a single facility / unit for KBTH (for aggregated analyses).

Table 5 Overview of Health Facility Characteristics. Characteristics. In bold are values that are statistically significant at 5% level.

	Control N=55	Intervention N=40	p-value
Level of health facility (structural), N (%)			**0.19**
CHPS compound	6 (10.9%)	5 (12.5%)	
Health center	9 (16.4%)	4 (10.0%)	
Polyclinic	**9 (16.4%)**	**16 (40.0%)**	
District hospital	**26 (47.3%)**	**12 (30.0%)**	
Regional hospital	3 (5.5%)	2 (5.0%)	
Tertiary hospital	2 (3.6%)	1 (2.5%)	
Level of care (functional), N (%)			0.18
Primary	**24 (43.6%)**	**25 (62.5%)**	
Secondary	26 (47.3%)	12 (30.0%)	
Tertiary	5 (9.1%)	3 (7.5%)	
Type of health facility, N (%)			**0.030**
Public	**41 (74.5%)**	**37 (92.5%)**	
Faith-based organization - CHAG	8 (14.5%)	0 (0.0%)	
Quasi (government-owned)	6 (10.9%)	3 (7.5%)	
Services offered, N (%)			
Outpatient clinics	55 (100.0%)	40 (100.0%)	
In-patient hospitalization	44 (80.0%)	34 (85.0%)	0.51
Emergency maternal care	48 (87.3%)	35 (87.5%)	0.96
Emergency adult care (non-pregnancy related)	48 (87.3%)	33 (82.5%)	0.53
Laboratory testing	46 (83.6%)	34 (85.0%)	0.84
Diagnostics/Radiological	34 (61.8%)	27 (67.5%)	0.49
Pharmacy/Dispensary	52 (94.5%)	39 (97.5%)	0.47
Surgery	31 (58.5%)	20 (51.3%)	0.49
Intensive care unit	13 (23.6%)	10 (25.0%)	0.90
Coronary care unit	4 (7.3%)	3 (7.5%)	0.98
Referrals received at this facility	41 (77.4%)	25 (64.1%)	0.16
Referrals out to another facility	**52 (98.1%)**	**35 (89.7%)**	0.17
Ambulance available	45 (81.8%)	26 (65.0%)	0.092
Ambulance functional	44 (80.0%)	23 (57.5%)	0.042
NHIS subscription accepted	51 (92.7%)	40 (100.0%)	0.081
HeFRA accreditation	47 (85.5%)	37 (92.5%)	0.29
Outpatient attendance July-Sep 2022, mean (SD)	3410.2 (2987.3) (n=53)	3673.3 (4461.6) (n=35)	0.74
Beds available, mean (SD)	68.3 (64.4) (n=55)	68.6 (100.7) (n=36)	0.98
No. of patient referred out, July-Sep 2022, mean (SD)	13.1 (22.6) (n=44)	16.7 (14.9) (n=23)	0.48
Medical records storage, N (%)			**0.009**
Electronic only	**28 (50.9%)**	**10 (25.0%)**	
Paper based only	**15 (27.3%)**	**23 (57.5%)**	
Both	12 (21.8%)	7 (17.5%)	

Health workforce available, mean (SD)			
Specialist Doctors	2.0 (9.5) (n=55)	3.4 (10.3) (n=38)	0.51
General Doctors*	14.2 (51.4) (n=55)	16.7 (22.6) (n=40)	0.77
Nurses**	135.8 (138.8) (n=55)	191.1 (187.2) (n=40)	0.10
Physician assistants	**2.9 (2.6) (n=55)**	**4.9 (4.4) (n=38)**	**0.010**
Other Healthcare assistants	5.7 (10.3) (n=52)	6.8 (10.4) (n=37)	0.62
Health workforce by level of facility, mean (SD)			
Primary care (N=48)			
Specialist Doctors	0.1 (0.3) (n=24)	0.8 (2.1) (n=25)	0.11
General Doctors*	**2.0 (3.0) (n=24)**	**9.9 (12.8) (n=25)**	**0.005**
Nurses**	**46.4 (43.1) (n=24)**	**126.8 (84.8) (n=25)**	**<0.001**
Physician assistants	**1.5 (1.6) (n=24)**	**3.7 (2.7) (n=25)**	**0.001**
Other Healthcare assistants	1.4 (2.4) (n=23)	1.7 (2.2) (n=25)	0.67
Secondary care (N=36)			
Specialist Doctors	1.2 (2.1) (n=26)	2.0 (1.7) (n=11)	0.26
General Doctors*	10.7 (9.0) (n=26)	22.3 (25.6) (n=12)	0.045
Nurses**	174.7 (78.6) (n=26)	197.8 (132.0) (n=12)	0.50
Physician assistants	4.5 (2.6) (n=26)	5.2 (3.7) (n=11)	0.55
Other Healthcare assistants	**7.0 (7.8) (n=25)**	**17.2 (14.7) (n=9)**	**0.013**
Tertiary care (N=8)			
Specialist Doctors	15.2 (30.7) (n=5)	42.5 (23.3) (n=2)	0.32
General Doctors*	90.6 (163.9) (n=5)	50.3 (43.8) (n=3)	0.70
Nurses**	362.2 (298.4) (n=5)	700.7 (244.2) (n=3)	0.15
Physician assistants	1.8 (2.5) (n=5)	18.0 (5.7) (n=2)	0.002
Other Healthcare assistants	21.5 (27.8) (n=4)	17.3 (5.9) (n=3)	0.81

FACILITY SELECTION AND MATCHING BETWEEN INTERVENTION AND CONTROL REGIONS

We acknowledge the presence of a minor imbalance in the distribution of health facilities between the intervention and control groups. This circumstance is due to the inherent design of our study, arising from our involvement subsequent to the initiation and ongoing upscaling of the GHI intervention. Our engagement necessitated the selection of a previously unaffected region, thereby constraining the selection of available facilities. It is pertinent to underscore two key considerations:

1. Our focus remained exclusively on public and faith-based facilities under governmental ownership, distinct from private-for-profit entities.
2. The adoption of a 1:2 or 1:3 ratio for matching is deemed an acceptable approach. Having a higher quantity of control facilities does not pose an issue, as our standard practice involves presenting results or estimates as an average for each facility or in the form of proportions.
3. All analytical methodologies have been adjusted to account for variances in the level of care provided. Additionally, whenever feasible, data stratified by the level of care has been reported. Consequently, it is crucial to acknowledge that the misalignment observed in sample proportions will not exert any substantive effect on the accurate estimation of effects. Thus, the higher number of control facilities does not affect the results or estimates generated by our study.

OVERVIEW OF OUT-PATIENT CHARACTERISTICS

A total of 1,196 outpatient records were reviewed in the study (**Table 6**). 499 individuals were in the intervention region (i.e., Greater Accra region) and 697 in the control regions (i.e., Western and Central regions). Hypertension was the most frequent diagnosis in the records analysed in both the intervention and control regions, pre- and post-GHI. Other diagnoses identified and reviewed in the records included cerebrovascular accidents (CVA) (n=54, 4.5%) (haemorrhagic, infarctive and CVA not specified as haemorrhagic or infarctive), heart failure (n=35, 2.9%). The mean age was 59.7 years. Of the patient records analysed, females made up 67.6%.

Table 6 Overview of Outpatient Characteristics (Medical Record Review)

	Overall (N=1196)				Pre-GHI			Post-GHI		
	Total	**Control**	**Intervention**	**p-value**	**Control**	**Intervention**	**p-value**	**Control**	**Intervention**	**p-value**
N	1196	697	499		207	184		490	315	
Age, mean (SD)	59.7 (13.8)	60.0 (13.8)	59.3 (14.0)	0.45	60.4 (14.8)	60.0 (13.1)	0.74	59.8 (13.3)	59.0 (14.5)	0.43
Sex				0.043			0.042			0.36
Male	377 (31.5%)	235 (33.7%)	142 (28.5%)		67 (32.4%)	43 (23.4%)		168 (34.3%)	99 (31.4%)	
Female	809 (67.6%)	454 (65.1%)	355 (71.1%)		136 (65.7%)	139 (75.5%)		318 (64.9%)	216 (68.6%)	
Medical History										
- Confirmed Case of Hypertension	1177 (98.4%)	690 (99.0%)	487 (97.6%)	0.015	204 (98.6%)	182 (98.9%)	0.75	486 (99.2%)	305 (96.8%)	0.002
- Coronary Heart Disease	2 (0.2%)	2 (0.3%)	0 (0.0%)	0.95	4 (1.9%)	5 (2.7%)	0.60	16 (3.3%)	9 (2.9%)	0.74
- Stroke	54 (4.5%)	25 (3.6%)	29 (5.8%)	0.069	8 (3.9%)	13 (7.1%)	0.16	17 (3.5%)	16 (5.1%)	0.27
- Heart Failure	35 (2.9%)	15 (2.2%)	20 (4.0%)	0.063	6 (2.9%)	5 (2.7%)	0.91	9 (1.8%)	15 (4.8%)	0.018

OVERVIEW OF IN-PATIENT CHARACTERISTICS

A total of 385 records for inpatients (IDP) were reviewed; 228 records from the control regions and the 157 records from the intervention region (**Table 7**). Elevated BP and hypertensive emergencies i.e. hypertensive urgency and emergency were the most prevalent diagnoses in the IPD records, with 96.6% (373) records having these diagnoses. The next most common reason for the admission was the cerebrovascular accidents (n = 108; 28.0%). There was no significant difference between the types diagnosed in the controls (before & after the GHI) and in the intervention (before & after the GHI) regions. The mean age was 58.7 years. Of the patient records analysed, females made up 52.7%. **There was a significantly larger decrease in systolic BP (p=0.025) and patient referrals (<0.001) after the implementation of GHI in the intervention facilities**.

Table 7 Overview of Inpatient Characteristics (Medical Record Review)

	Overall				Pre-GHI			Post-GHI		
	Value	**Control**	**Intervention**	**p-value**	**Control**	**Intervention**	**p-value**	**Control**	**Intervention**	**p-value**
N	387	230	157		55	22		173	135	
Sex				0.013			0.72			**0.009**
Male	180 (46.5%)	95 (41.3%)	85 (54.1%)		25 (45.5%)	11 (50.0%)		69 (39.9%)	74 (54.8%)	
Female	204 (52.7%)	133 (57.8%)	71 (45.2%)		30 (54.5%)	11 (50.0%)		103 (59.5%)	60 (44.4%)	
Age (in completed years), mean (SD)	58.7 (14.5)	59.9 (15.1)	56.9 (13.4)	0.051	61.1 (14.2)	63.0 (10.7)	0.56	59.6 (15.3)	55.9 (13.6)	**0.029**
BP systolic, mean (SD)	167.8 (35.8)	171.3 (35.3)	162.9 (36.2)	0.025	175.9 (31.0)	176.3 (40.4)	0.96	170.1 (36.4)	160.7 (35.1)	**0.025**
BP diastolic mmHg, mean (SD)	103.1 (50.9)	106.9 (63.6)	97.8 (21.9)	0.091	104.3 (26.4)	96.6 (25.1)	0.25	107.8 (71.8)	98.0 (21.5)	0.13
Heart rate in beats/min, mean (SD)	91.9 (20.7)	89.1 (18.4)	95.8 (23.1)	0.004	83.9 (19.6)	93.4 (14.4)	0.069	90.5 (17.9)	96.2 (24.3)	**0.028**
Discharge Status:										
Deceased	14 (3.6%)	6 (2.6%)	8 (5.1%)		3 (5.5%)	0 (0.0%)		3 (1.7%)	8 (5.9%)	
Alive	370 (95.6%)	222 (96.5%)	148 (94.3%)		52 (94.5%)	22 (100.0%)		169 (97.7%)	126 (93.3%)	
Smoke Counselling	47 (12.1%)	30 (13.0%)	17 (10.8%)	0.59	9 (16.4%)	3 (13.6%)	0.67	21 (12.1%)	14 (10.4%)	0.77
Exercise Counselling	66 (17.1%)	42 (18.3%)	24 (15.3%)	0.49	10 (18.2%)	3 (13.6%)	0.56	32 (18.5%)	21 (15.6%)	0.60
Referral	30 (7.8%)	5 (2.2%)	25 (15.9%)	<0.001	1 (1.8%)	3 (13.6%)	0.042	4 (2.3%)	22 (16.3%)	**<0.001**
MACE	82 (21.2%)	42 (18.3%)	40 (25.5%)	0.088	6 (10.9%)	6 (27.3%)	0.074	36 (20.8%)	34 (25.2%)	0.36

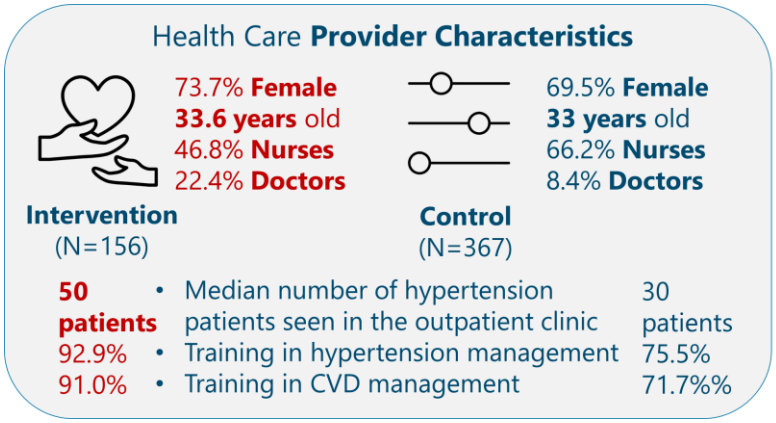
MACE = Major Adverse Cardiovascular Events; Referral refers to patients that were referred out to another health facility.

A standard deviation (SD) tells you how spread out the data is. It is a measure of how far each observed value is from the mean.

OVERVIEW OF PROVIDER CHARACTERISTICS – KAP SURVEY

We interviewed **523 health care providers** distributed across primary (13.6%), secondary (80.2%), and tertiary-care (6.2%) facilities (**Appendix: Table 4**). The mean age (SD) was 33.2 (6.4) years and 70.9% were female. Most respondents were nurses (62.4%), physician assistants (13.4%) and primary care doctors (12.6%). Staff composition was not similar at intervention and control facilities, with the intervention facilities reporting a significantly higher number of medical officers, nurses and physician assistants (<0.001) (**Figure 6**). About two-thirds of the care providers reported receiving training in hypertension or CVD management, and one third of the respondents provided care in both out-patient and in-patient departments. **A significantly greater proportion of health care providers in intervention facilities had received training in the management of hypertension and CVD (<0.001).** The median number of patients with hypertension and CVD seen in a typical outpatient clinic per day was 50 and 30, respectively (**Figure 6**).

Figure 6 Health Care Provider Characteristics



OVERVIEW OF PATIENT CHARACTERISTICS INCLUDED IN PATIENT EXIT INTERVIEWS

A total of **577 exit surveys** were conducted (**Appendix: Table 3**). The majority of respondents were female (74.5%) and had completed senior high school (19.4%). The mean age of participants was 61.7 years, with a median of 63 years. The majority of study participants reported having secondary level of education or higher (19.4%), while 13.0% had only primary level education and one fifth (20.1%) had no formal education. Only 9% of patients receiving CVD services were aged under 44 years, while a third (33.4%) of those receiving CVD care were in the 65-74 age group. Among the survey population, 3.9% were current smokers and 5.7% were current drinkers. Over half (53.0%) of the participants were urban residents. There were notable variations between intervention and control regions: Patients from the intervention facilities (30.5%) were more likely then control facilities (12.9%) to have completed senior high school ($p = 0.001$). By contrast, and as expected, patients from the control region were more likely to reside in a rural area, 20.6% vs. 1.4% of intervention facilities.

The average number of times a health facility is visited in the last 6 months is about **3 visits** in intervention and control facilities. Upon reaching the health facility, a patient waited for almost **48 minutes** on average before being seen by medical personnel (the nurse). A typical patient spent longer waiting to see the nurse to check vitals at the intervention facilities (median of 45 min) than the control facilities (median of 30 mins). This indicator may not be directly influenced by the programme. We included it to provide insights into potential interconnections within the care process.

NUMBER AND FUNCTION OF DIFFERENT KEY INFORMANTS INCLUDED IN QUALITATIVE INTERVIEWS

Between October 2022 and March 2023, 50 interviews with key informants were conducted. The selection of respondents was based on their function (**Table 8**) in the healthcare system.

The qualitative findings presented in this report pertain exclusively to the intervention region. It is imperative to acknowledge that, in accordance with our stringent ethical protocols, data sharing is restricted to instances where it can be presented in a fully anonymous format. Consequently, we are only able to disclose the list of institutions from which policymakers participated: Ministry of Health (1); Ghana Health Service (3); Ghana Heart Initiative (4); Korle Bu Teaching Hospital (KBTH)/University of Ghana Medical School (UGMS) (1); CHAG (1); Ghana Cardiology Society (1)

Please be aware that the identification of respondents followed a comprehensive process of consultation and snowballing, facilitated by our dedicated local GHI research team.

Table 8 Number of Qualitative Interviews in 3 regions (GAR, CR and WR) in Ghana

Study Location	Policymaker	Training of Trainers	Healthcare Providers	Health Facility Manager	Patients	Declined to be Interviewed	Total
Greater Accra Region	11	3	20	5	11	8	50
Western Region	0	0	22	19	16		57
Central Region	1	0	59	43	44		147
Total	10	3	101	67	71		252

The number of stakeholder interviews conducted was predominantly determined by the respondents' availability. Notably, respondents in the control regions demonstrated a higher level of responsiveness, availability, and cooperation compared to those in Greater Accra Region. Consequently, we chose to capitalise on this positive aspect by conducting additional interviews in the region.

Table 9 Characteristics of Qualitative Respondents in the GAR

Category	Policy	Patients	Health facility manager	Healthcare providers	Trainer-of-Trainers
	N (%)	N (%)	N (%)		N (%)
Gender					
Male	7 (63.6)	5 (45.5)	4 (80.0)	6 (30.0)	3 (100.0)
Female	4 (36.4)	6 (55.5)	1 (20.0)	14 (70.0)	-
Total	11	11	5	20	3
Education					
Tertiary	11 (100)	5 (45.5)	5 (100.0)	20 (100.0)	3 (100.0)
Secondary/High school	0	3 (27.3)	0	0	0
Primary	0	1 (9.1)	0	0	0
Vocational		2 (18.2)	0	0	0
Not stated	0		0	0	0
Total	11	11	5	20	3
Level of health system					
National	9 (81.8)	0	0	0	1 (33.3)
Region	2 (18.2)	0	0	0	2 (66.7)
District		0	0	0	0
Health facility		20 (100.0)	5 (100.0)	20 (100.0)	0
Total	11	11	5	20	3

THE FOLLOWING PAGES DISPLAY THE RESULTS WITHIN ALL OF THE RE-AIM DOMAINS, AND THE TABLES INCLUDE ALL VALUES, WHILE THE TEXT CONCENTRATES ON THE MOST IMPORTANT FINDINGS, HIGHLIGHTING DIFFERENCES BETWEEN INTERVENTION AND CONTROL FACILITIES AND/OR ANY STRIKINGLY HIGH OR LOW FIGURES.

READER'S NOTES FOR THE SCIENTIFIC REPORT:

In analysing the results presented in this report, one must account for the intricate challenges inherent to the broader health system. Factors such as out-of-pocket expenses, the attrition of healthcare staff and transitions, and inconsistencies within health data can influence outcomes. Though these elements might interplay with the results associated with GHI's programme activities, they stem from complex systemic issues beyond GHI's immediate goal. When considering the findings, it is crucial to contextualise them within this larger framework of health system challenges that are not within GHI's direct control. While these systemic issues may impact the perceived outcomes of GHI interventions, it is imperative to understand they fall outside the direct scope and influence of the GHI.

The final analysis included a total of 95 facilities, divided into 40 intervention and 55 control facilities. This included 11 CHPS compounds, 13 health centers, 25 polyclinics, 38 district hospitals, 5 regional hospitals, and 3 tertiary hospitals. According to the Health Facility Assessment Survey data, these figures are accurate and reliable. However, when considering alternative study tools, particularly for GHI facilities, a slight deviation is noted, resulting in a slightly distribution of 41 facilities in the intervention group as opposed to 55 in the control group, while the HFAS distribution remains at 40 vs 55.

REACH

Reach by definition is the absolute number, proportion, and representativeness of facilities, providers and patients who were reached by the Ghana Heart Initiative (GHI), and reasons why or why not.

Within the framework of our evaluation, Reach of the GHI was captured through: the number of facilities, providers and patients that have been reached by the programme at the health facility level; there is an element of fidelity within Reach so we show the degree to which the various GHI components are delivered as intended by the programme officials at the various levels in the intervention region. Please note, we assessed Reach in absolute terms rather than against any specific objective since no information regarding the GHI's targets was available, and we did not want to make any assumptions about the greatest number of facilities, providers, and patients that may or may not have been reached.

REACH – FACILITIES

The GHI showed a wide reach in the GAR. Of the 41 implementing facilities, 40 facilities (97.6%) participated in our health facility assessment survey. Of these, 92.5% were public (Table 5). There was statistical difference neither in the structural nor in functional level of care for facilities chosen for assessment in the control or intervention region. There were more primary healthcare facilities in the intervention region largely due to the fact that, the main focus of the GHI was to strengthen the primary healthcare system for the management of hypertension and CVDs. Analysis of health workforce data by level of care revealed that the number of general doctors, nurses, and physician assistants at the primary care level were higher in the intervention facilities (Table 5).

SELECTION OF IMPLEMENTING FACILITIES

Respondents of the key informant interviews indicated that the selection process of health facilities was done in conjunction with the Greater Accra Regional Health Directorate (GARHD) of the GHS to facilitate the spread of improvement among providers and patients across the levels of care in the region. Respondents indicated that a criterion had been developed for the identification of health facilities, which was being used during the roll-out phase in other regions as well. The Korle Bu Teaching Hospital demonstrated a strong commitment by providing office space and hosting the GHI project office and the CVD support and call center. The GHI had no major issues obtaining commitment from health facilities in the GAR mostly because of the leadership of the GHS at the national and regional levels.

The GHI programme implementors spoke of dropping two of the facilities, because at the beginning, when a needs assessment of equipment was carried out, the facilities did not participate. However, what they noticed when they started to train health care providers across Accra, was that other health facilities were clamouring, saying, '*why didn't you choose us*' and that the GHI would need to find a way to include them. Training was provided to facilities not included in the list as soon as spots became available. One of the respondents from the GHI shared how some health facilities, which were not in

the original list, participated in the training and data collection, demonstrating that the GHI had gone beyond its targeted facilities:

> *". I'm sure that someone in the Cocoa Clinic didn't take this seriously, so they refused to take part in a baseline, and they missed out. But others heard about this and are fighting to join and request to join."*

The CHPS compounds were not considered at first because the GHI team did not appreciate the significance of the CHPS compound at the time. However, because the MoH and the World Health Organization specifically mentioned the importance of CHPS compounds, 6 CHPS compounds were included in the GAR. We wanted to work in '*over 44 facilities in the Greater Accra Region*'. However, of the 44 facilities in the pilot phase, the implementers faced challenges in health facilities/hospitals such as the 37 Military Hospital, Police Hospital, the Trust (SSNIT) Hospital and the Cocoa Clinic because these are quasi-government health institutions / facilities not directly under the leadership and administration of the GHS:

> *"So, for example, the 37 Military Hospital and the Ghana Police Hospital. Because they fall were under the Ministry of Interior and yeah, I mean, we just did not have that same political buy-in and support and commitment and, yeah, we could only include those facilities to a certain extent." (Respondent_ Policy/Admin_ XXX)*

For our evaluation we were recommended that we omit these facilities from consideration due to ongoing difficulties in terms of accessibility and their willingness to participate in the GHI. These facilities have been reluctant to share their data and grant the GHI team regular access, posing substantial challenges.

AVAILABILITY OF HYPERTENSION / CVD SERVICES

We assessed the presence of services related to hypertension and CVDs as an indicator of Reach. This evaluation was based on the premise that the GHI's efforts to augment equipment supply and staff training would result in an increased capacity to deliver essential healthcare services.

Nearly every facility in both the intervention and control regions reported that they offer services for hypertension (**Table 10**). Probably due to the small sample, we observed no statistically significant difference in the composite score for hypertension services between intervention and control facilities, although intervention facilities generally scored higher (Table 10). This is in line with the expectation that the investments in supply and training did translate in better service availability.

In general, compared to control facilities, CVD-related services are readily available at intervention facilities, and the presence of electrocardiograms and renal function tests was statistically significant (Table 11). Overall, the composite score for CVD services did not differ between the intervention and the control facilities (Table 11). However, when grouped by the level of the care, the primary-level facilities in the intervention arm were better able to provide the services for the CVDs than the control facilities (Table 11). This was primarily driven by the increase in the proportion of facilities that reported having the necessary laboratory tests for CVDs.

Table 10 Provision of Hypertension Services Available at The Intervention Vs. Control Facilities

	Control (N=55)	Intervention (N=40)	p-value
Does the facility provide services for hypertension?	54 (98.2%)	40 (100.0%)	0.39
Essential hypertension-related services offered / available at the health facility:			
1. *Screening for hypertension;*	54 (98.2%)	38 (95.0%)	0.097
2. *Initial risk assessment (e.g., other risk factors: tobacco use, diabetes, obesity);*	50 (90.9%)	39 (97.5%)	0.44
3. *Assessment of medical history;*	52 (94.5%)	38 (95.0%)	0.48
4. *Physical examination;*	51 (92.7%)	38 (95.0%)	0.33
5. *Laboratory investigation;*	46 (83.6%)	36 (90.0%)	0.61
6. *Lifestyle modification counselling;*	50 (90.9%)	38 (95.0%)	0.75
7. *Pharmacotherapy (prescribe medicines);*	48 (87.3%)	36 (90.0%)	0.86
8. *Follow-up (existing protocol or mechanism to follow-up patients);*	48 (87.3%)	32 (80.0%)	0.31
9. *Annual assessment (existing protocol or mechanism to perform annual assessment for all hypertension patients.*	36 (65.5%)	31 (77.5%)	0.37
The composite score ranges from 0 -18, and we report here the mean (SD) overall.	16.2 (3.5)	16.5 (3.1)	0.60

The composite score was derived by combining all the 9 hypertension related services available at the facility. We assigned the score of 0 to the facility if it does not provide hypertension services, the score of 1 to the facility if it provides hypertension services sometimes, and the score of 2 to the facility if it always provides hypertension services.

Table 11 Provision of Cardiovascular Disease Services Available at The Intervention Vs. Control Facilities

	Control (N=55)	Intervention (N=40)	p-value
Does the facility provide services for CVDs?	54 (98.2%)	40 (100.0%)	0.39
Essential CVD-related services offered / available at the health facility:			
1. *Initial CVD Signs and Symptoms Assessment*	41 (74.5%)	34 (85.0%)	0.14
2. *Assessment of Medical History*	45 (81.8%)	34 (85.0%)	0.39
3. *Checking Blood Pressure*	45 (81.8%)	34 (85.0%)	0.39
4. *Checking Blood Sugar*	44 (80.0%)	34 (85.0%)	0.22
5. *Checking Total Cholesterol*	34 (61.8%)	28 (70.0%)	0.62
6. *Checking High-density Lipoprotein (HDL)*	33 (60.0%)	29 (72.5%)	0.16
7. *Checking Low-density Lipoprotein (LDL)*	32 (58.2%)	29 (72.5%)	0.13
8. *Checking Triglycerides*	32 (58.2%)	28 (70.0%)	0.42
9. *Checking Urine Sugar*	40 (72.7%)	34 (85.0%)	0.091
10. *Checking Urine Albumin*	34 (61.8%)	28 (70.0%)	0.21
11. *Checking Renal (Kidney) Function Test*	**29 (52.7%)**	**30 (75.0%)**	**0.039**
12. *Electrocardiogram (ECG)*	**29 (52.7%)**	**31 (77.5%)**	**0.013**
13. *Echocardiogram (ECHO)*	7 (12.7%)	4 (10.0%)	0.071
14. *X-ray*	27 (49.1%)	22 (55.0%)	0.45
15. *Computerised Tomography (CT) Scan*	4 (7.3%)	5 (12.5%)	0.17
16. *Heart Healthy Diet*	45 (81.8%)	34 (85.0%)	0.39
17. *Physical Activity*	45 (81.8%)	34 (85.0%)	0.39
18. *Avoidance of Tobacco*	46 (83.6%)	34 (85.0%)	0.40
19. *Avoidance of Alcohol*	46 (83.6%)	34 (85.0%)	0.41
20. *Stress Management*	45 (81.8%)	34 (85.0%)	0.39
21. *Duration of Sleep*	45 (81.8%)	34 (85.0%)	0.39
22. *Regular monitoring of CVD risk factors (blood pressure, blood cholesterol, blood glucose, body weight).*	41 (74.5%)	33 (82.5%)	0.21
The composite score ranges from 0-44. *We report here the mean (SD) overall for:*			
Services for CVD	29.8 (14.8)	32.1 (14.3)	0.44
Tests to Diagnose CVD	15.0 (9.2)	16.9 (8.3)	0.32

The composite score was derived by combining all the 22 CVD related services available at the facility. We assigned 0 – if a facility does not provide CVD service, 1 – if a facility provides CVD service sometimes, 2 – if a facility always provides CVD service for every type of service.

AVAILABILITY OF LABORATORY TESTS

Similar to what was observed for services in general, laboratory services were most frequently available in the intervention facilities, with fasting blood glucose test being significantly higher in the intervention facilities (**Table 12**). This was likely due to the supply of glucometers and strips to the intervention facilities by the GHI, which made blood glucose tests more accessible than in the control facilities.

Table 12 Laboratory / Diagnostic Services Available in Health Facilities

LABORATORY/DIAGNOSTIC SERVICES AVAILABILITY	Control (N=55)	Intervention (N=40)	p-value
Total cholesterol	**29 (52.7%)**	**29 (72.5%)**	**0.17**
High density lipoprotein (HDL) cholesterol	29 (52.7%)	29 (72.5%)	0.17
Low density lipoprotein (LDL) cholesterol	29 (52.7%)	29 (72.5%)	0.17
Triglycerides	30 (54.5%)	29 (72.5%)	0.24
Fasting Blood Sugar	**43 (78.2%)**	**39 (97.5%)**	**0.037**
Oral glucose tolerance test (OGTT)	31 (56.4%)	23 (57.5%)	0.64
Glycosylated hemoglobin (HbA1c)	21 (38.2%)	17 (42.5%)	0.53
Blood Urea	29 (52.7%)	29 (72.5%)	0.17
Liver Function Test	29 (52.7%)	29 (72.5%)	0.15
Renal Function Test	**29 (52.7%)**	**29 (72.5%)**	**0.15**
Creatinine Phosphokinase (CPK) (cardiac enzyme)	16 (29.1%)	19 (47.5%)	0.20
Troponin (cardiac enzyme)	11 (20.0%)	4 (10.0%)	0.074
Sodium	26 (47.3%)	27 (67.5%)	0.16
Potassium	26 (47.3%)	27 (67.5%)	0.17
Calcium	16 (29.1%)	19 (47.5%)	0.19
Urine Albumin (proteinuria)	31 (56.4%)	25 (62.5%)	0.88
Urine Sugar	40 (72.7%)	36 (90.0%)	0.11

AVAILABILITY OF EQUIPMENT

In the GHI Status Report of October 2021, it was reported that GHI provided medical equipment to 41 healthcare facilities within the GAR region. This equipment was specifically allocated to aid in the diagnosis and treatment of hypertension and CVDs. The distribution of this equipment was carried out based on the assessed needs of the recipient facilities, and it included essential items such as defibrillators, ECG machines, patient monitors, weighing scales with height meters, glucometers, and sphygmomanometers. In the health facility assessment survey, it was reported that the GHI supplied the following items to the intervention facilities (n=40): weighing scales (n=2, 5%), digital BP monitors (n=27, 67.5%), ECG machines (n=17), ECG treadmill (n=1, 2.6%), cardiac monitor with defibrillator (n=2, 5.0%), and glucometers (n=2, 5.0%) (**Appendix: Table 5**). A needs assessment informed the GHI of which essential equipment was missing and needed to be supplied, according to documentation provided by the GHI team. The equipment was distributed to each health facility, and health workers were trained in its use and maintenance.

The vast majority of the equipment available to treat and manage hypertension and CVDs in health facilities in the intervention and control regions is either privately owned (i.e., donated) or supplied by the government (Appendix: Table 5). From time to time, international organisations supply health facilities with equipment to improve health service delivery in Ghana. Donations are sporadic and irregular, making it impossible to forecast when equipment replacement in the facilities will be necessary. However, in the coming years, the GHS also have regional equipment units that support health facilities, and can also be used for the maintenance of existing equipment, and for the installation of new products when the intervention is expanded.

With regard to equipment availability, the intervention facilities had a significantly greater number of digital BP monitors (p=0.003), and ECG apparatus (p<0.001); in addition, they reported a larger number of cardiac monitors fitted with defibrillators (Appendix: Table 5). A larger number of intervention facilities utilised calibrated apparatus, which directly impacted the

measurement quality, diagnosis, and CVD health outcomes (Appendix: Table 5). The evaluation team acknowledges that there may be a discrepancy between the equipment given to a facility and what has been reported in the health facility assessment survey. One GHI respondent described that when it came to equipment support, the GHI only intervened '*to actually find the gap and fill the gap*' [GHI Implementer].

Intervention facilities had the ability to maintain the equipment, and one implementer confirmed that equipment managers were part of the process in installing and training health facility personnel on the utilisation of the equipment:

> *"We call them the equipment managers – they were part of the process, the installation [of the equipment], and training. So, they will go around and check the equipment, if they need to be maintained and all of that."*

For some of the respondents, the Covid-19 pandemic also influenced reach of GHI, and some of the pilot phase activities moved into 2021, including the distribution of equipment and training healthcare providers, with some facilities obtaining the equipment they needed in May 2021 – with the procurement process taking several months:

> *"…there was a bit of delay in the equipment because of Covid in 2020. Covid came, and there were procurement issues (…). But the equipment, so some parts of it, for example, the equipment even though [the GHI] procured them, they actually arrived early part of last year. And so, I think somewhere May last year [2021] that was when it [the equipment] was handed over to the facilities…"*

It is evident that providers in the intervention facilities have access to important measurement devices to measure BP, blood glucose, and body mass index (Appendix: Table 5). Nearly every facility in the intervention region reported having an adult weighing scale and height board, and over two-thirds reported having a sphygmomanometer (Appendix: Table 5). Further, 97.5% of intervention facilities had access to digital blood glucose monitors and glucometers, however the availability of test strips was an issue. Importantly, among the intervention facilities that had access to BP monitors and glucometers, the exit survey indicates that approximately 99.1% and 72.3% of adult patients had their BP measured and blood glucose screened on the day of their visit (Table 9). Also, more than half (55.0%) of the intervention facilities reported having a cardiac monitor with defibrillator (Appendix: Table 5). Respondents indicated that equipping facilities with defibrillators has saved lives and '*after the GHI project has given the defibrillator, they are able to resuscitate patients*' [GHI Programme Team], which indicates that any large gap in the treatment of CVDs is not attributable to equipment availability. The implementers attested that the pilot phase initially focused on '*providing equipment to the facilities so that people [providers] are not only capacitated, but they also have the tools that they need to really provide high quality [hypertension and CVD] services*' [Respondent].

REACH – PROVIDERS

Based on the GHI status report (programme data) and interviews conducted with the GHI, it was reported that they provided training to more than 750 healthcare providers. The health facility assessment survey further revealed that, on average, each intervention health facility had trained approximately 4.6 healthcare providers in hypertension and dyslipidaemia management (as shown in **Table 13**). This cumulative training effort resulted in a total of 184 healthcare providers trained for

hypertension management within the GAR. The average count of healthcare professionals who received training in handling rheumatic heart disease, coronary heart disease, and infective endocarditis varied from 3.7 to 3.9 across each facility (Table 13). In contrast, there were twice as many healthcare workers trained in measuring BP and utilising glucometers for the screening and monitoring of hypertensive and diabetic patients. Specifically, the mean number of trained providers per health facility was 11.8 and 10.6 individuals for BP measurement and glucometer use, respectively (as shown in Table 13). This equates to 424 and 472 providers trained on using BP monitors and glucometers, respectively. Please take note that Table 13 represents the number of individuals we encountered during our survey who reported having received training and were still employed at the facilities. However, it is important to clarify that this count may not encompass the actual number of individuals who underwent training through the GHI programme, as previously mentioned.

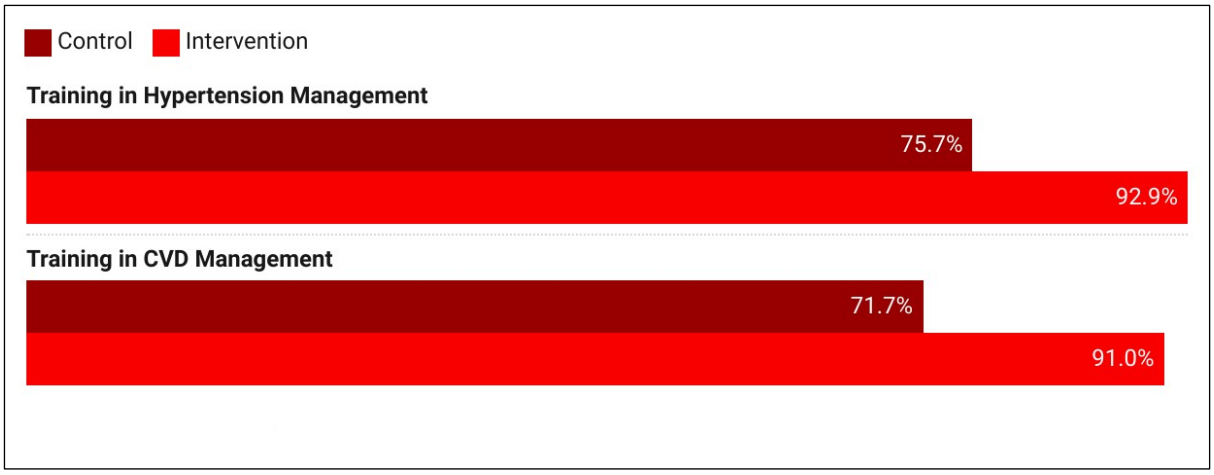
Similarly, the KAP survey showed that there was a significant increase in the number of health care providers who had been trained in hypertension management and CVDs in intervention facilities, compared with control facilities ($p<0.001$) (**Figure 7**).

Table 13 Training of Health Care Providers – Health Facility Survey in Intervention Facilities

TRAINING OF HEALTH CARE PROVIDERS	Intervention N=40
The average number of healthcare workers trained on:	
Hypertension Management, Mean (SD)	4.6 (3.0)
Dyslipidaemia Management, Mean (SD)	4.6 (3.5)
Obesity Management, Mean (SD)	4.4 (3.1)
Stroke Management, Mean (SD)	4.4 (3.0)
Heart Failure Management, Mean (SD)	4.1 (3.2)
Pulmonary Embolism Management, Mean (SD)	4.2 (3.2)
Cardiac Arrhythmia Management, Mean (SD)	4.2 (3.2)
Coronary Heart Disease Management, Mean (SD)	3.8 (3.3)
Rheumatic Heart Disease Management, Mean (SD)	3.7 (3.3)
Infective Endocarditis Management, Mean (SD)	3.9 (3.3)
The average number of healthcare workers trained on:	
BP monitor, Mean (SD)	**11.8 (28.2)**
Glucometer, Mean (SD)	**10.6 (24.9)**
Stadiometer, Mean (SD)	8.8 (26.1)
Defibrillator, Mean (SD)	8.0 (21.4)
Electrocardiogram (ECG), Mean (SD)	4.9 (12.4)
Patient monitor, Mean (SD)	2.1 (2.7)
Echocardiogram (ECHO), Mean (SD)	0.9 (1.9)

**A standard deviation (SD) tells you how spread out the data is. It is a measure of how far each observed value is from the mean. The indicators are just measured for intervention facilities because the second part of the of KAP survey focused on GHI facilities.*

Figure 7 Healthcare Providers Trained in Management of Hypertension and Cardiovascular Diseases



*** There was statistically significant difference in the healthcare providers trained in management of hypertension and CVD between the two groups (p<0.001).*

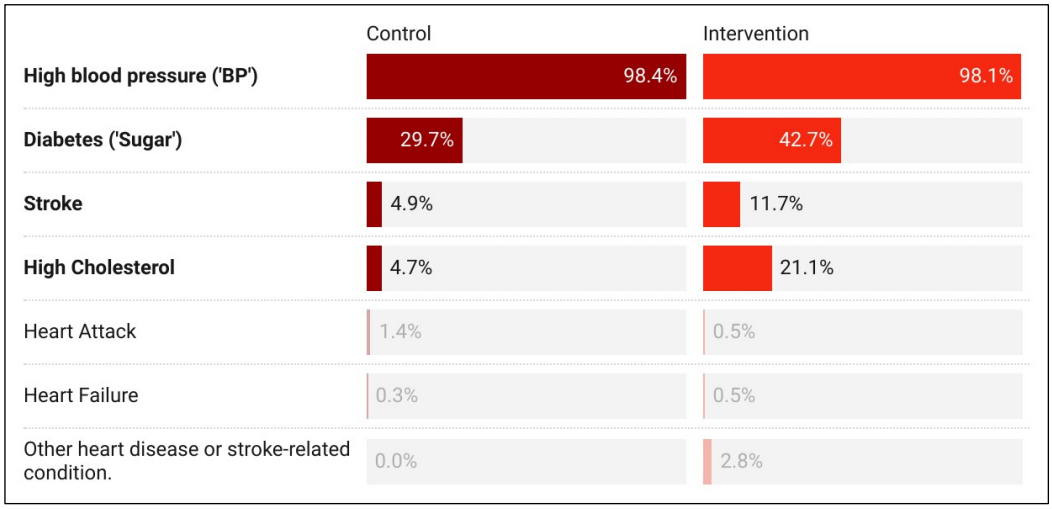
REACH – PATIENTS

In an ideal setting, Reach would be assessed by estimating the number of patients reached by the programme out of the entire population in need. The challenge here remains that we do not know what the population in need really is nor, acting exclusively as a supply-side intervention, the intervention acted to bring the population in need at the facility. The intervention was limited to improve care for those reaching a facility in the first place, but did not try to actively shape demand. This is why we can only assess Reach in relation to the services offered and the number of people treated in the facilities.

All health facilities had outpatient clinics and rendered services for hypertension, with there being no significant difference between the intervention and control facilities in terms of outpatient department (OPD) attendance, beds available, or referrals made out of the facility. According to data obtained from the health facility assessment survey, the average number of patients seeking care for hypertension and/or CVD at the intervention facilities during the three-month period from July to September 2022 was 5,913.0 (please refer to Table 18 on page 74). This translates to an average of 1,971 patients monthly. Meanwhile, during the same three-month span, the control facilities reported 7,893.4 patients.

According to the KAP survey results, the median number of hypertension patients seen in the outpatient clinic per facility per week was 30, with the median number of patients in the intervention facilities significantly higher than the control facilities (50 versus 30, p<0.001). Similarly, the providers in the intervention groups indicated they saw a two-fold (median) number of patients with CVDs compared with the control group (10 versus 5, p=0.016). The GHS Wellness Clinics have established hypertension clinics in all healthcare facilities to encourage the adoption of hypertension screenings among the population. Nevertheless, the significantly higher number of CVD cases handled by intervention facilities might result from better infrastructure and specialist care. Additionally, the infrastructural investments by the GHI programme might have played a role in enhancing the capacity of intervention facilities to accommodate a larger number of CVD/HTN patients.

Figure 8 Heart Disease (Akoma Yaree) Or Stroke-Related Condition That the Patient Has Been Previously Diagnosed With Between Intervention and Control Facilities



*** There was statistically significant difference in previously diagnosed heart disease or stroke-related condition between the two groups (p<0.001).*

In the exit survey, respondents (patients) reported being previously diagnosed with hypertension, diabetes, stroke, high cholesterol, heart attack, heart failure or other heart disease (**Figure 8**). Hypertension was the heart disease most frequently reported by patients. A significantly higher number of patients in intervention facilities were diagnosed with stroke, hyperlipidaemia and diabetes, compared with those in the control facilities. This was mainly because majority of the facilities in the intervention arm had more specialists than in the control, the availability of equipment supplied by the GHI and the training of the providers. The setting in the GAR, being more urban and having a higher literacy level among the population, may also have contributed to this improved screening and level of awareness.

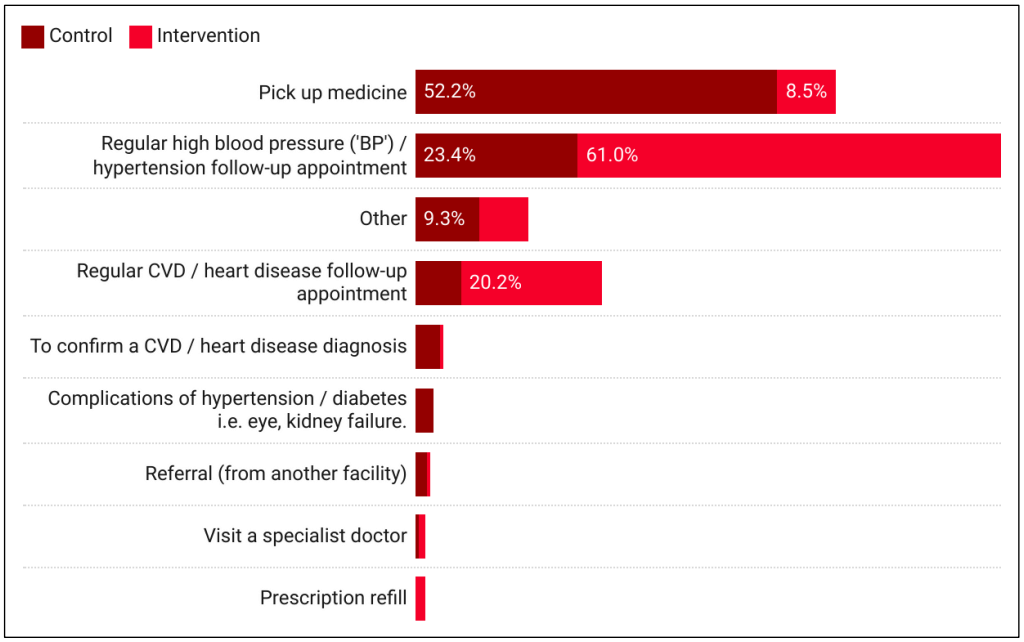
Regular high BP follow-up appointment (37.3%) and picking up medicines (36.0%) was the primary reason for visiting a health facility by those who responded to the exit survey; the two groups had significantly divergent reasons (p<0.001) (**Figure 9**). **Of the respondents who visited the intervention facilities, 61.0% were more likely to attend regular BP check-ups, with 20.2% coming for regular follow up on CVD and heart disease (Figure 9).** The higher number of patients returning for BP control may suggest that health workers are providing better care to these patients due to the training they have received.

More than half (52.2%) of the patients who visited control facilities did so to acquire medicine, and to have their regular BP check-ups (23.4%) (Figure 9). Out of the 190 patients who visited the control facility to pick up medication, 143 (75.3%) of the patients were able to get all prescribed medicines. According to the exit survey, when the primary reason for visiting both intervention and control facilities was to 'acquire medicine', 98.1% also had their BP taken and had lifestyle advice given to them, thus enabling them to consult with a provider (nurse or doctor) before they collected their medication.

Approximately 43.5% of respondents to the exit survey indicated that they preferred to visit the health facility because it was located close to their home, as well as because of high quality care (22.7 %) and trust in the provider (17.5%) (**Figure 10**).

Although there was no substantial difference in the health services received by patients between the intervention and control facilities, monitoring of blood glucose (p=0.002), glycosylated haemoglobin (p=0.001), and renal function (p=0.025) was statistically significant in the intervention facilities and this could be result of the equipment supplied and training provided to the health workers (**Table 14**).

Figure 9 Patient's Primary Reason to Visit Health Facility Between Intervention and Control Facilities

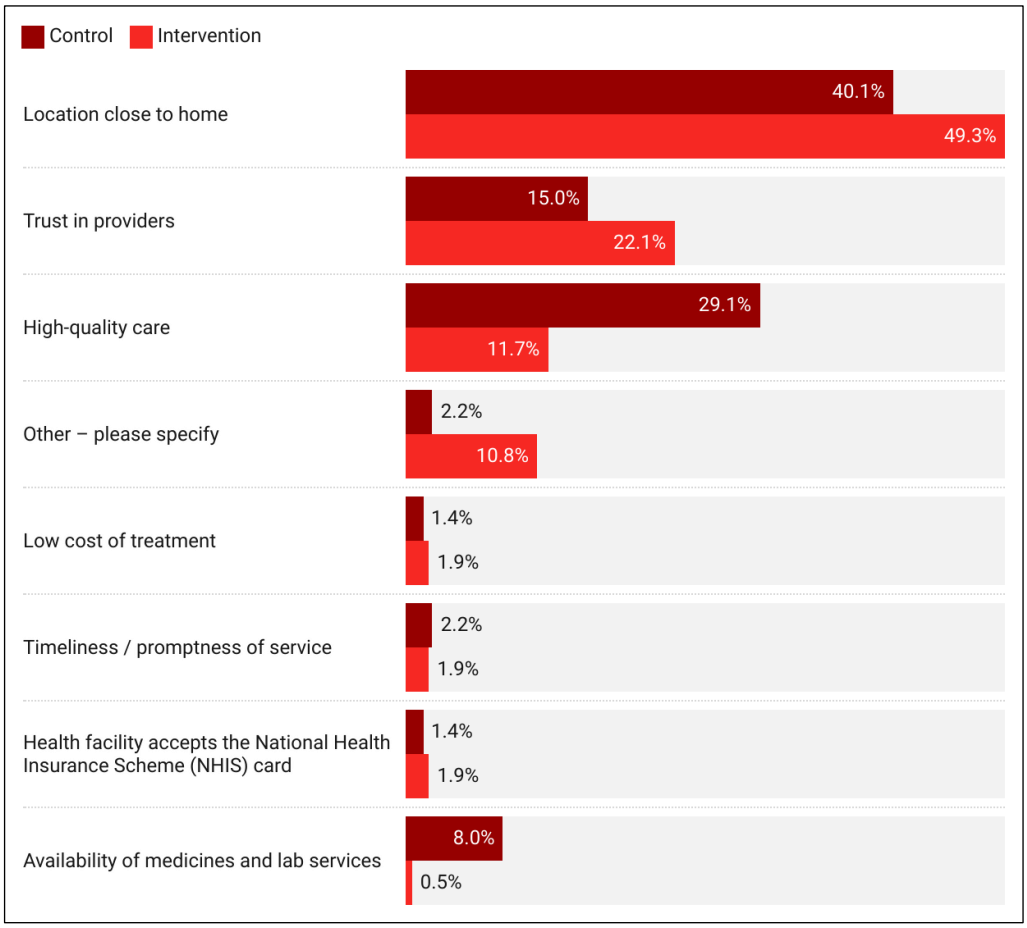


*** There was statistically significant difference in the patient's primary reason to visit the health facility between the two groups (p<0.001).*

However, despite receiving training, healthcare providers' expectations to proactively engage with patients and offer them pertinent and insightful information to enhance awareness regarding heart disease, illness, and hypertension were not consistently met. A significant number of patients remained uninformed about the implications of their CVD conditions and the diagnostic process, with several mentioning the absence of explanations provided by their healthcare providers. One patient explicitly mentioned:

> *"…. he [the doctor] did not give me much explanation, maybe he is tired or something, so I really do not know or have an idea about how it becomes really higher and how it becomes low, I don't really know, I don't have any idea about that."*
>
> (Respondent_Patient_03

Figure 10 Patient's Preference to Visit the Current Health Facility Between Intervention and Control Facilities



** *There was statistically difference in the patient's preference to visit the health facility between the two groups ($p<0.001$).*

Table 14 Type of Health Services Availed by The Patients Between the Intervention and Control Facilities

What services did you receive today?	CONTROL N=364	INTERVENTION N=213	P-VALUE
Blood pressure checked?	353 (97.0%)	211 (99.1%)	0.10
Blood glucose (blood sugar) checked?	**216 (59.3%)**	**154 (72.3%)**	**0.002**
Glycated haemoglobin (HbA1c / A1c) checked?	**9 (2.5%)**	**18 (8.5%)**	**0.001**
Cholesterol (lipids "fats") checked?	41 (11.3%)	15 (7.1%)	0.11
Kidney function checked?	**2 (0.6%)**	**6 (2.8%)**	**0.025**
Height checked?	50 (13.7%)	28 (13.1%)	0.84
Weight checked?	310 (85.9%)	143 (67.1%)	<0.001
Given a prescription form?	244 (67.8%)	152 (71.4%)	0.37
Received counselling on healthy lifestyle?	137 (37.8%)	83 (39.0%)	0.79
Received counselling about managing heart disease?	112 (30.9%)	52 (24.4%)	0.094
Referred for specialist visit to another facility?	4 (1.1%)	6 (2.8%)	0.13
Referred for specialist visit in the same facility?	3 (0.8%)	5 (2.4%)	0.13
Other – Please Specify	3 (0.8%)	1 (0.5%)	0.61

PATIENT REFERRALS

Table 15 Patient Referrals - July, August, September, 2023

REFERRALS INDICATORS (JULY, AUGUST, SEPTEMBER, 2023)	Control	Intervention	p-value
Referrals made to:			
Health center/ Polyclinic	0 (0.0%)	1 (2.6%)	0,13
District hospital	9 (16.4%)	8 (20.0%)	0,098
Regional hospital	14 (25.5%)	11 (27.5%)	0,34
Tertiary hospital	13 (23.6%)	5 (12.5%)	0,63
Specialist cardiology clinic	4 (7.3%)	2 (5.0%)	0.62
Referral made for which services			
Investigation - Radiology	12 (21.8%)	6 (15.0%)	0.59
Specialist care	16 (29.1%)	11 (27.5%)	0.029
Investigation - Lab	10 (18.2%)	9 (22.5%)	0.059
Inpatient services	12 (21.8%)	11 (27.5%)	0.15

The health facility assessment survey reported referrals made over a 3-month period, July to September, 2022 (**Table 15**). In the intervention facilities patients were referred to all levels of care, from health center to specialist unit in a tertiary hospital. As expected, the highest number of referrals were from primary care level facilities to the district hospital i.e., secondary level of care. There was no significant difference between control and intervention areas.

In the exit survey, 7 patients reported referrals to different health facilities. One from an intervention facility was referred for specialist care at a tertiary hospital. Six from control facilities were referred for various reasons, including laboratory tests, specialist care, and inpatient treatment, at different levels of healthcare.

The qualitative findings highlight persistent challenges in the referral process for hypertension and CVD cases. Respondents revealed that difficulties exist in smoothly transferring patients to higher-level medical facilities. A recurring issue is that intervention facilities sometimes complain about patients being delayed before referral. This delay is attributed to an increased workload at the receiving facility.

One respondent emphasised the dilemma faced by healthcare providers in deciding when to escalate patients to higher-level care. The competence of the provider was noted as a factor influencing the appropriateness and frequency of referrals. A positive trend was noted in reducing inappropriate referrals, particularly by more competent providers.

Another concern expressed by respondents was the overcrowding of receiving facilities. This often led to extended waiting times for patients, and the fear of a '*no-bed syndrome*' exacerbated the situation. Despite these challenges, the quality of referrals has notably improved within the GAR. The number of referrals has decreased, and local facilities have become more capable of managing certain cases, such as cardioversions, without needing to refer them externally. Overall, the referral system's quality and appropriateness have shown signs of enhancement.

> *"… The referrals have come down. And then we are also capable of handling some of the cases ourselves, like cardioversions - we hardly send cardioversions out again. I will say the referrals without solid data but presumptively I will say that we have fewer of them and then also the inappropriate referrals have reduced…"*

(Respondent_ Policy/Administration_ 08)

HEALTHCARE PROVIDE LIFESTYLE MODIFICATION COUNSELLING

Table 16 Did the Health Worker Provide Lifestyle Modification Advise/Counselling During the Current Visit Between the Intervention and Control Facilities

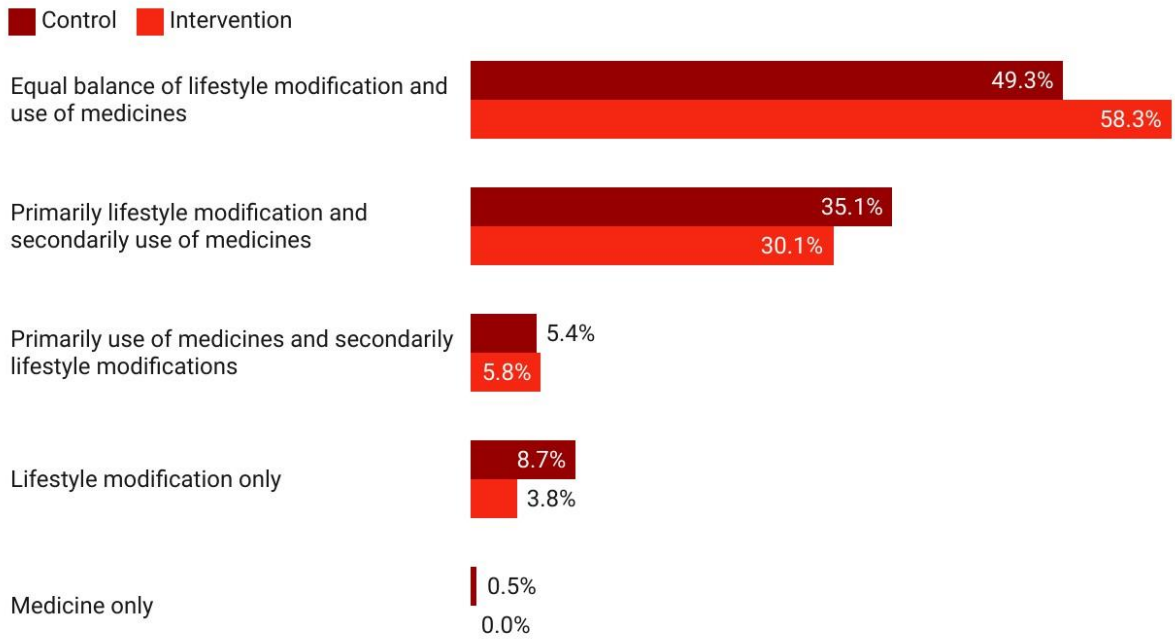
What lifestyle counselling did the patient receive?	**CONTROL**	**INTERVENTION**	**P-VALUE**
	N=364	**N=213**	
To maintain a healthy diet (with fruits and vegetables)?	**170 (47.0%)**	**118 (55.4%)**	**0.051**
To maintain an adequate weight?	125 (34.5%)	73 (34.3%)	0.95
To consume less salt?	162 (44.9%)	100 (47.2%)	0.59
To practice regular physical activity (i.e. exercise, brisk walking, biking etc.)?	178 (49.4%)	69 (32.5%)	<0.001
To refrain from smoking tobacco / cigarettes?	108 (29.8%)	16 (7.5%)	<0.001
To limit drinking alcohol in excess?	118 (32.8%)	20 (9.5%)	<0.001
To have regular follow-up care for high blood pressure and/or heart disease?	192 (53.5%)	67 (31.6%)	<0.001

Despite the encouraging findings from the health facility assessment survey, which indicated that counselling services to promote lifestyle changes for hypertension and CVDs were available in a substantial 85% to 95% of the intervention health facilities (as shown in Tables 10 and 11), **Table 16** unveils a concerning disparity. It reveals that fewer than half of the patients actually received counselling aimed at encouraging physical activity, adopting a healthy diet, quitting smoking, and maintaining regular follow-up care for CVDs. The most frequent changes in lifestyle or counselling a patient received during a visit to the facility were to maintain a healthy diet (50.1%), eat less salt (45.7%), have a regular check-up for high BP and / or heart disease (45.4%) and regular exercise (43.2%). Patients who visited the intervention facilities were less often advised to refrain from smoking and limit the consumption

of alcohol, exercise regularly and follow up care, compared to those who visited the control facilities (Table 16).

When providers were asked about their practice-related preferences for hypertension and CVD care, there was no difference in attitudes towards lifestyle modification versus pharmacotherapy to manage hypertension and CVD (**Figure 11**). Similar patterns were seen between providers working in intervention and control facilities. For the 156 providers in the intervention facilities, 91 (58.3%) make use of an equal balance of lifestyle modification and medicines, whereas a third (30.1%) mostly focus on lifestyle modification and secondarily on medicine use (Figure 11).

Figure 11 Healthcare Providers Practice Related Preferences Between Intervention and Control Facilities



MANAGEMENT OF HYPERTENSION

Out of the 577 patients who completed the exit survey, 97.4% indicated that their BP had been recorded by a healthcare provider on the day of their visit (Table 17). The provider KAP study revealed that the BP measurement in the outpatient clinic of the health facility is carried out by nurses (98.6%), followed by the doctors (61.7%), and then the healthcare assistants (59.6%). Doctors in the intervention facilities had a higher frequency of measuring a patient's BP compared to those in control facilities ($p=0.01$). Approximately 81.4% of healthcare providers reported using electronic BP monitors validated to measure BP in accordance with the health facility assessment survey, with a higher use in intervention facilities ($p<0.001$).

Among 567 patients diagnosed with hypertension, 497 (87.7%) were prescribed medication to treat their high BP (Table 17). The number of patients treated with medication for hypertension in intervention facilities was significantly higher than those from control facilities ($p<0.001$). Among patients who were treated during their hospital visit, 114 (22.9%) of them received a monotherapy and 244 (49.1%) patients received two antihypertensive drugs. The review of outpatient medical records indicated that 468 (46.0%) of the patients were given two antihypertensive medications in both the intervention and control areas, and there was no difference pre- and post-GHI in the intervention facilities, (41.7% versus 39.5%) (please refer to Table 20). As per the national CVD

guidelines, dual therapy is suggested when treatment response for grade I hypertension is inadequate, and considered essential for grade 2 or 3 hypertension.

Table 17 Prescription of BP Lowering Medications at The Current Visit Between the Intervention and Control Facilities

	CONTROL N=358	INTERVENTION N=209	P-VALUE
When was the last time a doctor, nurse, physician assistant or other healthcare provider checked your blood pressure?			0.85
My blood pressure was measured today.	353 (97.2%)	208 (97.7%)	
Less than 6 months.	8 (2.2%)	4 (1.9%)	
Between 6 months and less than 12 months.	1 (0.3%)	0 (0.0%)	
Between 2 years and less than 3 years.	1 (0.3%)	1 (0.5%)	
	N=358	**N=209**	
Has a health care worker ever prescribed any medicine for you to treat your high blood pressure (hypertension)?			<0.001
No	66 (18.4%)	4 (1.9%)	
Yes	292 (81.6%)	205 (98.1%)	
	CONTROL N=292	**INTERVENTION N=205**	**P-VALUE**
How many medications have you been prescribed for lowering your blood pressure (hypertension)?			<0.001
1 Medication	42 (14.4%)	72 (35.1%)	
2 Medications	156 (53.4%)	88 (42.9%)	
3 Medications	72 (24.7%)	35 (17.1%)	
3 or More Medications	20 (6.8%)	7 (3.4%)	
Don't know	2 (0.7%)	3 (1.5%)	

REACH: HIGHLIGHTS (SUMMARY)

- **While the Ghana Heart Initiative (GHI) demonstrated an extensive presence in the GAR, it is worth noting that there is some variation in the implementation of GHI activities among the 41 facilities, highlighting opportunities for alignment and improvement.** The GHI team reported that determining the start of the GHI intervention was not easy. The intervention is multifaceted, with an important supply-side component, provider training, and supportive supervision, and it does not contain a specific component, such as a financial incentive or something that establishes a definite timeline. The pilot phase, according to the implementers, began in 2019, and all activities took place between 2019 and 2020. They planned to expand the project activities beyond the GAR in 2021, but COVID-19 caused a delay in the roll-out into the regions.
- **Almost every facility in the intervention region reports the presence of essential equipment such as adult weighing scales and height meters**, and well over two-thirds of them are equipped with sphygmomanometers. Interestingly, when it comes to equipment availability, there were no substantial disparities observed between the intervention and control facilities, with the exception of BP monitoring devices and ECG apparatus, which were provided directly to the intervention facilities by the GHI. Moreover, diagnostic and laboratory services are most commonly found in intervention facilities, and it is worth noting that intervention facilities surpassed the control facilities in the percentage of fasting blood glucose tests conducted.
- **Nearly every facility in both the intervention and control regions demonstrates their efforts to addressing hypertension by offering related services**. Encouragingly, within this context, our analysis revealed that intervention facilities achieved a slightly higher composite score for hypertension services, although this difference was not statistically significant due to the small sample size. Nevertheless, this observation underscores the positive effect of the investments in supply and training, indicating that the GHI has contributed to improved service availability in the intervention facilities.
- **Overall, intervention facilities stand out positively when it comes to the availability of CVD-related services in comparison to control facilities**. Notably, the presence of electrocardiograms and renal function tests is statistically significant in the intervention facilities, underscoring their ability to providing comprehensive care. While the composite score did not demonstrate a significant difference between the interventions and control facilities, it is important to note that this observation is likely influenced by the limited sample size rather than any deficiency in the intervention itself.
- **Similar to the general trend in hypertension and/or CVD service availability, intervention facilities consistently provided laboratory services**, particularly excelling in offering fasting blood glucose tests. This success can be attributed to the GHI's provision of glucometers and strips, which significantly improved accessibility to blood glucose testing services in intervention facilities. In the intervention facilities, a significantly greater number of hypertensive patients were prescribed medication, and a notably higher number also visited the facility for routine follow-up.
- **One significant positive point regarding referrals, particularly in the context of intervention facilities, is the wide range of care options available**. These facilities demonstrated the ability to refer patients to various levels of care, from primary health centers to specialised units in tertiary hospitals. Additionally, despite challenges highlighted in the qualitative findings, there are clear signs of improvement and the number of patient referrals from intervention facilities has decreased.
- Although less than half of the patients visiting the intervention facilities received counseling on specific aspects like physical activity and diet, the focus remains on encouraging healthy behaviours. **Notably, a significant percentage of patients were advised to adopt a healthy diet (50.1%) and engage in regular check-ups (45.4%).** Moreover, among providers in the intervention facilities, a substantial 58.3% follow a balanced approach, integrating both lifestyle modifications and medication for hypertension and CVD management, which promises improved patient care and outcomes.

EFFECTIVENESS

Effectiveness by definition is the impact of an intervention on desired health outcomes, including potential negative effects, and broader impact; variability across sub-groups (heterogeneity of effects).

Within the framework of our evaluation, effectiveness was measured by the effect of the Ghana Heart Initiative (GHI) on relevant health service delivery indicators and quality of care indicators, including process indicators; the proportion of health facilities that achieve blood pressure control among patients receiving care in the intervention versus control group facilities; patient's experience and satisfaction with the care received at the intervention and control facilities. Due to our study design (ex-post evaluation), specifically the absence of baseline assessment, we could not attribute causality to the GHI. The chapter is structured to evaluate the effectiveness of GHI by considering facility indicators, provider perspectives, analysing prescription patterns and care processes, and measuring patient satisfaction.

HEALTH FACILITY SURVEY: AGGREGATE FACILITY-LEVEL INDICATORS

We first present a comprehensive analysis of aggregate facility-level indicators obtained from the health facility assessment survey.

HYPERTENSION / CARDIOVASCULAR DISEASE CARE DELIVERY

Our evaluation depended on health information officers and administrators at the facility for the initial round of data collection, especially insofar as process indicators (e.g., total number of patients newly diagnosed with hypertension i.e., BP >140/90 mmHg) are concerned. Owing to administrative difficulties and inadequate upkeep or reporting of facility-specific metrics to DHIMS2, we were unable to compile all the necessary data essential for shaping service delivery indicators. Consequently, the team obtained comprehensive details from patient records (in the form of paper-based folders or LHIMS) to address this gap. In fact, we later discovered, through key informant interviews, not even all GHI facilities were regularly collecting and reporting the necessary process indicators.

Unfortunately, these indicators were also not available in the DHIMS2 system. Hence, the evaluation team decided to collect these indicators through a different independent data collection assessment, which entailed extracting relevant indicators directly from medical records. This was particularly challenging, especially when it came to managing manual records. The team utilised the register for outpatient visits to identify all the conditions related to CVD and hypertension during a specified period. They then accessed the folder or medical records room to extract the necessary data. The main limitation was that the team could only extract records from the folders that were retrieved and available for facilities with manual records. The main difference between the first and second rounds of health facility data collection was the source of information. In the first round, the health information officers at the health facilities provided the information. However, in the second round, the team extracted the information directly from existing records in the folder/medical records room.

Data presented hereafter combines information from 45 health facilities where we were able to obtain data from the facility records (first round of data collection) and 50 facilities where we needed to obtain data directly through consultation of medical records (second round of data collection) Briefly, we generated summary estimates by combining data from the first and second round of data collection at health facilities.

Overall, for analysis we combined results for essential indicators presented in **Table 18**, and the key aspects to highlight:

- The percentage of patients who had their BP measured was higher in the intervention facilities. However, this difference did not reach statistical significance because of the small sample size.
- The percentage of patients who had their BP controlled <140/90 was higher in the intervention facilities compared to the control facilities. However, this difference did not reach statistical significance, most likely due to the small sample size.

The findings reveal that about 41.8% of patients who visited the intervention facilities achieved controlled BP levels, defined as being below 140/90 mm Hg. While this outcome falls short of the desired target, it is important to consider the broader context. It is worth noting that the national average for successful BP control typically ranges between 5% and 7%. This indicates that the intervention facilities operated by GHI are already performing better than the national average.

Furthermore, the lower percentage of patients with controlled BP (33.6%) in the control facilities should be interpreted with caution due to the limitations posed by the sample size, making it statistically insignificant.

Table 18 Facility-Level Aggregate Measures Related to Hypertension and CVD Care Delivery

Indicators	Control	Intervention	p-value
N	**55**	**40**	
OPD Attendance, Mean Per Month Per Facility (SD) (Jul ---– Sep 2022)	7893.4 (7824.5)	5913.0 (8712.9)	0.25
OPD Attendance, Median (IQR) (Jul ---– Sep 2022)	6550.0 (951.0, 12295.0)	1078.0 (456.5, 9328.5)	0.061
No. of OPD Patients (Old cases), July ---– Sep 2022, Mean (SD)	4233.0 (5457.3)	2347.6 (4930.1)	0.087
No. of OPD Patients (New cases), July ---– Sep 2022, Mean (SD)	3481.2 (3814.5)	3439.3 (6196.7)	0.97
No. of patients who have BP measured, July ---– Sep 2022, Mean (SD)	4982.1 (6397.8)	2679.7 (4028.7)	0.048
Proportion screened for hypertension (BP measured / all OPD cases), including missing	63.6% (34.7) (n=51)	68.6% (37.2) (n=36)	0.52
Proportion screened for hypertension (BP measured / all OPD cases), exclude missing	70.5% (29.0) (n=46)	74.9% (32.2) (n=33)	0.53
No. of patients having BP under control defined as BP<140/90, Jul ---– Sep 2022	1942.2 (2754.7) (n=36)	1911.0 (2766.0) (n=28)	0.96
Proportion of patients having BP <140/90 (People with BP<140/90 / People with BP measured)	33.6% (25.8) (n=36)	41.8% (20.3) (n=28)	0.17
No. of patients with prior history of **hypertension**, mean (SD)	399.7 (1153.2)	291.6 (655.8)	0.60
No. of patients with newly diagnosed hypertension, mean (SD)	171.4 (259.7)	313.6 (630.4)	0.13
No. of patients with prior history of **coronary heart disease**, mean (SD)	0.7 (4.5)	0.5 (2.1)	0.75
New cases of coronary heart disease, mean (SD)	4.8 (14.4)	6.0 (15.6)	0.71
No. of patients with prior history of **heart failure**, mean (SD)	2.2 (7.3)	1.6 (8.2)	0.71
New cases of heart failure, mean (SD)	8.8 (28.1)	13.6 (39.8)	0.49
No. of patients with prior history of **stroke**, mean (SD)	6.9 (35.2)	11.6 (65.6)	0.65
New cases of stroke, mean (SD)	14.1 (43.9)	38.3 (83.8)	0.071

Note: Differential BP screening rates were observed between data collected manually obtained versus from routine electronic health records (LHIMS). Manual review of health facility records showed significantly higher BP screening rates in the GHI-intervention facilities vs control group.

PROVIDER KNOWLEDGE, ATTITUDES, AND PRACTICES (KAP) SURVEY

Building on the insights gained from the health facility assessment survey, this section will examine the KAP of healthcare providers. Their KAP play a pivotal role in influencing the effectiveness of healthcare delivery.

KNOWLEDGE OF HEALTHCARE PROVIDERS

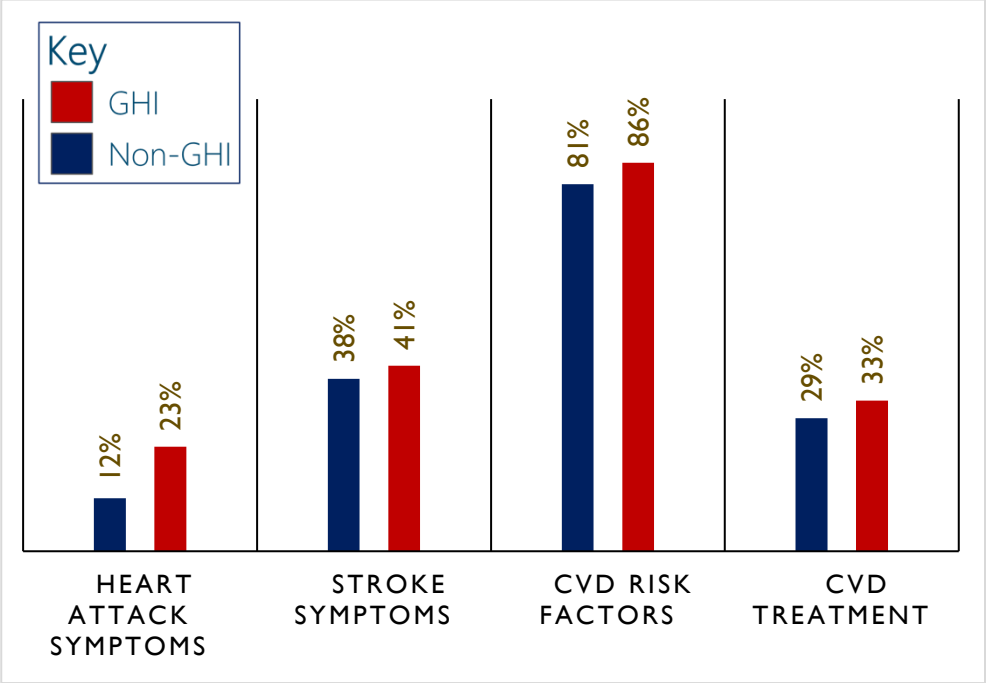
Correct knowledge of CVD risk factors, stroke symptoms, heart attack symptoms, and CVD treatment (defined as >75% correct answers) was: 82.6%, 84.1%, 15.1%, and 30.6% respectively (**Table 19**). **The mean difference in heart attack symptoms knowledge between the intervention and control group was 0.4 (p<0.001).** While no notable statistical difference emerged between the intervention and control groups concerning stroke symptoms, CVD risk factors, and treatment, providers within the intervention facilities exhibited higher knowledge of heart attack and stroke symptoms, CVD risk factors, and treatment options (Table 19). As previously stated, nearly half of the providers (52.0%) preferred an equal balance of lifestyle modification and medicines vs lifestyle modification alone (7.3%) or medicine alone (0.4%) to care for patients with hypertension or CVD.

Table 19 Score Summary of Knowledge on Heart Attack and Stroke Symptoms, CVD Risk Factors and Treatment

	Correct Score (Mean ± SD)			
Survey Category	**Overall**	**Control**	**Intervention**	**p-value**
Heart Attack Symptoms	5.2 (1.3)	5.1 (1.2)	5.5 (1.3)	<0.001
Stroke Symptoms	5.2 (1.2)	6.1 (0.9)	6.2 (1.0)	0.75
CVD Risk Factors	10.8 (0.9)	10.8 (0.9)	10.7 (1.1)	0.47
CVD Treatment	3.2 (1.6)	3.2 (1.6)	3.2 (1.6)	0.91

Note: Knowledge of heart attack and stroke symptoms, was assessed by asking 8 different questions. Knowledge of CVD risk factors and CVD treatment was assessed by asking 12 and 6 different questions, respectively. For each correct response, we assigned a score of 1. For incorrect responses, we assigned a score of 0. We report the mean score (SD) for knowledge. Further, we created a binary variable to indicate the level of knowledge, distinguishing between high and suboptimal. To determine this, we established an arbitrary threshold based on previous publications. Responses with more than 75% of correct answers were classified as "High Knowledge," while responses with 75% or less were classified as "Sub-Optimal Knowledge".

Figure 12 Knowledge of CVDs Among Healthcare Providers



As depicted in **Figure 12**, healthcare providers at facilities implementing GHI reported greater knowledge regarding symptoms of heart attacks, stroke, risk factors for CVDs, and treatment options for CVD, compared to facilities without GHI.

AVAILABILITY OF ANTIHYPERTENSIVE MEDICATIONS

The GHI was not involved in distributing medications to health facilities, however, the evaluation team deemed as important examining the availability of medications in health facilities since this represents the first step toward providing adequate care (**Appendix: Table 6**). **It is important to note that this information is not directly related to the effectiveness of the GHI but serves as valuable context for understanding the broader health system.**

By and large, drugs used to treat hypertension, diabetes, and CVD were readily available in both intervention and control facilities (Appendix: Table 6). However, beta-blockers, calcium-channel blockers (CCBs), and diuretics, which are all essential hypertension related medicines were more readily available in the intervention compared to control facilities. Antidiabetic agents and insulin were available at most health facilities surveyed across intervention and control facilities.

Among the 40 intervention health facilities, the availability of agents by class was 90.0% for CCBs, 85.0% for diuretics, 82.5% for angiotensin converting enzyme (ACE)-inhibitors, 80.0% for angiotensin II receptor blockers (ARBs) and 75.0% for beta-blockers. The most commonly stocked medications in each class were Felodipine (87.5%), Furosemide (80.0%), Lisinopril (80.0%), Valsartan (80.0%) and Carvedilol (45.0%). Overall, 10% of facilities did not have any antihypertensive medications; 82.5% stocked either CCBs, diuretics, ACEIs/ARBs, or beta-blockers. The selection of healthcare facilities comprises 11 CHPS compounds, which are not intended to offer medical treatment and thus do not maintain any medication inventory.

OUTPATIENT AND INPATIENT MEDICAL RECORD REVIEW – PRESCRIPTION PATTERNS AND PROCESS OF CARE MEASURES FOR HYPERTENSION

Shifting focus to the operational aspects of healthcare, this section sheds light on the prescription patterns and process of care measures. By examining the medical records of both outpatient (OPD) and inpatient (IPD) cases, this part of the chapter gives valuable insights into the actual prescription patterns within the facilities.

A limitation of this prescription pattern analysis is that we could not assess whether the prescribed medicines aligned with recommended treatment guidelines due to the absence of BP values and cross-sectional data.

OUTPATIENT MEDICAL RECORD REVIEW – PRESCRIPTION PATTERNS FOR HYPERTENSION

A total of 1,196 outpatient clinical records were reviewed, with 1,100 of them being prescribed medication for hypertension (**Table 20**). Essential points to consider regarding antihypertensive medication prescription post GHI:

- The intervention facilities showed a significantly **higher usage of beta-blockers**.
- There was a **higher utilisation of a triple combination of BP-lowering medications** in the intervention facilities.
- There was a significantly **higher use of statins** in the intervention facilities.

Table 20 presents prescription patterns for antihypertensive drugs before and after the implementation of the GHI. Across both intervention and control facilities, the majority of hypertension patients (94.9%) were prescribed BP-lowering medicines. CCBs were the most commonly recommended class of medication (84.2%), followed by ACE-inhibitors (46.3%), diuretics (27.8%), and beta-blockers (10.2%). Approximately 68.9% of all prescriptions in the intervention facilities were for combination therapies (either dual or triple-drug combination), aligning with current recommendations in the distributed national CVD guidelines.

Following the GHI, CCBs were the preferred monotherapy choice for managing hypertension in intervention facilities (82.6%), followed by ACE inhibitors/angiotensin II receptor blockers (44.2%), thiazide diuretics (23.8%), and beta-blockers (16.3%). Notably, there was a statistically significant increase in the prescription of beta-blockers after GHI implementation in intervention facilities ($p=0.001$).

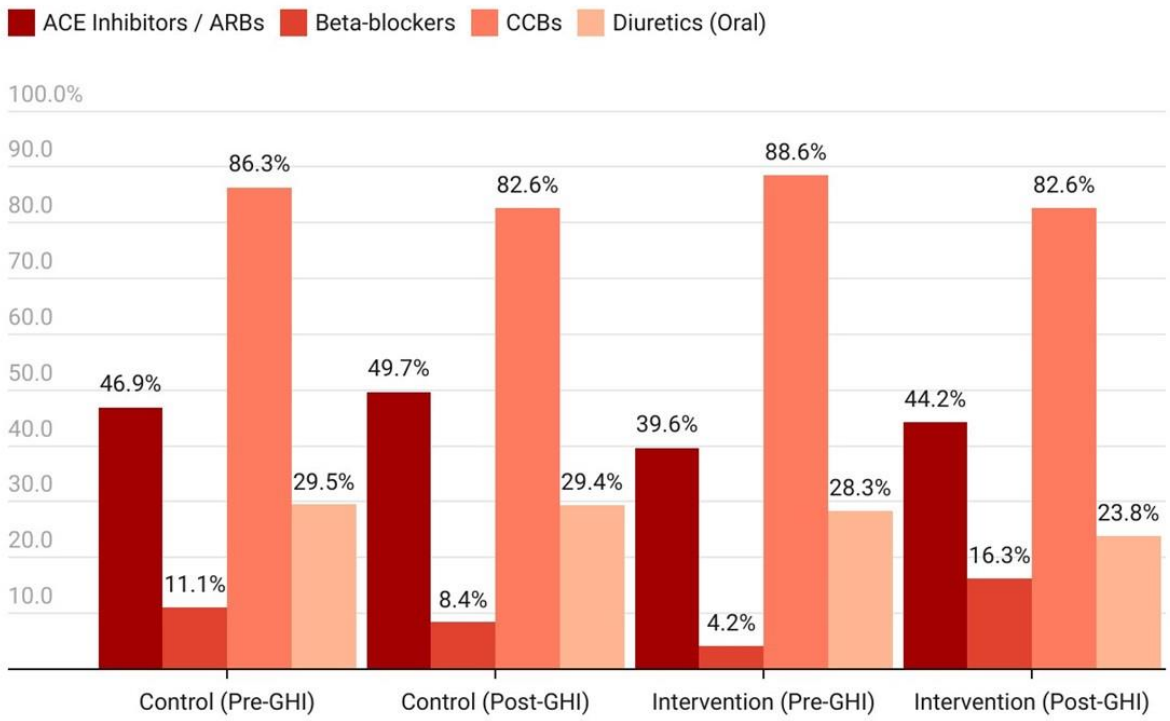
Diuretics, along with calcium channel blockers (CCBs), are endorsed as the primary drug of choice according to the national CVD guidelines. However, it is notable that diuretics ranked fourth in monotherapy prescriptions within the intervention region, and there was no significant increase observed post-GHI. In instances of dual therapy for hypertension, the most prevalent combination consisted of CCBs and diuretics, aligning with the guideline recommendations. A higher percentage of patients received dual therapy in intervention facilities compared to control facilities, consistent with exit survey findings.

Additionally, a small proportion of hypertension patients were prescribed antiplatelets (9.5%) and statins/lipid-lowering agents (13.7%) for possible primary prevention of CVD, though the role of antiplatelets in primary prevention remains controversial.

Table 20 Prescription of Medications in Patients with Hypertension (Out-patient Department) – Pre And Post-GHI Implementation in The Intervention And Control Facilities

	Overall				Pre-GHI			Post-GHI		
Prescribed Medicines	**Total**	**Control**	**Intervention**	**p-value**	**Control**	**Intervention**	**p-value**	**Control**	**Intervention**	**p-value**
N	1100	657	443		194	169		463	274	
Monotherapy (any BP drug)	1044 (94.9%)	627 (95.4%)	417 (94.1%)	0.33	189 (97.4%)	162 (95.9%)	0.41	438 (94.6%)	255 (93.1%)	0.40
ACEi/ACE inhibitor / ARB	509 (46.3%)	321 (48.9%)	188 (42.4%)	0.036	91 (46.9%)	67 (39.6%)	0.16	230 (49.7%)	121 (44.2%)	0.15
Beta-Blockers	109 (10.2%)	59 (9.2%)	50 (11.6%)	0.19	21 (11.1%)	7 (4.2%)	0.017	38 (8.4%)	43 (16.3%)	0.001
Calcium Channel Blockers	904 (84.2%)	538 (83.7%)	366 (84.9%)	0.58	164 (86.3%)	148 (88.6%)	0.51	374 (82.6%)	218 (82.6%)	1.00
Diuretics Oral	299 (27.8%)	189 (29.4%)	110 (25.5%)	0.17	56 (29.5%)	47 (28.3%)	0.81	133 (29.4%)	63 (23.8%)	0.10
Dual Therapy (Any 2 BP Drugs)	681 (61.9%)	437 (66.5%)	244 (55.1%)	<0.001	127 (65.5%)	94 (55.6%)	0.055	310 (67.0%)	150 (54.7%)	<0.001
Triple Therapy (Any 3 BP Drugs)	120 (10.9%)	66 (10.0%)	54 (12.2%)	0.26	21 (10.8%)	15 (8.9%)	0.54	45 (9.7%)	39 (14.2%)	0.062
Antiplatelets	104 (9.5%)	73 (11.1%)	31 (7.0%)	0.022	19 (9.8%)	10 (5.9%)	0.17	54 (11.7%)	21 (7.7%)	0.083
Lipid Lowering Agents	147 (13.7%)	58 (9.0%)	89 (20.6%)	<0.001	10 (5.3%)	25 (15.1%)	0.002	48 (10.6%)	64 (24.2%)	<0.001

Figure 13 Distribution of First-Line Therapy Prescribed in A Cross-Section of Patients with Hypertension Pre- and Post-GHI



Abbreviations: ACE inhibitors, angiotensin-converting enzyme inhibitors; ARB, angiotensin II receptor blocker.

The clinical implications that can be derived from the data on prescribed medication changes before and after the GHI intervention:

Improved Medication Selection: The increase in beta-blocker usage and lipid-lowering agents in the intervention group post-GHI could suggest that the GHI influenced more appropriate medication selection for patients with cardiovascular conditions such as hypertension, heart failure, and hyperlipidemia. However, this improvement hinges upon the correct clinical rationale / justification for prescribing these medications.

Potential Cardiovascular Benefits: The notable increase in the prescription of lipid-lowering agents could lead to improved management of lipid profiles, reducing the risk of cardiovascular events such as heart attacks and strokes. This outcome could result in better long-term cardiovascular health among patients in the intervention group.

Dual and Triple Therapy Considerations: The decrease in dual and triple therapy usage among the intervention group suggests a potential shift in treatment strategies. Further exploration is needed to understand whether this change aligns with the CVD guidelines, patient preferences, or other clinical factors.

Individualised Treatment Approach: The trend towards monotherapy usage in both control and intervention groups indicates that healthcare providers might be tailoring treatment plans to individual patient needs, aiming to minimise medication burden while maintaining effective BP control.

Potential Impact of Antiplatelet Usage: The decrease in antiplatelet usage in the intervention group, although not statistically significant, should be monitored to ensure that there are no adverse effects on patients at risk of cardiovascular events. This warrants careful consideration in treatment decision-making.

It is important to remember that clinical implications are best understood in the context of comprehensive healthcare, involving collaboration among healthcare providers, researchers, policymakers, and patients. The data-driven insights from this study should be used as a foundation for further research and ongoing healthcare improvement efforts.

In sum, within the intervention facilities, there were notable changes in the distribution of first-line therapies post-GHI (**Figure 13**). ACE inhibitors / ARBs and beta-blockers saw increased prescription rates, while CCBs and diuretics decreased. These changes suggest that the GHI had an influence on the prescription patterns of first-line therapies in the intervention facilities, possibly indicating a shift in treatment strategies or adherence to new guidelines. Monitoring and assessing these patterns in the context of clinical outcomes will further help determine the intervention's effectiveness in improving patient care.

INPATIENT MEDICAL RECORD REVIEW – PRESCRIPTION PATTERNS FOR HYPERTENSION

A total of 387 inpatient clinical records were reviewed, with 122 of them being prescribed medication for hypertension (**Table 21**). Essential points to consider regarding antihypertensive medication prescription post GHI:

- The **intervention facilities showed a higher usage of beta-blockers and diuretics**.
- There was a **significantly higher utilisation of a double combination of BP-lowering medications in the intervention facilities**.
- There was a **higher use of statins in the intervention facilities**.

In the intervention facilities, most patients were on monotherapy or on two-drug regimens, which significantly increased from 0.0% to 42.3% at the intervention facilities (p=0.023) post-GHI (Table 21).

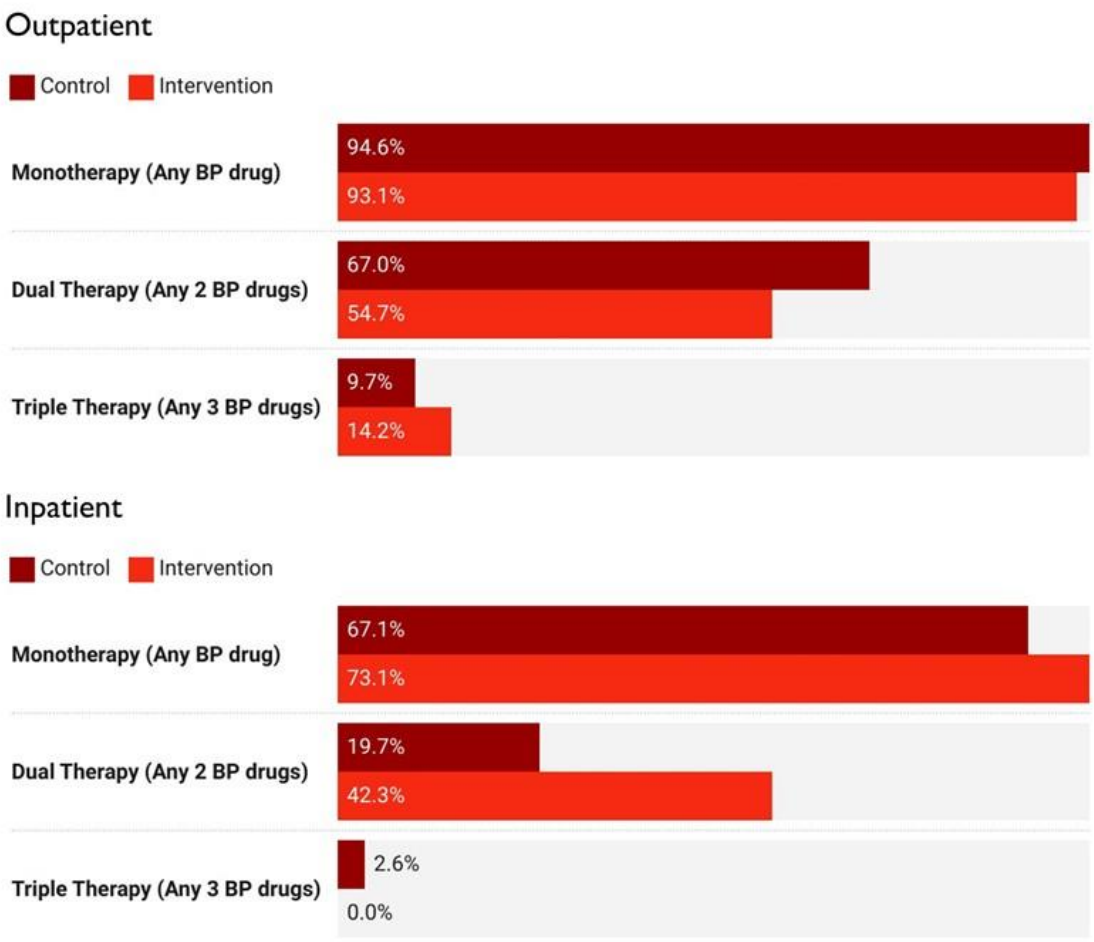
In the context of our scientific report, the current presentation of the inpatient data lacks substantial relevance in terms of clinical significance, especially when examined through the lens of guideline directed medical therapy. The data presented combines all prescribed antihypertensive medications without differentiation.

Table 21 Prescription of Medications in Patients with Hypertension (In-patient Department) – Pre And Post-GHI Implementation In The Intervention And Control Facilities

	Overall				Pre-GHI			Post-GHI		
Prescribed Medicines	**Total**	**Control**	**Intervention**	**p-value**	**Control**	**Intervention**	**p-value**	**Control**	**Intervention**	**p-value**
N	122	95	27		18	1		76	26	
Monotherapy (any BP drug)	83 (68.0%)	64 (67.4%)	19 (70.4%)	0.77	13 (72.2%)	0 (0.0%)	0.13	51 (67.1%)	19 (73.1%)	0.57
ACEi/ARB	59 (48.4%)	47 (49.5%)	12 (44.4%)	0.64	11 (61.1%)	0 (0.0%)	0.23	36 (47.4%)	12 (46.2%)	0.91
Beta Blocker	18 (14.8%)	13 (13.7%)	5 (18.5%)	0.53	1 (5.6%)	0 (0.0%)	0.81	12 (15.8%)	5 (19.2%)	0.68
Diuretics	35 (28.7%)	24 (25.3%)	11 (40.7%)	0.12	5 (27.8%)	0 (0.0%)	0.54	19 (25.0%)	11 (42.3%)	0.095
Calcium Channel Blockers	93 (76.9%)	76 (80.9%)	17 (63.0%)	0.052	15 (83.3%)	1 (100.0%)	0.66	60 (80.0%)	16 (61.5%)	0.060
Dual therapy (Any 2 BP drugs)	30 (24.6%)	19 (20.0%)	11 (40.7%)	0.027	4 (22.2%)	0 (0.0%)	0.60	15 (19.7%)	11 (42.3%)	0.023
Triple therapy (Any 3 BP drugs)	2 (1.6%)	2 (2.1%)	0 (0.0%)	0.45	18 (100.0%)	1 (100.0%)		2 (2.6%)	0 (0.0%)	0.40
Antiplatelet	11 (9.0%)	9 (9.5%)	2 (7.4%)	0.74	2 (11.1%)	0 (0.0%)	0.72	7 (9.2%)	2 (7.7%)	0.81
Lipid lowering agents (statins)	13 (10.7%)	8 (8.4%)	5 (18.5%)	0.13				8 (10.5%)	5 (19.2%)	0.25

It is important to note that the categories are not mutually exclusive. Specifically, monotherapy encompasses any single blood pressure (BP) drug, while dual therapy involves the use of any two BP drugs concurrently.

Figure 14 Specific Regimens of Antihypertensive Drugs Prescribed For The Hypertensive Patients In OPD And IPD Records Post-GHI



PROCESSES OF CARE MEASURES FOR HYPERTENSION

To understand how care was delivered for patients with hypertension at the outpatient clinic, we analysed the following processes of care measures between the intervention and control health facilities (if data were available in the medical records), e.g., whether doctor checked BP, performed initial CVD risk assessment considering risk factors, physical examination (weight, height checked), any laboratory tests ordered or lab test results reviewed (if available), medications prescribed, lifestyle modification advice given, follow-up advice given for regular monitoring of cardiovascular risk factors.

The intervention facilities appear to have influenced specific aspects of care in hypertension management (**Table 22**). While the overall mean composite scores for the processes of care measures for hypertension remained relatively unchanged between the intervention and control facilities, there were notable improvements in areas such as risk assessment and medical history evaluation. **Post-GHI, the intervention facilities had a significant increase in their ability to test for blood lipids and serum creatinine, and in supporting healthy dietary practices, physical activity, stress management and sleep duration (Table 22)**. However, certain measures experienced declines, suggesting the need for a more comprehensive assessment of the intervention's effectiveness. The findings underline the complexity of healthcare interventions and underscore the importance of tailored approaches to address diverse care processes for optimal hypertension management.

Of the three regions examined, all three had a high proportion of individuals reaching each stage of the care cascade. **Within regions, there was a substantial variation in the proportion of individuals with hypertension attaining each cascade step**.

Table 22 Process of Care Measure for Hypertension Between the Intervention and Control Facilities

Processes of care (POC) measures, composite mean scores	Total	Control	Intervention	p-value	Control	Intervention	p-value	Control	Intervention	p-value
Hypertension - POC score, mean (SD)	5.7 (2.8)	5.7 (2.5)	5.6 (3.3)	0.50	5.7 (2.2)	5.8 (3.3)	0.71	5.8 (2.6)	5.5 (3.3)	0.28
Processes of care (POC) measures for hypertension as %										
Checked blood pressure	1166 (97.5%)	687 (98.6%)	479 (96.0%)	0.026	204 (98.6%)	179 (97.3%)	0.13	483 (98.6%)	300 (95.2%)	0.073
Initial Risk Assessment	856 (71.6%)	565 (81.1%)	291 (58.3%)	<0.001	168 (81.2%)	113 (61.4%)	<0.001	397 (81.0%)	178 (56.5%)	<0.001
Assessment of Medical History	998 (83.4%)	611 (87.7%)	387 (77.6%)	<0.001	186 (89.9%)	153 (83.2%)	0.045	425 (86.7%)	234 (74.3%)	<0.001
Physical Examination (weight, height recorded)	1099 (91.9%)	642 (92.1%)	457 (91.6%)	0.56	191 (92.3%)	171 (92.9%)	0.73	451 (92.0%)	286 (90.8%)	0.67
Laboratory test results, if available reviewed	1053 (88.0%)	628 (90.1%)	425 (85.2%)	0.033	188 (90.8%)	151 (82.1%)	0.005	440 (89.8%)	274 (87.0%)	0.68
Laboratory tests ordered	893 (74.7%)	568 (81.5%)	325 (65.1%)	<0.001	170 (82.1%)	129 (70.1%)	0.005	398 (81.2%)	196 (62.2%)	<0.001
Blood sugar	726 (60.7%)	506 (72.6%)	220 (44.1%)	<0.001	151 (72.9%)	87 (47.3%)	<0.001	355 (72.4%)	133 (42.2%)	<0.001
Blood lipids	146 (12.2%)	46 (6.6%)	100 (20.0%)	<0.001	15 (7.2%)	41 (22.3%)	<0.001	31 (6.3%)	59 (18.7%)	<0.001
Serum creatinine	125 (10.5%)	30 (4.3%)	95 (19.0%)	<0.001	12 (5.8%)	34 (18.5%)	<0.001	18 (3.7%)	61 (19.4%)	<0.001
Cardiac enzymes (Troponins, BNP)	14 (1.2%)	8 (1.1%)	6 (1.2%)	0.62	3 (1.4%)	2 (1.1%)	0.88	5 (1.0%)	4 (1.3%)	0.46
Medications prescribed	1081 (90.4%)	627 (90.0%)	454 (91.0%)	0.13	184 (88.9%)	165 (89.7%)	0.75	443 (90.4%)	289 (91.7%)	0.073
Referral to dietician	68 (5.7%)	32 (4.6%)	36 (7.2%)	0.045	8 (3.9%)	16 (8.7%)	0.046	24 (4.9%)	20 (6.3%)	0.33
Follow-up advice (next clinic appointment) given	782 (65.4%)	479 (68.7%)	303 (60.7%)	0.011	138 (66.7%)	114 (62.0%)	0.34	341 (69.6%)	189 (60.0%)	0.016
Has the doctor advised lifestyle modification?	140 (11.7%)	81 (11.6%)	59 (11.8%)	0.83	25 (12.1%)	23 (12.5%)	0.88	56 (11.4%)	36 (11.4%)	0.91
Healthy Dietary Habits	104 (8.7%)	51 (7.3%)	53 (10.6%)	<0.001	12 (5.8%)	21 (11.4%)	0.001	39 (8.0%)	32 (10.2%)	0.043
Appropriate physical activity	83 (6.9%)	34 (4.9%)	49 (9.8%)	<0.001	8 (3.9%)	19 (10.3%)	<0.001	26 (5.3%)	30 (9.5%)	<0.001
Avoidance of tobacco	71 (5.9%)	46 (6.6%)	25 (5.0%)	0.095	13 (6.3%)	7 (3.8%)	0.13	33 (6.7%)	18 (5.7%)	0.42
Avoidance of alcohol	97 (8.1%)	51 (7.3%)	46 (9.2%)	0.048	14 (6.8%)	18 (9.8%)	0.10	37 (7.6%)	28 (8.9%)	0.19
Stress Management	74 (6.2%)	27 (3.9%)	47 (9.4%)	<0.001	4 (1.9%)	18 (9.8%)	<0.001	23 (4.7%)	29 (9.2%)	<0.001
Duration of sleep	61 (5.1%)	23 (3.3%)	38 (7.6%)	<0.001	4 (1.9%)	15 (8.2%)	<0.001	19 (3.9%)	23 (7.3%)	0.006
Regular monitoring of cardiovascular disease risk factors (i.e., blood pressure)	122 (10.2%)	69 (9.9%)	53 (10.6%)	0.52	20 (9.7%)	20 (10.9%)	0.52	49 (10.0%)	33 (10.5%)	0.69

PATIENT EXPERIENCE AND SATISFACTION BETWEEN INTERVENTION AND CONTROL FACILITIES

Recognising the significance of patient experience and satisfaction as an indicator of healthcare effectiveness, this section presents the exit survey results. By capturing the experiences and opinions of patients who have received care, this segment intends to provide a comprehensive overview of patient experience and satisfaction across various dimensions.

PATIENT EXPERIENCE

Appendix: Table 7 provides a summary of patient feedback regarding eight distinct aspects of their healthcare encounters. Notably, patients who received care at the control facilities reported significantly higher ratings of their overall experience compared to those who received care at the intervention facilities.

Provider-patient communication

The majority of patients (76.5%) in the intervention facilities agreed that health workers discussed treatment fully with them that they could understand. Although nearly 70.9% of all patients agreed that the health workers gave them enough time to ask questions, almost 20% of the patients (19.2%) agreed that health workers were too busy to listen carefully to their problems.

Choice of provider and prompt attention

Patients attending intervention facilities had a significantly higher level of ease in seeing a health worker of their choice, someone they were satisfied with and/or of a gender they preferred, compared to the patients in control facilities. A higher percentage of patients at the intervention facilities (52%) compared to control facilities (40%) reported experiencing a short wait time at the facility before seeing a healthcare provider. However, when asked if they found the distance and travel time between their home and the health facility to be reasonable, the minority of patients (6.6% in the intervention group and 12.9% in the control group) agreed that it was reasonable.

Privacy and confidentiality

For patients both at intervention and control facilities, 96.2% reported that their privacy was maintained throughout their treatment, and 87.3% reported that their medical reports/history were kept confidential. 16.0% of intervention patients and 8.8% of control patients reported that they had limited ability to talk in private to their doctors and nurses in their past clinic visit. However, a significantly higher number of intervention patients acknowledged that they were involved in making decisions for their treatment.

Staffing and amenities

Slightly more than a fifth (22.7%) of patients utilising either intervention or control health facility agreed that the facilities were not clean. A higher percentage of control patients (86.7%) agreed that the waiting room of the health facility was cleaner compared to intervention patients (70.9%). A higher percentage of control patients compared to intervention patients reported having access to clean water (82.8% versus 64.3%). Similarly, a larger proportion of control patients reported having cleaner toilets (72.9% versus 47.9%) and better facilities for people with disabilities (77.9% versus 46.0%).

Overall, most respondents were satisfied with cleanliness, communication, and privacy settings across all levels of healthcare facilities, but the levels of patient experience in these aspects were significantly higher in control facilities than the intervention healthcare facilities. However, both the intervention and control facilities prioritised the maintenance of high levels of confidentiality to ensure privacy during medical consultations and the protection of medical records. We understand that the health facilities are located in different environments, and it is possible that the health facilities in the control area may be less appealing or attractive compared to facilities in the GAR. However, the healthcare providers who are benefiting from the GHI have been motivated to manage and treat patients with high BP and CVDs, and are facing constraints such as a larger number of patients and long waiting periods. **A positive experience for patients at intervention facilities was closely associated with autonomy/shared decision-making, the ease of being seen, and gender of provider.** To improve the patient experience in healthcare facilities, it should start with healthcare providers being willing to assist patients, as one participant stated:

> *"… it starts with the prescriber, the willingness to help the patients; if the prescriber is tired of the people treating them will be difficult – you will not give the best care you are supposed to give…"*

(Respondent_ Policy/Administration_ 13)

PATIENT SATISFACTION

Table 23 summarises patients' satisfaction of the 8 specific aspects of a health encounter. **The patient satisfaction ratings were significantly higher for patients attending the intervention facilities than for control facilities.** The findings underscore a general trend towards increased patient satisfaction within the Intervention group across various dimensions of healthcare experiences. This trend is supported by the statistical significance observed in the p-values, indicating that the differences between the groups are unlikely due to chance. The study suggests that intervention facilities play a role in fostering higher patient satisfaction levels and potentially positive healthcare outcomes. The findings highlight the importance of patient satisfaction as a valuable measure of healthcare effectiveness, and suggest that intervention facilities targeted at improving patient experiences can have a positive effect on satisfaction levels, treatment adherence, and overall wellbeing. This information can guide healthcare providers and policymakers in making informed decisions to create better healthcare experiences for patients with hypertension and/or CVDs.

Table 23 Patient Satisfaction Between Intervention and Control Facilities

	Total	Control	Intervention	p-value
	N=575	N=362	N=213	
How satisfied were you with this health care-seeking experience?				0.12
Not Satisfied	151 (26.3%)	103 (28.5%)	48 (22.5%)	
Satisfied	424 (73.7%)	259 (71.5%)	165 (77.5%)	
How satisfied were you with the quality of care you received at this facility?				0.36
Not Satisfied	114 (19.8%)	76 (21.0%)	38 (17.8%)	
Satisfied	461 (80.2%)	286 (79.0%)	175 (82.2%)	
I was given a treatment plan with specific steps to take.				**0.043**
Not Relevant	129 (22.4%)	91 (25.1%)	38 (17.8%)	
Relevant	446 (77.6%)	271 (74.9%)	175 (82.2%)	
My health / medical condition was successfully treated.				**<0.001**
Not Relevant	118 (20.6%)	91 (25.2%)	27 (12.7%)	
Relevant	456 (79.4%)	270 (74.8%)	186 (87.3%)	
My health / medical and wellbeing improved.				**0.001**
Not Relevant	132 (23.0%)	99 (27.4%)	33 (15.5%)	
Relevant	442 (77.0%)	262 (72.6%)	180 (84.5%)	
I was connected to resources to manage my health / medical condition.				**0.021**
Not Relevant	156 (27.2%)	110 (30.5%)	46 (21.6%)	
Relevant	418 (72.8%)	251 (69.5%)	167 (78.4%)	
I felt motivated to follow my treatment plan.				**0.006**
Not Relevant	112 (19.5%)	83 (23.0%)	29 (13.6%)	
Relevant	462 (80.5%)	278 (77.0%)	184 (86.4%)	
I felt better about life after leaving.				**0.031**
Not Relevant	116 (20.2%)	83 (23.0%)	33 (15.5%)	
Relevant	458 (79.8%)	278 (77.0%)	180 (84.5%)	

The qualitative interviews with patients attending intervention facilities for hypertension or CVD-related issues affirmed their positive experiences regarding both the care they received and their interactions with healthcare providers. The patients expressed satisfaction with the quality of treatment and the attention given to their health concerns. This positive rapport consistently led to increased adherence and more regular visits to the healthcare facility.

One patient highlighted the attentive care, stating that they are treated very well, especially regarding their health issues, which have been effectively addressed. The patient also noted that the way patients are received feels normal and this pleasant experience encourages them to continue visiting the facility. Another patient emphasised the doctor's approach, sharing that the doctor's manner of addressing them as "*Mummy*" and inquiring about their well-being and any discomfort immediately puts them at ease. Even if they had pain prior to the visit, the doctor's approach makes them feel better. A patient also discussed the tangible improvements in their health, noting that the positive experiences were reflected in the reduced frequency of visits. They expressed that if their condition had not improved, they would have been coming monthly, but now they only need to visit every three months:

> *"…Really, I have seen improvement, if not I would have been coming monthly but I come every three months…"*

(Respondent_ Patient_12)

Patient satisfaction at intervention facilities primarily hinges on two factors: the waiting time and the quality of the provider-patient relationship. Patients expressed dissatisfaction with the wait time, stating that they had received their medication but were still left waiting without any communication or updates.

One patient pointed out the importance of efficiency in service, sharing their experience of arriving at 9:17 am and highlighting the contrast between their quick departure now and the potential extended wait if they had to stand in line for medication.

Furthermore, a patient mentioned their observations about the behaviour of the nurses. They noticed that some nurses lacked friendliness and seemed indifferent to patients if they were not directly involved in their care.

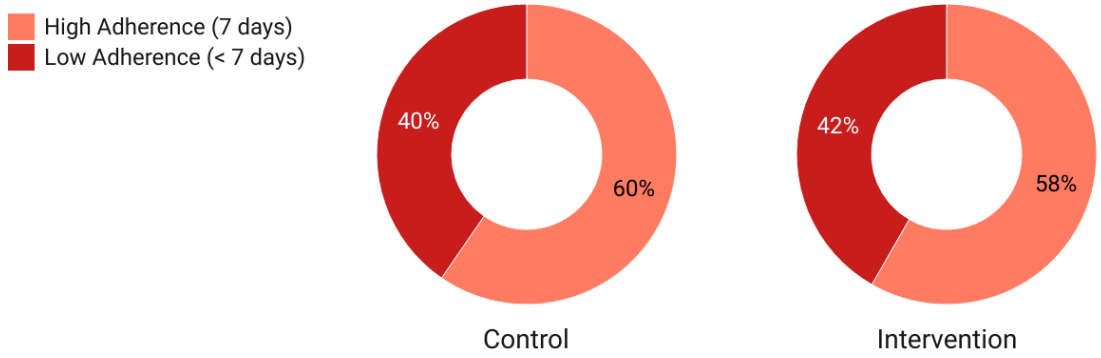
> *"… I started coming here and realized that nurses were not friendly in the sense that if she is not taking care of you, she doesn't care..."*

(Respondent_ Patient_09)

MEDICATION ADHERENCE

In the exit survey, the patient's compliance with the antihypertensive medication taken on all seven days of the last week in the intervention group was at 58.3%, which was relatively constant in control groups (59.6%) and the difference was statistically not significant (**Figure 15**).

Figure 15 Patients Adherence to Taking Medicines on All 7 Days In The Past Week Between Intervention And Control Facilities



The extent to which patients adhered to their treatment exhibited a diverse range, spanning from low to high levels of commitment. Some individuals faced challenges in maintaining adherence, often stemming from circumstances like forgetting to take doses or perceiving their condition as less critical, leading to occasional non-compliance.

On the other end of the spectrum, certain patients showcased remarkable dedication to their treatment regimen. These individuals consistently adhered to their prescribed medications, diligently followed the instructions provided by their healthcare providers, ensured they completed their courses of medication, and proactively attended scheduled check-ups to monitor their progress.

> *"… So always I take the medication given and if it gets finished, I go for check-up, and if I go for the check-up then I take the medicine…"*

(Respondent_ Patient_ 05)

EEFECTIVENESS: HIGHLIGHTS (SUMMARY)

- **Medication Availability**: Although not directly linked to the GHI's effectiveness, this offers a valuable insight into physicians' ability to comply with the guidelines set in place by the GHI. The intervention facilities showcased improved access to essential antihypertensive medications, such as beta-blockers, calcium-channel blockers, and diuretics.
- **Prescription Patterns - Outpatient MRR**: Intervention facilities showed increased utilisation of beta-blockers; significant rise in the usage of triple combination therapy; statin prescriptions substantially increased, indicating a focus on cardiovascular risk reduction. **Inpatient MRR:** The intervention facilities showed a higher usage of beta-blockers and diuretics; there was a significantly higher utilisation of a double combination of BP-lowering medications in the intervention facilities; there was a higher use of statins in the intervention facilities.
- **Blood Pressure Control**: Intervention facilities successfully achieved controlled blood pressure (<140/90 mm Hg) in approximately 41.8% of patients, while control facilities achieved this in 33.6% of cases. It is important to highlight that the national average for successful blood pressure control typically falls between 5% and 7%. This clearly demonstrates that the intervention facilities are already performing better than the national average.
- **Care Delivery Processes**: Intervention facilities exhibited improved practices, with higher proportions of patients having blood pressure measured; Post-GHI, these facilities displayed advancements in lipid and serum creatinine testing, and support for healthy lifestyle practices.
- **Healthcare providers exhibited diverse knowledge** of CVD risk factors, stroke, heart attack symptoms, and treatment. There is enhanced understanding of heart attack symptoms in intervention facilities.
- **Majority of providers leaned towards balanced lifestyle modification** and medication for hypertension/CVD care.
- **Patient Experience**: Positive trends emerged in intervention facilities for provider-patient communication, provider choice, prompt attention, privacy, and shared decision-making.
- **Patient Satisfaction**: Patients attending intervention facilities reported heightened satisfaction levels. Increased patient motivation to adhere to treatment plans and overall health and wellbeing improved. **This finding is probably a reflection of greater service availability and higher quality of service delivery, as depicted by some of our other quality of care process indicators.** Appraised together, our findings indicate that the GHI was ultimately successful in enhancing patient-centeredness by acting to improve health service delivery models.
- In Ghana, maintaining patient data, records, and reporting were described as problematic – whether it was healthcare providers unable to write in patient charts or the inability for a patient's medical record to be linked across visits at public facilities. The outpatient registers had many incomplete records and, in a few cases, it was impossible to retrieve the paper records because of storage challenges in the facilities. The electronic health record (EHR) system was now in use in the majority of hospitals and health facilities in Ghana, though the system has not been standardised across the entire network. During data collection, field data collectors recalled that facilities had just recently migrated to EHR, and observed incomplete fields in the system. Providers complained of how laborious clinical documentation in the EHR could be as well. These various challenges underscore the importance of strong health systems to the success of the GHI programme, as well as the need for programmes to address known weaknesses in health systems. Finally, the success of the GHI programme might be hindered by the health system's capacity to supply the necessary staff, facilities, and services.

ADOPTION

Adoption is defined as the absolute number, proportion, and representativeness of settings and intervention agents (people who deliver the programme) who are willing to participate in the Ghana Heart Initiative (GHI), and why.

Within the framework of our evaluation, Adoption was measured by the number / percentages of health care providers who took part in the GHI and who report using the national CVD treatment guidelines and equipment. Fidelity – evidence of use of guidelines is analysed descriptively and qualitatively. Perceived quality of equipment and their functionality, supplies and maintenance is described descriptively. Proportion of health care workers who report satisfaction with the GHI programme activities, including training.

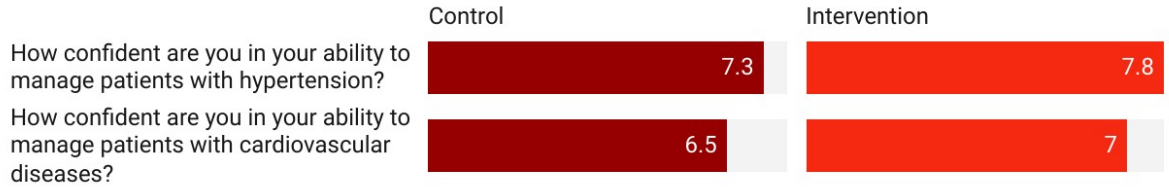
Important: A relatively small proportion of providers in the GHI facilities participated in the acceptability survey. Of the 156 providers interviewed in the intervention facilities for the KAP survey, only 41(26.2%) respondents completed the survey. This was the second part of the of KAP survey focusing on GHI facilities and we only generate data on perceived quality of the guidelines, training and equipment.

ATTITUDES OF PROVIDERS TOWARDS HYPERTENSION / CVDS

The healthcare providers in facilities who were approached and participated in GHI activities reported significantly higher confidence in their ability to care for patients who have hypertension or CVD ($p<0.001$ and $p=0.007$; **Figure 16**).

Approximately 81.4% of healthcare providers used electronic validated BP monitoring devices to take measurements consistent with the health facility assessment survey. As depicted in **Table 24**, there was a notable difference in usage between intervention and control facilities, with a significantly higher utilisation rate in the intervention group (87.2% versus 75.7%, *p <0.001*). The CVD risk assessment was primarily based on clinical judgement (94%). Nearly one fifth of providers (19.2%) in the intervention facilities acknowledged that they did not assess for CVD risk when seeing patients in the outpatient clinic; in contrast, 10.4% of providers in the control facilities did not appraise CVD risk. Around 22.3% of the providers spent in excess of 20 minutes or more with patients during routine, uncomplicated hypertension and/or CVD visits overall, with those in the intervention group spending significantly less time compared with the control group (11.2% versus 26.9%, *p <0.001*).

Figure 16 Health Care Providers Confidence in Caring for Patients with Hypertension and/or CVDs



** *There was statistically significant difference in the healthcare providers confidence in caring for patients with hypertension between the two groups (p<0.001).*

Table 24 Provider Clinical Practice-Related Factors

Clinical Practice-Related Factors	Control (N=367)	Intervention (N=156)	p-value
Type of blood pressure device used:			
Mercury	217 (59.1%)	68 (43.6%)	0.410
Electronic Validated	278 (75.7%)	136 (87.2%)	**<0.001**
CVD risk assessment tool used in the outpatient clinic:			
CVD Risk Calculator	32 (8.7%)	23 (14.7%)	**0.001**
CVD Risk Charts	148 (40.3%)	69 (44.2%)	**0.008**
Clinical Judgement	328 (89.4%)	130 (83.3%)	0.48
Other	4 (1.1%)	4 (2.6%)	0.005
CVD Risk is Not Assessed	38 (10.4%)	30 (19.2%)	<0.001
Time spent in a routine clinic visit for a typical (uncomplicated) patient with hypertension or CVD, N (%)			<0,001
Less than 2 minutes	2 (0.5%)	0 (0)	
2-5 minutes	19 (5.2%)	17 (11.2%)	
5-10 minutes	104 (28.6%)	50 (32.9%)	
10-20 minutes	94 (25.8%)	35 (23.0%)	
Greater than 20 minutes	98 (26.9%)	17 (11.2%)	

ADOPTION OF THE GHANAIAN NATIONAL CVD GUIDELINES

For CVD guidelines, the GHI programme aimed to facilitate the awareness of guidelines to all participating facilities. Such guidelines are crucially important in facilities where most services are provided by non- physician health workers, mainly physician assistants and nurses. The KAP survey showed that, one-third of the providers had seen a copy of the Ghanaian National Guideline for the Management of CVDs, with a significantly higher number of providers having seen and received training on the guidelines in the intervention facilities (p>0.001) (**Table 25**). The majority of providers were trained within the previous 12-24 months and within the previous 24 months, with nearly one-third (29.4%) attending a one-day training and 38.2% attending a three-day training (Table 25).

As reported in the KAP survey, one in five (20.5%) health care workers indicated they use the Ghanaian National Guideline for the Management of CVDs to manage patients with hypertension and/or CVDs (Table 26); however, in the intervention group, the use of the national guidelines, standard treatment guidelines (STGs), guidelines of the American Heart Association (AHA) and American College of Cardiology (ACC), guidelines of the European Society for Cardiology (ESC) and others was significantly higher (<0.001). As shown in Table 26, providers in

intervention and control facilities showed the greatest adherence to the Standard Treatment Guidelines (STGs) (92.1%). The STGs are tied in with insurance payments and drive prescribing and reimbursement across Ghana.

Table 25 Seen and Trained on The Ghanaian National CVD Guidelines

	Total N=523	Control N=367	Intervention N=156	p-value
Have you seen a copy (soft or hard) of the National Guidelines for the Management of Cardiovascular Diseases?				<0.001
Yes	29.9% (155)	24.8% (90)	41.7% (65)	
Have you received training on the National Guidelines for the Management of Cardiovascular Diseases				<0.001
Yes	32.3% (50)	17.8% (16)	52.3% (34)	
When did the most recent training take place?				0.038
Within the last 6 months	22.0% (11)	43.8% (7)	11.8% (4)	
Within the last 6-12 months	14.0% (7)	18.8% (3)	11.8% (4)	
Within the last 12-24months	30.0% (15)	12.5% (2)	38.2% (13)	
Within the last 24months	34.0% (17)	25.0% (4)	38.2% (13)	
How long was the training for?				0.013
1 day	42.0% (21)	68.8% (11)	29.4% (10)	29.4% (10)
2 days	6.0% (3)	12.5% (2)	2.9% (1)	2.9% (1)
3 days	30.0% (15)	12.5% (2)	38.2% (13)	38.2% (13)
4-7 days	18.0% (9)	0.0% (0)	26.5% (9)	26.5% (9)
7 days	4.0% (2)	6.3% (1)	2.9% (1)	2.9% (1)

Table 26 Use and Accessibility of CVD Guidelines

	Total	Control	Intervention	p-value
	N=523	N=367	N=156	
Use of CVD Treatment Guidelines for Patients with Hypertension or Cardiovascular Diseases	398 (76.5%)	285 (77.7%)	113 (72.4%)	0.02
Ghanaian National Guidelines for The Management of CVD	75 (20.5%)	32 (8.7%)	43 (27.6%)	<0.001
Standard Treatment Guidelines (Ghana)	359 (92.1%)	261 (71.1%)	98 (62.8%)	0.84
AHA/ACC* Guidelines	66 (17.8%)	35 (9.5%)	31 (19.9%)	<0.001
European Society of Cardiology (ESC) Guidelines	22 (6.2%)	10 (2.7%)	12 (7.7%)	<0.001
Other Guidelines	27 (7.9%)	14 (3.8%)	13 (8.3%)	<0.001
Hypertension or CVD Guidelines Available / Accessible in Any Form to Healthcare Workers**				
Frequently	168 (32.1%)	120 (32.7%)	48 (30.8%)	0.02
Very frequently	69 (13.2%)	43 (11.7%)	26 (16.7%)	
Not very often	**163 (31.2%)**	**126 (34.3%)**	**37 (23.7%)**	
Very infrequently	62 (11.9%)	35 (9.5%)	27 (17.3%)	
Infrequently	51 (9.8%)	36 (9.8%)	15 (9.6%)	

** *In this context, we intended it to be available in any format, whether as a physical hard copy or an electronic version through the Akomacare app.*

Overall, 31.2% of respondents indicated that the guidelines were not very often available or accessible in the facility either in soft or hard copies (Table 26). A few stakeholders were of the opinion that the training manuals and guides had been widely distributed among the different levels of care, however it should be underscored that hard copies of the national CVD guidelines had not been distributed at facilities; the guidelines are only available electronically on the Akomacare app, which was created to improve the availability, utilisation, and dissemination. The app was released in August of 2022 along with the guidelines, and it can be used on mobiles (smartphones) and desktops. Some respondents were of the opinion that the app was readily available and accessible to all category of healthcare workers especially clinicians, physician assistants and nurses in Ghana:

> *"… We also have the Akomacare app that is meant to deliver the national guidelines to the pockets of health workers because it's difficult to carry around a huge book all the time. So, we want to make sure that it's handy to use. So, the app is another major development…"*

(Respondent_ Policy/Administration_ 03)

Other respondents were excited about the availability of the guidelines because it standardised the management and treatment of patients with hypertension/CVD:

> *"… We now have various tools, an app that provides useful technical resources to frontline workers and also managers, and that is a big deal. Because for us in quality of care, usually when treatment guidelines are not standardised, then the doctors themselves, the nurses themselves become the treatment guidelines and everybody use a different treatment guideline and when harm occurs, then you don't even know who to blame, whether it is the system that didn't have the policy or the healthcare worker…"*

(Respondent_ Policy/Administration_ 07)

Furthermore, the qualitative interviews brought to light that respondents had limited knowledge and awareness about the Akomacare app and the CVD support and call center. Out of the respondents interviewed, which included the healthcare providers, more than a third had no prior knowledge or awareness of the Akomacare app:

> *"… it's an app? I didn't know… I only heard [during the interview] the name…"*

(Respondent_ Provider_ 06)

Similarly, knowledge and use of the CVD support and call center was also very poor among the respondents. None of the respondents [providers] (100%, 20) had used the call center before and three-quarters (75%, 15) had also not heard of it before and only 5 (15%) had had a passing knowledge of it.

> *"… no, I haven't [heard of it] … maybe they mentioned it there [during the training] but I don't remember"*

(Respondent_ Provider_ 07)

At a debrief session held with the field data collectors, during a visit to one of the implementing health facilities in Accra, a healthcare provider said they tried calling the call center but did not get an answer, and so their interest in calling had diminished. She tried to call several times at the beginning, but realised that it was unnecessary to call if it was not answered.

26% of the providers who responded to the acceptability questionnaire indicated they used or referred to the Ghana National Guidelines on the Management of CVDs (Table 27). The low proportions demonstrate that providers were not adhering to the treatment guidelines and this has a likely effect on the quality of care outcomes for CVD/hypertension patients. On a 10-point Likert scale, 41 providers who indicated that they use the national CVD guidelines, gave an average rating of 8.2 and agree to the fact that the guidelines are a good educational tool, easy to obtain and use, and that they have realistic goals / targets for risk factor control in patients with hypertension and/or CVD (Table 27).

While the guidelines were not associated with a performance incentive to motivate the healthcare providers to use them, the majority of providers reported that there is no financial benefit to following the national guidelines for patient care in their health facility, and limited time does not impede the utilisation of the guidelines. On average, the providers gave a rating of 3.5, suggesting they are not in agreement with the notion that health facilities are not sufficiently supplied with resources or personnel to implement the guidelines (Table 27).

Table 27 Perception and Use of The National CVD Guidelines

	GHI Facilities N=41
Do You Use the Ghanaian National Guidelines for The Management of Cardiovascular Diseases?	**41 (26.1%)**
Use of Guidelines (Likert scale, 1-10; strongly disagree to strongly agree)	
The guidelines are good educational tools;	**8.9 (1.7)**
The guidelines are easy to access;	**8.4 (1.9)**
The guidelines are easy to use;	**8.8 (1.4)**
The guidelines are too long;	4.7 (3.3)
There are inconsistent messages across the treatment guidelines;	2.5 (2.3)
The guidelines have unrealistic targets for patients to achieve;	2.0 (1.6)
The guidelines are too rigid to apply to individual patients;	2.5 (2.1)
Lack of time is a major barrier to using guidelines;	3.5 (2.9)
There is a cost incurred in using the guidelines;	1.8 (1.3)
There is a financial incentive to use guidelines as a part of patient care in my health facility;	1.4 (0.7)
Our health facility is not appropriately equipped to implement the guidelines;	3.5 (2.9)
Our health facility does not have the required human resource to implement the guidelines.	3.5 (2.9)

** The standard deviation (SD) measures the dispersion of the data relative to the mean. The indicators are only measured for intervention facilities because the second part of the of KAP survey focusing on GHI facilities. The guidelines are not only an educational tool, but rather a national document that instructs health professionals on how to manage patients with NCDs.*

Qualitative interviews have confirmed that providers' use of guidelines and their compliance with them are often arbitrary and vary depending on the level of the facility, and one respondent affirmed:

> *"… But at the end of the day, it's about the individual doctor and what he or she does with encounters with patients. Do they implement what they are taught? So, if your doctors are managing hypertension, are they really implementing guidelines? …"*

(Respondent_ Provider_ 03_ Secondary Level)

One more respondent gave a candid answer regarding their utilisation of the guidelines:

> *"… No, I don't [use the guidelines] …"*

(Respondent_ Provider_ 02_ Primary Level- District Hospital Provider)

Regrettably, there are also no effective regulations such as clinical audit programmes to evaluate the adherence to guidelines across health facilities in the country. The clinical governance system is weak, and in some cases, they don't even exist:

> *"… We realized that we haven't really started looking at what's happening with patients encounters. So, if your doctors are managing hypertension, are they really implementing guidelines? If they are managing, are they implementing guidelines? Nobody really knows. So, the way to go about it is to do clinical audit. So, our clinical care coordinator was supposed to do the clinical audit. But unfortunately, he got bogged down with his Fellowship exams so... But clinical audit is one of the ways we think will ensure that the training people receive had really translated into practice…"*

(Respondent_ Head of Facility_01_ Tertiary)

One implementer said the national CVD guidelines were available to the health workers, but the trained staff who gained new skills and knowledge moved from one place to the other, which was a challenge. On a positive note moreover, one of the implementers described the efforts to develop a particular guideline - or a booklet - for the CHPS compound, because their primary responsibility is to prevent and educate patients about a healthy lifestyle, take BP readings, recognise when to refer, and they have no need for all the complicated medical treatments and pathways that are in the main guidelines:

> *"They need basic things and they need how to do blood pressure and to know where to refer the people for treatment and how to monitor them when they are back and when they are put on treatment and come back to see them."*

ADOPTION OF TRAINING

26.8% of the providers received training in hypertension, diagnosis and management from the GHI (Table 28). The low proportion shows that there are many more healthcare providers in the health care system who may not have the required knowledge and competencies in the diagnosis, management and treatment of CVD/hypertension patients. Among the 41 providers who had received training provided by the GHI, on a 10-point Likert scale, gave an average rating of 8.2 in improving their technical competency in screening, diagnosing, and managing patients with hypertension and/or CVDs, and screening for CVD risk factors (Table 28). However, the need for additional training from the GHI in order to improve their understanding was highly rated.

Table 28 Perception of The Training Provided by the GHI

Perception of The Training Provided by The Ghana Heart Initiative	
Have you received training on hypertension or cardiovascular disease screening, diagnosis, and management from the Ghana Heart Initiative?	**42 (26.8%)**
Usefulness of Training (Likert scale, 1-10; strongly disagree to strongly agree)	
The training provided by the Ghana Heart Initiative (GHI) improved my technical competency or knowledge of the screening for hypertension.	**8.3 (1.8)**
The training provided by the Ghana Heart Initiative (GHI) improved my technical competency or knowledge of the diagnosis of hypertension.	**8.3 (1.8)**
The training provided by the Ghana Heart Initiative (GHI) improved my technical competency or knowledge of the hypertension management.	**8.3 (1.7)**
The GHI training improved my skills and knowledge of screening for cardiovascular risk factors (smoking or tobacco use, alcohol use, unhealthy diet, physical inactivity, etc.).	**8.2 (1.9)**
The GHI training improved my skills and knowledge of diagnosis of cardiovascular diseases.	**8.2 (1.7)**
The GHI training improved my skills and knowledge of cardiovascular disease management.	**8.4 (1.6)**
The GHI Training manuals and resources provided improved my clinical practice.	7.8 (1.8)
I would need further training from the Ghana Heart Initiative to improve my understanding of the cardiovascular diseases.	8.4 (1.8)

* *The standard deviation (SD) measures the dispersion of the data relative to the mean. The indicators are just measured for intervention facilities because the second part of the of KAP survey focusing on GHI facilities.*

Through the qualitative interviews, respondents, especially healthcare providers, expressed great enthusiasm about the training they received and its positive influence on their health facilities and CVD

outcomes. Some respondents restructured their services, establishing well-equipped resuscitation bays that reportedly led to improved results in CVD and hypertension emergencies. Respondents also noted improved abilities to identify and manage conditions they might have previously missed, and according to one provider:

> *"… But through the training we are now able to recognise arrythmias the one that needs cardioversion... We have had quite a number of successes in cardioversion. In the past those cases we would either refer or we lose them [patients die]. And then with time, we also had an echocardiogram machine which we bought which is also making quite a significant difference especially telling our part... when we have cases of shock, the echo can come in to help... a case in point we had a patient who had very low BPs we were not sure what we were dealing with but when we used the echocardiogram we realize that we were dealing with a cardiogenic shock and we saved that patient. We don't know what that patient what the outcomes would have been without that intervention. So, when we say transformation, it is really a transformation…"*

(Respondent_ Head of Facility_03_ Tertiary Level)

The training enabled the successful recognition and management of arrhythmias, including cardioversion, resulting in cases that would previously have been referred or led to patient fatalities. Additionally, the introduction of an echocardiogram machine facilitated the diagnosis of conditions like cardiogenic shock, leading to life-saving interventions. A respondent from a tertiary-level facility emphasised this transformative effect.

Another GHI trainer-of-trainers, gave a score of 8, on a 10-point Likert scale, when asked to describe his/her facility's readiness for CVD emergencies. However, the respondent believes that, even if there is adequate knowledge and equipment, there is not sufficient medical professionals, and there are logistical difficulties, which indicate gaps in the current treatment and management for CVDs:

> *"The scoring of the eight (8) is that the knowledge base is there, and then some of the equipment is available, however, we are limited in human resource and a bit of logistics as well so that puts us at an eight (8). Luckily, they are able to identify their limit and refer. I would have given us a 10 if we could handle everything by ourselves, but we can't, but I give us an eight (8) because I know they know when to say that this is beyond us, we have to let the person go to save the person's lives, and refer to the appropriate quarters for further management."*

In some cases, the dissemination of training knowledge to staff was inadequate, affecting the project's sustainability and its ability to influence intervention facility practices. Training programmes were seen as needing continuous efforts to counteract staff forgetfulness, requiring ongoing and frequent cardiovascular guideline training.

Originally intended supervision and mentoring for implementation proved inconsistent. However, when conducted, these sessions were valuable in facilitating facility improvements. During these visits, deficiencies were identified, and improvement targets were set, such as initiating a wellness clinic, although challenges in implementation were noted.

"… Yes. We've had two or three visits. The last one we had, it was very helpful because the person who came pointed out areas that; we had targets; he made us know our deficiencies, and we set targets. One of the targets was. One of the things is recommended was for us to start a wellness clinic. Which I directed the Public Health unit to start. They started it somehow, but they are not implementing the way I expected it…"

(Respondent_ Provider_ 02_ Tertiary)

ADOPTION OF EQUIPMENT

One quarter (24.8%) of the providers who responded to the acceptability questionnaire indicated they used equipment supplied by the GHI (**Table 29**). Among the 39 providers who used this equipment, the average rating was 8.5 in the sense that the provided equipment was useful in the screening, diagnosis and management of patients with high BP and/or CVD. They also have confidence in the use of the equipment, and they don't consider the heavy workload/patient volume to be an obstacle to their use.

Table 29 Provider Perception and Issues with The Equipment Provided By GHI

Have you used the equipment provided by the Ghana Heart Initiative for hypertension or cardiovascular disease management?	**39 (24.8%)**
Usefulness of Equipment (Likert scale, 1-10; strongly disagree to strongly agree)	
I feel the equipment provided by the GHI was helpful for the screening and diagnosis of hypertension.	**8.4 (1.7)**
I feel the equipment provided by the GHI was helpful for the screening and diagnosis of cardiovascular diseases.	**8.6 (1.7)**
I understand all the operational details relevant to the equipment provided by the GHI.	7.4 (2.2)
I have the confidence to use the equipment (example, blood pressure monitor, ECG, etc.) provided by the GHI.	7.8 (2.2)
My workload prevents me to use the equipment provided by the GHI for screening and diagnosis of hypertension or cardiovascular diseases.	3.9 (3.1)

** A standard deviation (SD) tells you how spread out the data is. It is a measure of how far each observed value is from the mean. The indicators are just measured for intervention facilities because the second part of the of KAP survey focusing on GHI facilities.*

Interviewees from the intervention facilities acknowledged the receipt of a number of equipment from the GHI, and agreed that it had been hugely beneficial in improving CVD care outcomes in their respective facilities. Prior to this, there had been noticeable gaps in their service organisation especially with respect to emergencies and resuscitation.

"… we had equipment from the GIZ and the Ghana Heart Initiative. So, we had an ECG machine and defibrillator. We had a defibrillator but this one came as an addition. We could keep this new one there and deploy the other ones we had to the wards…"

(Respondent_ Policy/Admin 01)

A respondent recalled an encounter with a doctor outside Accra, who before receiving an ECG machine, had to send patients to other clinics for ECG scans but after receiving training and the machine, was thrilled to finally be able to apply their theoretical knowledge, highlighting the importance of having both training and equipment available in healthcare facilities:

"Once, we have a guideline a lot of things have to follow, like training. Once people are trained, if they don't have the equipment and when they have the knowledge they actually can't do this. I remember while we started this process, I visited a facility, I think it was a health center and we met one lady doctor, one young doctor on the outskirts of Accra. Once we mentioned what we were there to do which included the equipment she was so excited. She was trained to use the ECG machine, but where she was in the facility there was no machine. She has to keep referring her patients to go get ECGs done. She was so physically excited that we would now get an ECG in the facility and she can use the knowledge she has gained from the training…"

(Respondent_ Policy/Admin_)

Several of the health workers reported that insufficient equipment and manpower hindered the ability to carry out hypertension screening and other measurements. A concern was raised by informants about the very few BP devices in their health facilities, and the lack of refresher training. Numerous informants indicated a shortage of appropriate equipment to evaluate and monitor CVD cases effectively. A few providers noted that the equipment was defective, and some equipment was not working at all and did not last long, including BP apparatus, and ECG machines. Many facilities lack the money to buy a part that could be missing, and when it needs to be serviced the parts must be imported and it is expensive. It was demonstrated by some providers that they treat around 250 patients daily in the out-patient department, however, they only have access to one BP apparatus, one weighing scale, and one thermometer, thus they require additional equipment:

"So, I would say that we don't have enough equipment. As you can see, this whole OPD has about 250 patients a day. And we use only one BP apparatus. Only one BP apparatus. 1 weighing scale, 1 thermometer 1PC to key in their information. And if we should get about three, four, at least, the nature of the stress can reduce a little time."

(Respondent_ Nurse_12 years)

"Look at this… this light is not [working]. You go to…you will be looking for a thermometer you will be using one thermometer for hundreds of patients. BP apparatus breaks down in the course of emergency. You have to take it to the engineer to fix it. A whole lot…it's a lot."

(Respondent_ Nurse_3 years)

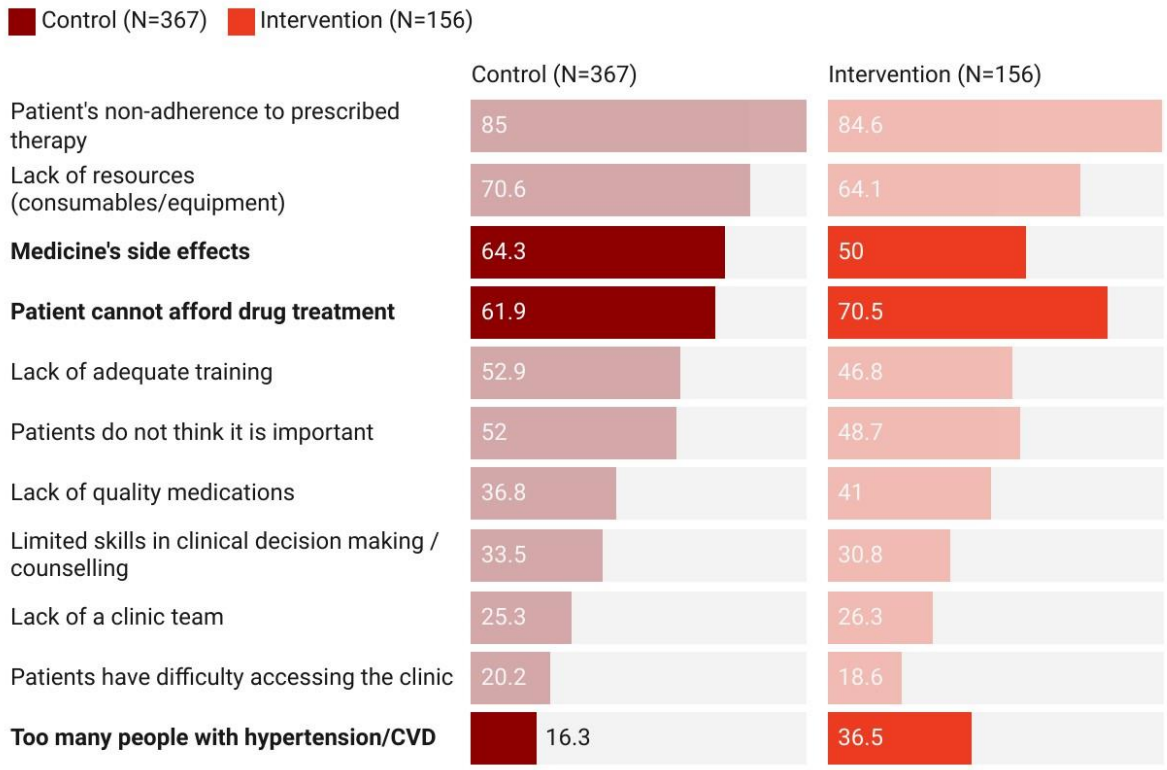
However, during the regular systematic debriefing sessions of the evaluation team at the beginning of the data collection, it had been reported that at least in one or more intervention facilities, they were *'not using the equipment provided [by the GHI] and it is still in the boxes, including a defibrillator*' [Critical Care Nurse, Intervention Facility]. One respondent said that not everyone received training in the use of the equipment so that, for instance, if a radiologist who is carrying out ECG scans is not available, it becomes hard to use the ECG machine. As previously stated, it appears that the participants in the training programme initiated by GHI did not, when they returned to their respective facilities, train or motivate their colleagues. Moreover, many healthcare providers who benefited from the training were transferred to other facilities, and the '*training has not trickled down*' [Debriefing Notes, Evaluation Team]. In the planning workshop for stakeholders organised by the GHI, stakeholders from the GHS also highlighted the need for more doctors to interpret the results of the ECG, which becomes a question of sustainability, since a higher level of clinical input is required and the interpretation of results is needed.

As the training progressed, the majority of communication with intervention facilities and all other communications came from the GHS rather than the GHI, which on the one hand contributes to sustainability and stakeholder involvement, which is very positive, but on the other hand, healthcare providers may not be able to make any connection with the fact that they attended the training, which was supported by the GHI. As a result, when visiting health facilities and asking healthcare providers if they participated in Basic Life Support and Advanced Cardiovascular Life Support training during 2020, many said yes. Nonetheless, during the qualitative interviews with healthcare providers, when questioned about their familiarity with the GHI, their response was ambivalent. They indicated that they were unaware that the training had received funding from GHI.

From the perspective of the GHI programme team, the primary objective is for healthcare workers to effectively apply the knowledge gained. They believe that even if these healthcare professionals were to relocate to different facilities, they would still apply this knowledge. Therefore, the lack of awareness about the GHI's involvement is not seen as a major issue.

CHALLENGES WITH PATIENT CARE

Figure 17 Practice-Related Barriers for Hypertension or CVD Care in Ghana



The most frequently reported practice-level barriers to hypertension or CVD care stated in the KAP survey were patients' nonadherence to prescribed therapy (84.9%), lack of resources (68.6%), unaffordable drug treatment for CVD (64.4%) and lack of adequate training for the health care workers (51.1%) (Figure 17). The providers' concerns about patient non-compliance with prescribed therapy are consistent with 40% of exit survey patients admitting to not taking their medication for hypertension, as prescribed or directed in both the intervention and control facilities. A significantly higher number of providers in intervention facilities stated negative effects of drugs, patients who cannot afford drugs, and a high number of people who have hypertension or CVD as barriers to their practice. As previously indicated, the number of hypertension and CVD cases seen by health workers at intervention facilities per OPD clinic was very high.

OUT-OF-POCKET EXPENDITURE (OOPE)

As stated in the Methods, we looked at OOPE because it is relevant to the contextualisation of findings and the sustainability of the GHI interventions within the health system of Ghana.

Furthermore, as previously mentioned, healthcare providers themselves have highlighted OOPE as a major challenge to the successful implementation of the GHI. This is particularly concerning because user charges for medications often hinder patients' ability to adhere to physicians' treatment recommendations. Although the GHI does not directly influence OOPE, it serves as a crucial source of information for shaping and advocating for health financing policies and ensuring the long-term sustainability of GHI-driven programme activities.

As suggested by the exit interviews, the average expenditure of patients in the intervention facilities was significantly higher than in the control facilities; they paid 125.27 Ghana cedis (9.7 Euros) out of pocket, compared to 47.72 Ghana cedis (3.7 Euros) (p=0.008). On further examination, a greater number of patients visiting the GHI facilities paid a consulting room fee compared to the patients visiting the control facilities (p<0.001). The OOP payment for different components of outpatient medical services among patients with CVDs by public and CHAG health facilities are reported in **Table 30**.

Table 30 Out-Of-Pocket Expenses for Patients Between Intervention and Control Facilities

	Total	Control	Intervention	p-value
	N=576	N=363	N=213	
Out-of-pocket expenses for this visit between intervention and control facilities.	73.3% (422)	70.0% (254)	78.8% (168)	**0.008**
	N=422	N=254	N=168	
Consulting Room Fee	8.1% (34)	4.3% (11)	13.7% (23)	<0.001
Nurse's Station	34.6% (146)	35.4% (90)	33.3% (56)	0.66
Labs / Diagnostic Tests	29.6% (125)	28.3% (72)	31.5% (53)	0.48
Pharmacy	62.3% (263)	59.1% (150)	67.3% (113)	0.089
Radiology	0.7% (3)	0.8% (2)	0.6% (1)	0.82
Other - Please Specify	9.0% (38)	10.6% (27)	6.5% (11)	0.15

Summary point:

- The study found significant differences in out-of-pocket expenses for visits, consulting room fees, and pharmacy between intervention and control facilities, while nurse's station, labs/diagnostic tests, and radiology expenses did not. The key issue is that patients face substantial costs, not only for medications across all health facilities.

The qualitative interviews brought to light various challenges that healthcare providers and facilities face when it comes to ensuring effective patient care. These challenges encompass a range of issues, including patient non-compliance with prescribed medications, a shift towards using herbal remedies, and difficulties in accessing critical diagnostic and therapeutic resources like laboratories and medications.

Surprisingly, even though patients held national health insurance cards, they frequently had to make payments for medical investigations and treatments. The distinction between insured and uninsured

patients was less noticeable in the immediate care provision, especially during emergencies. This was emphasised by a healthcare provider who noted that, from their perspective, there was not a significant difference in care quality between insured and uninsured patients during the initial hours of treatment.

Financial constraints often led patients to stop taking their prescribed medications, which, in turn, resulted in economic hardships. The affordability concerns markedly influenced treatment decisions, often causing patients to opt for generic or alternative medicines instead.

One quote from a nurse respondent underscored the trend of patients switching to herbal treatments due to perceived ineffectiveness of conventional medication. This led to worsened conditions and a higher rate of treatment non-adherence. To counter this, efforts were made to engage with public health units to ensure better medication adherence:

> *"But if they take their medication one month, and two months, and they realize the BP is not dropping as expected, then they switch to herbal treatments. And then they come back in the worst states. So, most of them, they default. So, we have a lot of defaulters. So that is why we liaise with the public health units. You see them this month, they come for the drugs instead of coming for a refill the following months, they won't come."*

(Respondent_ Provider_Nurse_12 years)

In conclusion, the qualitative interviews shed light on the multifaceted challenges faced by healthcare providers and facilities in delivering effective patient care. These challenges ranged from patient compliance issues to financial constraints and disparities in insurance coverage, all of which impact the overall quality of healthcare services provided.

ADOPTION: HIGHLIGHTS (SUMMARY)

- **The GHI's widespread and robust adoption becomes evident through its consistently high to moderate levels of compliance with implementation activities**, encompassing national CVD guidelines, equipment utilisation, and training, within a broad spectrum of healthcare facilities and among healthcare providers.
- **The health care providers in facilities who were approached and participated in GHI activities reported significantly higher confidence** in their ability to care for patients who have hypertension or CVD.
- **In the intervention facilities, there was a significantly higher level of adherence to a range of treatment guidelines**, including the National CVD guidelines, standard treatment guidelines, guidelines from the American Heart Association (AHA) and American College of Cardiology (ACC), as well as those from the European Society for Cardiology (ESC) and various others. While the intervention facilities demonstrated significantly higher adherence to various guidelines, there was notable dissatisfaction with the Akomacare app among some users, which calls for a closer examination of its usability and effectiveness.
- **The training provided by the GHI has been perceived positively by the healthcare providers**. The majority of those who received the training reported improvements in their technical competency and knowledge related to hypertension and CVD screening, diagnosis, and management. The training materials and resources were generally seen as beneficial for clinical practice, and there seems to be an interest in receiving more training from the GHI in the future.
- **The equipment provided by the GHI received an average rating of 8.5 out of 10 from providers who used it.** This indicates that the equipment was very useful in screening, diagnosing, and managing patients with hypertension and/or CVD.
- **A significantly higher number of providers in intervention facilities indicated that patients who could not afford their drugs, and the high number of people who have hypertension or CVD as barriers to their practice**. As previously indicated, the number of hypertension and CVD cases seen by health workers at intervention facilities per OPD clinic was significantly high.
- Many of the challenges raised by the GHI programme team, providers, and policymakers were related to **weaknesses in the broader health system** within which the programme operated. In the intervention region, participants described frustrations with staff shortages, and long wait times at facilities. In many of the intervention facilities, the training on hypertension and/or CVD was not disseminated to other co-workers / providers, and not all providers were familiar with and/or adhere to, for example, the national CVD guidelines.
- High levels of attrition in the health system, with trained health personnel moving on, may have contributed to the fact that we do not see much difference in the use of national CVD guidelines, equipment, and training. As a result, the 41 providers who participated in the KAP survey did not accurately represent the number of workers who were trained, as only one-fourth of them reported using the equipment and guidelines. This represents only a minor fraction of healthcare providers who have undergone training.
- There have been identified gaps in existing CVD care in the GAR. However, it takes time to implement guidelines, train employees, and use equipment. We observe that, for any given innovation, the rate of adoption begins slowly and then accelerates.

IMPLEMENTATION

Implementation by definition refers to the intervention (the GHI) agents' fidelity to the various elements of an intervention's key functions or components, including consistency of delivery as intended and the time and cost of the intervention.

Within the framework of our evaluation, implementation of the GHI was captured through facilitators and barriers of each component, and contextual issues using mainly qualitative methods.

The implementation of the GHI revealed key facilitators identified from key informant interviews, including strong leadership, stakeholder engagement, Ghana Health Services' support, extensive health provider training, and the launch of national CVD guidelines (summarised in the **Appendix: Table 8**).

To comprehensively interpret the results, it is essential to consider the challenges encountered during the pilot phase of the intervention. Interview respondents shared narrative evidence shedding light on hurdles faced during implementation. These challenges, though demanding, also presented opportunities for intervention improvement.

Across the 41 health facilities in the GAR, numerous healthcare system challenges emerged. These encompassed leadership and governance issues, human resource shortages, equipment availability, delays in the release of funds to the implementing districts/facilities, challenges in the organization service delivery, and patient-related factors. Additional challenges included procurement delays, variations in the adherence to the CVD guidelines; limited awareness of the Akomacare app, CVD Support and Call Center, and potential opportunities for healthcare personnel to get their capacities built through refresher and mentorship sessions/programmes (summarised in the **Appendix: Table 9**). These challenges, although formidable, present valuable insights and opportunities for further enhancement of the intervention's effectiveness in the future.

The successful implementation of the GHI hinged on several key enablers within the healthcare system. One of the primary enablers was a robust project governance structure that involved high-ranking officials, including the Minister of Health and the Director General of the Ghana Health Service. Their active involvement gave the project national importance and demonstrated a commitment to its success. Additionally, aligning the GHI with the existing healthcare system and working within established structures is likely to ensure sustainability. The project's decision not to create parallel systems but instead facilitate official letters and support from within the healthcare service ensured a seamless integration of GHI activities. Moreover, fostering a sense of local ownership has been instrumental in driving the initiative forward, with the Minister of Health emphasising that the project belonged to the healthcare service, thereby instilling a sense of responsibility and commitment.

Despite its objectives, the GHI faced substantial challenges within the healthcare system during project implementation. Notably, a high staff turnover disrupted project continuity, while the intricacies of the Ghanaian healthcare system resulted in implementation delays as stakeholders grappled with its complexities. Coordinating stakeholder schedules proved difficult, impacting the project's timeliness. Lengthy Memorandum of Understanding (MoU) signing processes involving legal teams were a major source of delay. Varying levels of leadership commitment and interest across healthcare facilities

influenced the quality and consistency of data collection and implementation efforts. Facilities led by dedicated leaders exhibited more accurate and timely data collection, while others struggled due to less engaged leadership. Moreover, some participants faced approval challenges from their management, hampering their institutional readiness to contribute effectively to the project. Inadequate training resulted in certain facilities attempting to use provided equipment, leading to end-user damage. Furthermore, discrepancies emerged between the planned project resources and the actual capabilities of healthcare facilities on the ground. The presence of bureaucratic hurdles and red tape within the Ghanaian system further compounded challenges, causing frustration among project stakeholders.

In conclusion, while the GHI benefited from strong governance, system alignment, and local ownership, it faced health system and programme-level challenges. Addressing these challenges, including staff turnover, system complexity, scheduling issues, leadership disparities, and bureaucratic obstacles, is vital to enhance the initiative's effectiveness in CVD outcomes.

OVERALL EXPERIENCES OF THE GHI

HEALTH PROFESSIONALS' EXPERIENCES

Within the survey that assessed the acceptability of the GHI, healthcare providers were asked to rate the resources available for implementing the GHI to manage CVDs. When asked about the support they received from senior leadership, the providers rated it an average of 7.2 out of 10 on a Likert scale (Table 31). The providers agreed that the senior leadership of the GHS supports the provision of evidence-based care for hypertension and CVD, in accordance with the national CVD guideline, the equipment provided, and the 24x7 CVD support and call center. In line with the health facility survey, the providers also gave an average rating of 6.3, showing that they moderately agree with having sufficient support to provide evidence-based care for hypertension and CVD in accordance with the national CVD guidelines.

The providers gave ratings of 4.5, 5.6, and 5.9 out of a possible 10 for their levels of satisfaction with the budget/financial resources, facility services, and regular monitoring visits from the GHI programme team, respectively (Table 31). These ratings suggest that though they were satisfied with the level of support from their senior leadership, they were less satisfied with the support they received in the areas of providing evidence-based care for hypertension and CVD according to the guidelines, the equipment provided, and the support from the CVD support and call center.

Table 31 Perception of The Resources Available to Implement GHI

Resource Availability to Implement the Ghana Heart Initiative Guidelines for CVD management	
Resources Available to Implement the GHI (Likert scale, 1-10; strongly disagree to strongly agree)	
We have the necessary support in terms of budget or financial resources at this health facility to provide evidence-based care for hypertension and CVD as per the National CVD guidelines, equipment provided, and 24x7 CVD support and call center support.	4.5 (2.9)
We have the necessary support in terms of facilities (laboratory services, pharmacy, other infrastructure) to provide evidence-based care for hypertension and CVD as per the National CVD guidelines, equipment provided, and 24x7 CVD support and call center support.	5.6 (2.8)
We have the necessary support in terms of staffing to provide evidence-based care for hypertension and CVD as per the National CVD guidelines, equipment provided, and 24x7 CVD support and call center support.	**6.3 (2.7)**
The senior leadership of the Ghana Health Services support to provide evidence-based care for hypertension and CVD as per the National CVD guidelines, equipment provided, and 24x7 CVD support and call center support.	**7.2 (2.8)**
The senior leadership of the Ghana Heart Initiative programme officials provide regular feedback through monitoring visits to provide evidence-based care for hypertension and CVD as per the National CVD guidelines, equipment provided, and 24x7 CVD support and call center support.	5.9 (3.1)

** The standard deviation (SD) measures the dispersion of the data relative to the mean. The indicators are just measured for intervention facilities because the second part of the of KAP survey focusing on GHI facilities.*

With no exception, healthcare providers and policymakers reported that the programme was better than previous hypertension measures in place. In the past, lower-level staff lacked the capability to diagnose hypertension and diabetes. There were also pockets of programmes or projects for hypertension, such as the Danfa Hypertension Programme and the Mamprobi Hypertension Programme, but these were isolated activities. However, there was nothing of national significance. According to one of the respondents, in his more than two decades of service at the Korle Bu Teaching Hospital, *'I don't remember anything before Ghana Heart Initiative that was focused on driving hypertension and/or heart failure, [and] building capacity for the care of these patients*.' As a result, diagnosing hypertension at the community level was only possible if a physician assistant was present. From the key informant interviews with the respondents, it was clear that they all agreed on the considerable effect that the project has made. They noted that the project was timely given the high rate of hypertension-related deaths among Ghanaians and the fact that the GHI aims to care for the average Ghanaian, the underprivileged person who is neglected due to lack of resources, and other factors rather than any genuine cause. One respondent (Respondent_ Policy/Administration_05), expressed enthusiasm for the programme: '*you know hypertension is a problem... a lot of people are dying from hypertension and all the related complications. So, it has come at the right time to help us and I am very much excited about it.*"

Another respondent specifically stated that:

> *"…the data we have collected from the health facilities. Initially, hypertension control within the health facilities was just about 6%; as at the last counts, it is gone to about 84%. For me that is really what we want to achieve. So, it is not just training, it is not just equipment, is not just knowledge you are giving to people, but it should translate into outcomes…"*

(Respondent_ Policy/Administration_01)

One of the health facility managers responsible for training trainers was delighted about the positive influence that the GHI has had on improving CVD care outcomes. Thanks to the training facilitated by the GHI, doctors are now able to diagnose patients with cardiac arrest and effectively perform resuscitation. Some providers who believed the intervention to be the cause of transformation in the past might have diagnosed a patient as clinically dead if they had not been breathing or had a pulse when they arrived at the facility. Therefore, even knowledge of cardiac arrest was lacking. Afterward, they went to the training, where they realised how to identify cardiac arrest. One facility head (Respondent_ Head of Facility_01) asserted that everything changed as a result of the training: '*We now diagnose cardiac arrest before starting resuscitation, as opposed to the past when we would simply certify deaths. And we are conscious of the fact that, at the time, our resuscitation involved making the best possible effort despite not even fully understanding the protocol.*'

As voiced by certain respondents, assigning the progress achieved in the domain of non-communicable diseases (NCDs), with a specific focus on CVDs, solely to the GHI can occasionally be misleading and challenging. This complexity arises from the involvement of numerous stakeholders and the diverse range of ongoing initiatives, alongside the impactful advocacy efforts being undertaken by certain entities in the realm of hypertension and/or CVDs. Consequently, it is advisable to approach any attribution exclusively to the GHI with caution, unless all possible confounding factors have been assessed and addressed.

POLICYMAKERS' PERSPECTIVES

Without exception, all policymakers familiar with the GHI were supportive of the programme, and that it increased the capacity of healthcare providers in managing CVD. Policymakers reported they believed the best way to control hypertension was more prevention oriented i.e., health education, staff training and data curation, which were activities that were included in the GHI. Further, they felt that GHI could also fill the gaps in screening, treatment and health education through the use of the national CVD guidelines, the Akomacare app and the CVD support and call center. Respondents reported that the GHI aimed to introduce integrated management of hypertension and CVD in health facilities via the adoption of the national CVD guidelines, providing education to health providers, equipment support, facilitating referrals, and data support to the facilities. All the policymakers interviewed indicated that the GHI was a beneficial programme and a positive addition to hypertension and CVD management in the GAR in Ghana. One of the respondents characterised the GHI as:

> *"… a capacity building project on cardiovascular diseases… with an objective to improve the prevention, diagnosis and management of cardiovascular diseases in public health facilities"*

(Respondent_ Policy/Administration_02)

At a broader macro-level, the GHI has raised awareness among stakeholders, policymakers, and managers regarding the issue of non-communicable diseases (NCDs), specifically highlighting hypertension as a significant risk factor of CVDs and the overall burden of NCDs. The programme's success is evident in its implementation at various levels, such as the ministry, tertiary, secondary, and primary facility levels. The intervention also helped to implement a policy and establish national guidelines for CVDs. Additionally, policymakers also mentioned the development of various tools, including the Akomacare app that provides valuable technical resources to frontline workers and managers. One of the respondents noted that, '*when it comes to NCDs, data is important. Gathering information has always been difficult for us in our projects. We have started collecting some data to gain a better understanding of the NCD issue*'. Thus, apart from the data that has been collected, the GHI has also laid the foundation to enhance the monitoring and evaluation framework for NCDs. During the

pilot phase, they supported the GHS to identify indicators that could be collected in DHIMS2. While certain areas, such as organisational relationships and communication, faced challenges, the GHI programme facilitated better communication between the MoH and the GHS. Collaboration between the medical schools and the government was also improved, contributing to a broader understanding of NCDs and CVDs.

The availability and adherence to CVD treatment and management guidelines play a crucial role in the GHI's success. In the context of preventing and managing CVD, both national and international guidelines are crucial. However, it is important to note that these guidelines can also impact risk behaviours associated with CVD persistence. One notable achievement of the GHI was its pivotal role in creating the National CVD Guidelines. These guidelines were officially launched by the Ministry of Health (MoH). This milestone was particularly noteworthy because, prior to this initiative, Ghana lacked a standardised national guide for CVD treatment. While standard treatment guidelines were already in place, the GIZ played a vital role in establishing a national standard specifically tailored to CVD treatment and management (includes diagnosis and clinical risk assessment) and aligned with local clinical standards. Importantly, this development effort was led by Ghanaian partners, demonstrating a collaborative approach in addressing CVD in the country.

Many informants, including policymakers and healthcare providers, reported that the guidelines were developed by experts from all levels of health care and stakeholders, and that they capture all recommended approaches and necessary information for clinicians and other healthcare workers on CVDs. They further stated that the guidelines serve as a practical guide for assessing and managing the most common CVDs in Ghana and that they can be used at all levels of care, including health facilities without a doctor, general practitioners, and physician specialists. As a result, the project implementers merely assisted in the facilitation of a process among Ghana's leading health institutions to establish their own treatment standards, which did not previously exist.

> *"… a treatment standard. Before that, there was no standard existing, so every health facility was basically, I mean, following their own procedures and regulations, process, etcetera. So, I mean, that is the number one thing that the Ghana Heart Initiative achieved to do is to set a national standard that is binding on all levels of care, and that is followed from the CHPS compounds and health centers up to the teaching hospitals…"*

(Respondent_ Policy/Administration_ 03)

According to the GHI team, each chapter was written by about four or five experts as an initial draft and then distributed to others. Apart from key people from various levels of care, there were also people from all over, with representation from all 16 regions. The GHI team brought people from Tamale, the north, the far east, the west, the far east, and everywhere else. So, first, different levels of care, such as primary, secondary, and tertiary care, were involved, and then people from all over the country were involved in developing the guideline. So, to some extent, the GHI team included in the development of the guidelines anyone they thought to be relevant. The GHI team explained that technical people developed and then drafted the guideline, and that at the end, non-medical people, patient groups, Queen Mothers, and official opinion leaders were all brought in to have a look. Thus, the guideline received a high level of stakeholder involvement and engagement throughout the process. A policymaker explained that the guidelines were developed in collaboration with numerous stakeholders:

> *"… for me the key is the guideline that we were able to develop and was done with input from people from all levels of care across the country, so it is a national document that is the key achievement for the Ghana Hearth Initiative…"*

(Respondent_ Policy/Administration_ 01)

Generally, stakeholders are very enthusiastic about the GHI project and its impact on the health system in Ghana. A policymaker expressed their support for the programme by stating, "*I must say that all the objectives of the Ghana Heart Initiative contribute to the work already being done in addressing cardiovascular diseases and their management*." The GHI programme team believed that the MoH is highly enthusiastic about the structure and progress made in addressing CVDs. Each time they had the opportunity to meet with the MoH, specifically the NCD advisor, he consistently discussed the possibility of applying the same process used by the GHI programme team for CVD to other non-NCDs such as respiratory diseases, diabetes, and cancers. As one GHI implementor stated:

> *"This replication can happen during the creation of national guidelines, training documents, and the training process itself. We also investigate opportunities to establish training as a regular practice, ensure the provision of necessary equipment, and support any necessary improvements to data."*

(Respondent_ Policy/Administration_ 02)

The Akomacare app, which is the digitalised version of the national CVD guidelines, is considered a strength of the programme. It allows all levels of healthcare providers to access the guidelines and manage CVD management via their smartphones. This was meant to make the national CVD guidelines easily accessible to all healthcare providers, including clinicians, physician assistants, and nurses in the country. One health administrator noted, "*This is a significant development. Because in the context of quality of care, when treatment guidelines are not standardised, doctors and nurses often become the de facto treatment guidelines, each following their own approach. This lack of consistency can result in harm, making it difficult to assign blame to either the healthcare system for not having a policy or the individual healthcare worker*."

PROJECT IMPLEMENTATION SHORTCOMINGS

Key stakeholders of the GHS, including national, regional, and district level policymakers, and health professionals, expressed their views on the overall challenges faced by the health system and specifically on the management of CVDs within the Ghana health delivery system. The GHI team observed discrepancies between what is 'on the ground' and what you are told. They realised that there was a notable gap while implementing the GHI. There were more challenges than anticipated in obtaining data from health facilities on the field than expected.

In particular, insights from national-level policymakers provided clarity on broader challenges across the entire system, not limited to the GHI intervention district. The main challenges lay in managing stakeholders at a macro level, especially at the national level. It was important to ensure that stakeholders' interests aligned with the goals of the GHI project. Another key challenge highlighted was the discrepancy between the prioritisation of CVDs and the current level of funding for interventions targeting CVDs. Policymakers consider CVDs as an emerging public health problem. Longstanding health challenges such as infectious diseases, maternal, neonatal and new-born deaths, malaria, and sanitation continue to be health sector priorities. A substantial portion of health system

funding is allocated to vertical programmes focused on maternal and child health, as well as infectious diseases. Initially, the GHI encountered challenges due to the lower prioritisation of CVDs within the healthcare system. The shift towards a focus on CVDs was prompted by the growing burden of morbidity and mortality associated with hypertension. A district-level official (Respondent Policy/Admin_) from GHS explained the situation in the following way: "*The difficulties we had in the beginning, the health system is mainly driven by communicable diseases, malaria, HIV, TB, maternal and child health, noncommunicable diseases, NCD not really …. So, initially there was just kind of apathy more or less. But we started with the Minister of Health, Director General and slowly we have been able to get break through*." Respondents revealed that some facets of the project had not been implemented as envisioned. Among these are the mentorship and the Akomacare app:

> *"… I find out why they don't use the app, which will now also be improved with gamification to make it nicer. And if we find out what, if they have problems in handling it, we can change it accordingly. Then they have this, this will also stay, because we have a system of updating it…"*

(Respondent_ Policy/Administration_04)

Some respondents expressed disappointment with the mentorship component, citing challenges in its effectiveness. The mentorship process faced hiccups, and participants struggled to apply what they learned. There was also a perception that mentors did not focus on relevant aspects of managing CVDs.

Additionally, entrusting districts with cascading training and mentorship was seen as a weakness due to financial constraints. The districts lacked the necessary funding, as their budgets were already allocated to other healthcare needs, making effective cascading training difficult to achieve.

LEADERSHIP AND GOVERNANCE

Exploring the views of the implementers and policymakers highlighted that the GHI endeavoured to work within the existing health system structures, avoiding the introduction of any additional frameworks, in order to make sure that the project was implemented successfully and its aims were achieved. As a result, it was suggested that it be a GHS-led initiative, led by the MoH. The respondents emphasised that they refrained from mentioning the initiative's sponsorship by Bayer AG. They had deliberately selected a more neutral title or name. As a result, it stood apart from being called the Bayer Heart Initiative or GIZ. Instead, it was recognised as the Ghana Heart Initiative, a name that had been embraced by the MoH in their concerted effort to reduce the morbidity and mortality associated with CVD.

So, the GHI team ensured that the project was implemented through the health system, and they avoided creating a parallel system. Therefore, as previously mentioned, the training letters and facility inclusion letters were not sent by the GHI. The letters were written by the MoH, the Director General of GHS, and the Regional Director. They GHI were simply facilitating the process. An implementer from the GHS / MoH (Policy/Administrator_01) explained the reason for this, saying, '*If you want to change the health system, you have to work from within the health system*'. Policymakers interviewed familiar with GHI reported that they had been involved in the planning and design of the programme. Since a complete range of actors from senior policymakers to international organisations were included in discussions about the programme from the beginning, this added an additional level of ownership to the programme, which could help it succeed where other programmes had not. There was a feeling that GHI had listened to their concerns and priorities and the flexibility and adaptability

of the programme was seen as one of its greatest strengths. Despite the GHI having cultivated a relationship and trust with GHS and MoH, senior policymakers were aware this relationship sometimes faltered and there have been miscommunications. Whilst the GHI had involved the GHS and MoH in all decisions, meeting regularly and coordinating activities, due to staff turnover many of the people who were the contact points and responsible for GHI in the GHS had left, and their successors were not always appropriately informed of the programme. This caused frustration as they were being considered an active part of a programme that they had not heard of.

A governance committee, formed in 2019, included members from the MoH, GHS, University of Ghana Medical School (UGMS), and Korle Bu Teaching Hospital (KBTH). This committee provided guidance and support for project implementation, facilitating cooperation with the government and addressing challenges.

However, the project faced obstacles during the pilot phase, particularly in terms of leadership and governance. Irregular meetings within the governance committee hampered effective communication and decision-making. Ghana's complex healthcare system further complicated the project's progress. Respondents highlighted the vital role of leadership commitment in achieving project goals. Convincing the MoH to join and sign an MoU was a formidable initial challenge, requiring extensive effort and persuasion.

IMPLEMENTATION: HIGHLIGHTS (SUMMARY)

- The enablers driving the successful implementation of the GHI project can be summarised as follows: **High-Level Project Governance:** The initiative's effectiveness is boosted by involving key stakeholders, including the Health Minister and the GHS. This national recognition elevates the project's importance and secures government support; **Integration Within Existing Systems:** Working within the framework of the national healthcare system enhances sustainability. Aligning the project with the existing infrastructure ensures long-term viability and relevance; **Non-Parallel Implementation:** The project emphasises integration rather than creating a separate system. Official letters from prominent health authorities lend credibility, emphasising the endorsement and facilitation of the initiative; **Ownership and Institutional Adoption:** The project's success is bolstered by institutional ownership, with healthcare service providers viewing the intervention as their own programme. Government endorsements and statements of responsibility ensure a sense of ownership and commitment. These enablers collectively contribute to the initiative's effectiveness by establishing a robust governance structure, ensuring alignment with existing healthcare systems, managing challenges associated with integration, promoting ownership among stakeholders, and emphasising non-duplicative efforts.
- **The GHI's implementation generated substantial outputs.** Stakeholders at different levels demonstrated commitment and willingness to implement the programmes strategies. The programme successfully integrated hypertension control into routine health services, resulting in increased BP measurement and improved compliance with treatment. Additionally, the monitoring system was expanded to include NCD data, contributing to better planning and decision-making. While some challenges persisted, such as limited funding and a need for integrating into pre-service training curriculum, the programmes achievements were noteworthy.
- Regarding integration into health facilities, interviewees explained that training was being scaled up across regions and facilities. National CVD guidelines have been launched and are intended to guide clinical practice. They discussed integration efforts related to curriculum changes for medical professionals by the Medical & Dental, and the Nurses & Midwives Council to ensure better preparedness of future healthcare workers in managing NCDs. The development of an e-learning module for CVDs and its integration into in-service training was also mentioned.
- Some of the respondents emphasised the ongoing challenges of working in an unfamiliar context, while also highlighting positive outcomes, such as improved communication between key stakeholders and steps taken towards integrating NCD management into medical education and healthcare systems.
- **Still, GHI has faced challenges at various levels, including bureaucracy, leadership commitment, human resources, stakeholder engagement, and alignment between plans and realities on the ground**. Overcoming these health system challenges has required addressing the bureaucratic processes, fostering strong leadership buy-in, ensuring stable staffing, optimising stakeholder coordination, improving equipment management, and managing expectations through effective communication.

MAINTENANCE

Maintenance at the setting level, is defined as the extent to which a programme or policy becomes institutionalised or part of routine organisational practices and policies. At the individual level, maintenance is defined as the long-term effects of a programme on outcomes after a programme is completed.

A common question that arose when reflecting on GHI and its effectiveness was the future of the programme – will it continue? where should it expand? how should the model evolve to incorporate other conditions? who will pay for it? what lessons will be adopted by regional health directorates?

Within the framework of our evaluation, the extent to which the GHI becomes part of routine practice and policy is explored. Evaluation of maintenance includes the following: Analysing the perceptions of health providers and policymakers who are introduced to the innovative approach and adapting the strategies.

MAINTAIN – FACILITIY

As stipulated in **Table 32**, the health facility managers indicated that they need additional support in provider training, essential equipment, laboratory and diagnostics tests for the screening, treatment and management of hypertension and CVDs in the intervention and control regions. Many healthcare providers reported that they are willing to seek additional training that will allow them to better engage in preventive screenings, e.g., annual electrocardiograms, regular BP and cholesterol checks, blood glucose monitoring for CVD in adults. A substantial number of healthcare facilities in the GAR demonstrated that they need an average of 22 to 23 additional healthcare workers, like doctors, nurses, and other healthcare professionals to more successfully manage patients with hypertension and/or CVDs. There was little variation across levels of care, and all intervention facilities expressed a need for additional training in hypertension and CVD management at the primary, secondary, and tertiary levels (**Appendix: Table 11**). Of the 25 primary care facilities, 21 (84.0%) and 22 (88.0%) expressed a need for additional health workers for hypertension and CVD management, respectively. They also all indicated a need for additional equipment and diagnostics/laboratory services.

Table 32 Additional Resource Requirement

ADDITIONAL RESOURCE REQUIREMENT (Sustainability) N (%)	Overall (n=92)	Control (n=53)	Intervention (N=39)
Additional health workers required for hypertension management	74 (80.4%)	46 (86.8%)	28 (71.8%)
Additional health workers required for CVD management	74 (80.4%)	45 (84.9%)	29 (74.4%)
Additional training required for hypertension management			37 (94.9%)
Additional training required for CVD management			37 (94.9%)
Additional equipment required for hypertension management	90 (97.8%)	51 (96.2%)	39 (100.0%)
Additional equipment required for CVD management	89 (96.7%)	50 (94.3%)	39 (100.0%)
Additional lab/diagnostics required for hypertension management	76 (82.6%)	46 (86.8%)	30 (76.9%)
Additional lab/diagnostics required for CVD management	75 (81.5%)	44 (83.0%)	31 (79.5%)
Additional no. of health workers required for hypertension management			
Doctors	3.3 (4.0) (n=73)	3.4 (4.6) (n=45)	3.0 (2.7) (n=28)
Nurses	9.5 (10.1) (n=71)	8.2 (6.3) (n=45)	12.0 (14.3) (n=26)
Other health workers	5.6 (6.0) (n=72)	4.4 (4.4) (n=45)	7.5 (7.7) (n=27)
Additional no. of health workers required for CVD management			
Doctors	3.3 (3.9) (n=73)	3.4 (4.6) (n=44)	3.2 (2.6) (n=29)
Nurses	9.5 (10.2) (n=71)	8.3 (6.6) (n=44)	11.5 (14.2) (n=27)
Other health workers	6.1 (5.9) (n=72)	5.0 (4.3) (n=44)	7.9 (7.5) (n=28)

MAINTAIN – PROVIDER AND PATIENTS

We surveyed providers regarding their acceptability and asked them to evaluate how the GHI affected their clinical practice, resulting in an overall rating for sustainability. Healthcare providers who had received training, used the equipment, and followed national CVD guidelines, and/or who had received mentorship or supportive supervision from GHI, gave a higher than average rating of 7.7 on a scale of 1-10 for the sustainability of the GHI. On average, providers gave a rating of 7.0 for the considerable advancement of their hypertension and/or CVD behavioural and clinical practice, and regarding screening, diagnosis and management of hypertension and/or CVD by means of GHI activities.

In general, of the health professionals who completed the acceptability survey, they reported that GHI's training helped them to perform in their new roles in managing patients with hypertension and CVD. The hands-on component of the training was singled out as particularly useful, and others stated that they would have liked more of it. Healthcare workers reported that their knowledge of risk factors, prevention, and treatment of hypertension and CVD had improved after the training. Overall, their confidence to advise and talk to their patients increased. The training of frontline healthcare workers, such as doctors, physician assistants, and nurses at teaching, regional, and district hospitals,

has given healthcare providers at various levels the necessary skills to effectively handle cases of CVDs. One respondent even mentioned that they no longer hesitate to handle complex CVD cases:

> *"… it is also good that we that the health workers now also don't shy away from more complicated diseases like stroke, heart attack or heart failure, or heart failure are not so much, but specifically stroke, that they don't just refer them. But it is the easiest way when you are at the district level, even regional level, but that they take that they provide at least emergency care and then also admit them and continue treating them. And this has been very low at the beginning, and this has increased, now as well, and we don't know. Some patients still die. We don't know how it was in the beginning because they just pushed them to Korle Bu Teaching Hospital (in Accra) or wherever. So, I think this is on this level very good…"*

(Respondent_ Policy/Administration_ 04)

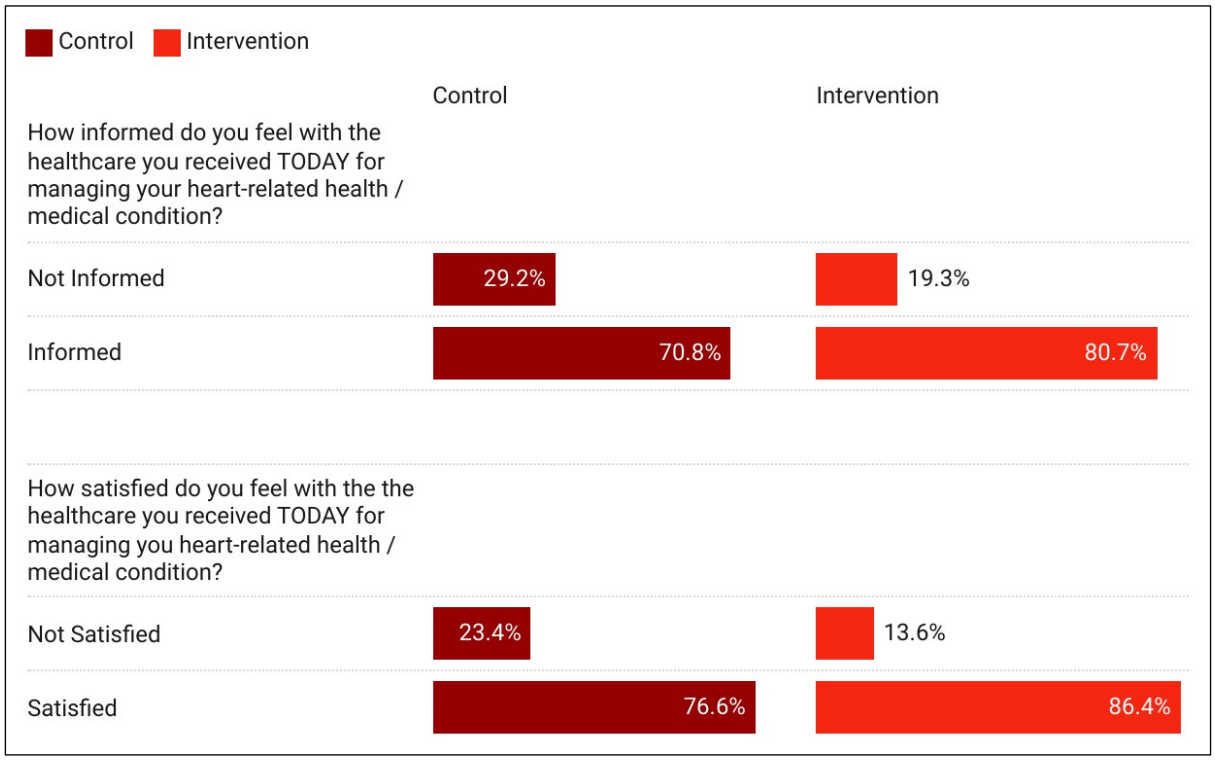
Table 33 Overall Provider Satisfaction and Sustainability of the Ghana Heart Initiative

Overall Provider Satisfaction and Sustainability of the Ghana Heart Initiative (GHI)	
Provider Satisfaction (Likert scale, 1-10; strongly disagree to strongly agree)	
Since the GHI was implemented, my overall hypertension care behaviour (screening, diagnosis, and treatment) has significantly improved.	7.0 (2.8)
Since the GHI was implemented, my overall cardiovascular disease care behaviour (screening, diagnosis, and treatment) has significantly improved.	6.8 (2.8)
In terms of screening, diagnosis and management of hypertension, I found the GHI activities i.e., training, guidelines, and equipment support helpful.	7.0 (2.9)
In terms of screening, diagnosis and management of cardiovascular diseases, I found the GHI activities i.e., training, guidelines, and equipment support helpful.	6.8 (3.0)
In your view, a health system strengthening quality improvement intervention such as Ghana Heart Initiative is sustainable (meaning can be continued in the long-term)	**7.7 (2.4)**

* *The standard deviation (SD) measures the dispersion of the data relative to the mean. The indicators are just measured for intervention facilities because the second part of the of KAP survey focusing on GHI facilities.*

Patients, who visited health facilities in the intervention region, 80.7% reported that they felt informed about the healthcare that they received for managing their heart-related health condition, compared to 70.8% in the control areas (p=0.009) (**Figure 18**). Patients in intervention facilities also reported higher satisfaction with the healthcare they received than patients in the control facilities (p=0.005).

Figure 18 Extent to Which Patients Feel Informed and Satisfied with The Healthcare They Received



** *There was statistically relevant difference in the patient's preference to visit the health facility between the two groups (p<0.001).*

MAINTAIN – QUALITATIVE INTERVIEWS

The Ghana Heart Initiative, as stated by its implementers, is designed to strengthen and sustain hypertension and CVD management in Ghana. The rollout has already been commenced:

> *'The further scaling up of the initiative, this is already, we call it rollout. The intention is now to move Ghana Heart Initiative to Ghana Health Initiative.'*

[Policymaker - Implementer, Female]

The implementers noted an intriguing feature of this project was that it was not utilising the traditional system-strengthening approach, that is usually funded by public funds. A private partner is making a considerable investment into this project in this case without receiving any direct benefit from this investment i.e., '*not contributing to marketing of pharmaceutical drugs*' [Implementer]. In their opinion, GHI is an exceptional programme because it builds upon existing national structures, and they expanded upon the CVD policy frameworks that have been existent thus far. They are of the view that they have laid the foundation via the development of the national guidelines to improve CVD treatment outcomes. As per the words of an implementer, the guidelines were not the product of GIZ or any external organization, they were developed by the Ghanaian partners and are proving to be beneficial to millions of people, even having life-saving effects:

"We simply provided the platform for the leading health institutions in Ghana to create their own guidelines, something that had never been done before. And I think that is a great achievement of the project that will and is already benefiting millions of Ghanaians and eventually saving millions of lives and from there we make sure that the learnings and the knowledge that exists in those national guidelines is also transferred to the people through a training facilitator's guide and corresponding trainings that are also institutionalized at the moment. This way, we are putting the foundations in place for a long-term, stable and sustainable CVD management in Ghana, and I'm immensely proud to be part of this effort."

Respondents highlighted that another point of great significance that has contributed to the success of the GHI is that, though initiated by GIZ with funding from Bayer AG, the project is distinctively Ghanaian, which makes it unique. Through conversing with local stakeholders from the MoH, Ghana Health Service, etc., they think of the GHI '*as their project*' [Implementer].

"So, we actually made and succeeded in having full local ownership for the implementation of this project. And I think that is also a very unique and important point. It's not something, it's, it's something you strive for in international corporation, but it's hardly achieved and I think we manage to do that. So, it's quite unique."

However, respondents, were concerned about the extent to which the programme activities could be sustained. This concern was justified, since most large-scale projects, such as these, often disappear at the end of the project. Some respondents were sceptical about sustainability of the gains, but others were optimistic, and they even said that the gains have already been achieved. As an illustration, one respondent stated:

"… it has been institutionalized, because to a larger extent now in the Ghana Health Service, national, all actors are involved; in the regional level too, we have our regional managers involved; at facility level the relevant teams that have been trained are also involved. We have guidelines, policies that have been adopted by the Ghana Health Service after the Ministry of Health launched it. So, I think largely it's been institutionalized…"

(Respondent_ Policy/Administration_07)

Respondents mentioned several strategies aimed at ensuring the long-term sustainability of the project, with a particular focus on the call center, which was managed by the Korle Bu Teaching Hospital. This call center featured two dedicated nurses working round the clock, without any extra compensation, as it was considered part of their regular duties. Importantly, the implementers had foreseen the need for sustainability beyond project funding and had programmed the call center to remain operational even in the absence of sufficient funds.

Moreover, respondents emphasised the need for the Korle Bu Teaching Hospital to fully embrace and take over the call center. This transition was well underway, with Korle Bu staff already working in the call center, and nurses assigned to shifts as part of their regular duties, without any additional remuneration. These measures were aimed at seamlessly integrating the call center into the healthcare system, ensuring its long-term sustainability.

Additionally, respondents stressed the importance of incorporating CVD training into the continuing professional development courses for healthcare professionals. To achieve this, one respondent urged

professional regulatory councils to include CVD training in both pre-service and in-service training curricula for doctors and nurses in Ghana.

> *"… It will also require the Councils to really embed the cardiovascular disease training into the pre-service trainings, into the curricula that is important. Once this is achieved the trainings will automatically be linked to the normal pre-service trainings for all upcoming doctors and nurses in Ghana, and the same as for the in-service…"*

(Respondent_ Policy/Administration_03)

Despite the sustainability efforts, some professional regulatory councils have been met with resistance to modifying their programmes or curricula to incorporate hypertension and CVD management, which is a minor component at this time. Hence, when interventions such as the GHI are not available in 20 years, the curriculum will become extremely vital, so that it can be altered to serve multiple generations of doctors, nurses, and physician assistants. One respondent discussed challenges faced in collaborating with the Ghana Medical and Dental Council, as well as the Nursing and Midwifery Council. The aim was to modify their training curricula to ensure comprehensive CVD education for health professionals before they enter the field. The intention was to integrate guidelines and training manuals into the curriculum for nurses, doctors, and physician assistants. This approach aimed at creating a lasting impact by preparing future generations of healthcare providers. Despite encountering resistance, especially from the Nursing and Midwifery Council, efforts were being made to push for curriculum changes that would include essential skills like BP measurement and heart failure management, rather than just a limited coverage of CVD management within the existing curriculum.

Looking forward, interviewees had several ideas about how the GHI could be expanded and adapted to new regions and conditions. Overall, they were very enthusiastic about commitment from government agencies and respondents suggested that they garner as much support as they can from the government, utilising leadership endorsement. Interviewees expressed the belief that there was potential for the e-learning programme, where health professionals can login from anywhere. Other comments relating to future applications of the GHI model focused on financing issues. Many interviewees mentioned the challenge of identifying sustainable sources of funding for some of the project activities, describing existing payment systems acting as a hurdle to paying for training activities. It was also uncertain if the call center and app would be institutionalised, and that more evidence supporting their use is necessary.

During the qualitative interviews, respondents identified commitment from all stakeholders, in particular the government, and money as fundamental elements of sustainability.

> *"…you need the governments to support that, otherwise you cannot do that… commitment of the government, beside money, but money is an important point. Without that, you, you have got…"*

(Respondent_ Policy/Administration_04)

Respondents underscored the critical role of leadership support in ensuring sustainability, highlighting that lack of interest from leadership could lead to decreased engagement. To sustain efforts, they advocated for stringent trainee selection criteria and conducting training sessions within the facility rather than expensive hotel conference rooms. Designated champions were suggested to lead these sessions, fostering knowledge dissemination and long-term sustainability.

Additionally, the e-learning module emerged as a vital sustainability component. Respondents agreed that the GHI could potentially facilitate this by hosting an e-learning programme for CVDs. This initiative aimed to enable continued capacity development even beyond the lifespan of the GHI, with the GHS poised to take over and continue the training. In relation to sustaining the project's impact, a respondent (Respondent_ Policy/Administration_02) mentioned, "*we have currently started a discussion on what is going on concerning the e-learning programme for cardiovascular diseases. With that, we have supported the GHS to develop the e-learning programme that would be hosted by the GHS. So, whether the Ghana Heart Initiative ends or not, this capacity development training will be available, and the Ghana Health Service can continue the training.*"

Certain individuals had doubts about the degree to which the CVD support and call center, and the Akomacare app would be utilised after the project completion:

> *"… also, with regard to the CVD support and call center, and the Akomacare app usage, I mean, those are, they will remain in place. But of course, the question is whether they will remain in place and be used. And that is fully up to the local institutions and whether they see a benefit in the activities. And I hope we are able to showcase that there is a huge benefit of using them, and we have lots of revision rounds to really make sure that whatever we do is in line with what the institutions, the system requires. But of course, it's all up to the local institutions to then continue the activities…"*

(Respondent_ Policy/Administration_03)

Overall, stakeholders perceive the GHI intervention positively based on the successes they experienced, particularly the improvement of quality of care.

- The inclusion of stakeholders early in the design and implementation process was recognised as a key component contributing to aspects of acceptability, adoption, and ownership of the intervention.
- Although stakeholders acknowledge the strong influence of the initial infrastructure upgrades, they still identify the introduction of incentives as being essential to increasing provider motivation and patient satisfaction experience.
- While the government has expressed commitment to the intervention, funding remains a major concern. The vast majority of stakeholders want this programme to be expanded to all facilities and to include health services other than the GHS.

THREATS TO SUSTAINABILITY

During our investigation into various health facilities in the GAR, we observed a notable phenomenon from an outsider's ("etic") perspective. A substantial number of healthcare providers who had received training were no longer present in their positions. This attrition was due to a variety of reasons, such as transfers, relocations, leaves of absence, or international travel – a phenomenon often referred to as brain drain by those within the local context. The GHI had provided a list of contacts for follow-up, but it became evident that many of these contacts were no longer available to fulfil their project-related duties. This unpredictability in personnel turnover is not unique to the GHI but extends to the broader healthcare landscape in Ghana. It highlights a common challenge: investing in training

individuals only to see them move on to different roles or locations. This issue cannot be solely attributed to the GHI approach but underscores a systemic weakness within the GHS.

Looking forward, an objective perspective suggests the need for innovative strategies for capacity building, especially at the level of the CHPS compound, where there is often a reliance on a single individual. When that individual inevitably departs, contingency plans should be in place at the district level to ensure continuity. This issue, from an outsider's viewpoint, reflects broader human resource challenges within the GHS.

Furthermore, difficulties in accessing what is colloquially referred to as "*free money*" within the healthcare system pose a substantial hurdle. The scarcity of available funds inhibits the ability to sustain training efforts or support the goals of the GHI. This is recognised as a programming issue, where funding is essential not only for training but also for the ongoing maintenance and development of skills. During the qualitative interviews, a valuable insight emerged from one of the respondents. They proposed the initiation of a dialogue to explore the possibility of tapping into domestic funding sources in order to ensure the sustainability of the project. They acknowledged the inevitability of dwindling external funding and recognised the necessity of devising strategies to maintain the accomplishments of the GHI.

MAINTENANCE. HIGHLIGHTS (SUMMARY)

- The GHI programme, in its entirety, exemplified sustainable approaches in numerous aspects, including the prioritisation of frontline healthcare workers for CVD screening and treatment, and the collaborative efforts forged between the public and private sectors, among other notable initiatives. Furthermore, within this overall structure, the opportunity for the implementing / programme team and grantee to tailor the programme to the local context gave grantees the flexibility to develop further innovations; novel services and structures were explored. This included launching the CVD support and call center, starting e-learning courses and developing the Akomacare app, all of which are being adopted by the government following the example of the GHI.
- Healthcare providers found GHI's training useful in managing hypertension and CVD patients, especially the hands-on component. Trust in patient advice increased as did knowledge of risk factors, prevention, and treatment. Patients visiting health facilities in the intervention region were significantly more likely to feel informed about the healthcare they received for managing their heart-related health condition than patients in the control facilities. In addition, patients in intervention facilities were significantly more satisfied with their healthcare than patients in control facilities.
- However, there are **threats to sustainability**: (i) **Limited Priority for CVD in the Health Sector:** The extent to which CVD has been prioritised within the health sector remains a concern. Adequate funding and resources are essential, and there is apprehension regarding the relatively low financial investments made in this area; (ii) **High Attrition Rates among Healthcare Workers:** The frequent turnover of healthcare workers, often redeployed to different roles, poses a substantial challenge. This mobility raises questions about whether the valuable knowledge they have gained will be effectively applied in their new positions; (iii) **Migration of Experienced Healthcare Workers:** Particularly concerning is the migration of experienced healthcare workers, especially nurses. This trend poses a substantial threat to the overall healthcare system in Ghana, as it depletes the pool of skilled professionals; (vi) **Lack of Accountability in the Public Sector:** There is a noticeable lack of accountability within the public sector. Healthcare providers, for instance, may choose not to adhere to national CVD guidelines without facing consequences; (v) **Absence of Coercion to Sustain Programmes:** Medical superintendents do not face any compulsion to continue the programme. Although the interventions do not necessarily require large financial resources, the prevailing system often places financial considerations above the practice and delivery of services; (vi) **Challenges in Incorporating CVD into Curricula:** The GHI encounters difficulties in integrating CVD-related content into the curricula for medical and nursing students. Furthermore, the development of continuing professional development programmes in this context remains a work in progress.
- **GHI is likely to make sustainable accomplishments because of the acknowledgement that CVD and hypertension are a priority in Ghana's national health sector strategy and the national NCD policy going forward**. Also, the national guidelines for managing CVD is a remarkable accomplishment and a landmark achievement of the GHI. Technical proficiency of healthcare professionals however, is still limited and there are notable geographic and socio-economic discrepancies in terms of access and utilisation of health services and large facility-level gaps, posing a challenge for sustainability. **The section that follows will provide information on how much it will cost to maintain the GHI programme during its expansion**.

ECONOMIC EVALUATION

We adopted a health system perspective and traced costs from the inception of the pilot phase of the Ghana Heart Initiative (GHI) in 2018 until its completion of activities in 2022. Accordingly, we considered all programme-level costs and categorised costs in two phases: design costs incurred from 2018 to 2019, and implementation costs incurred from 2019 to 2022. All costs were reported in Euro. All financial data reported are based on the invoices and/or expenditure data shared by the GIZ team. We describe the activity-based costing and the budget-impact analysis results in detail in this chapter. The budget impact analysis provides decision-makers with cost information and its implication for expanding or scaling up the pilot intervention at the national level as part of ongoing efforts towards achieving universal health coverage.

A health system approach is being taken, in which expenses incurred by the GHS / MoH and its development partner, the GIZ, for rolling out the GHI are tracked, but those from health facilities or patients are not. Economic costs are estimated but not restricted to financial costs, i.e., the full value of resources being used by any of the parties (MoH; GHS; and GIZ) involved in the implementation of the intervention is traced, whether reported in financial statements or not. We rely on activity-based costing, i.e., an approach that recognises the relationship between costs, activities, and products. Accordingly, all activities are mapped and related to the design and pilot implementation of the GHI; then, all resources being consumed by these activities are traced; and finally, all resources being consumed are valued [43]

ACTIVITY-BASED COSTING

We used an activity-based costing approach, where a cost is derived for every activity conducted as part of the GHI programme at the design and pilot implementation phase. It considers a four-year time horizon (2018-2022) and is organised according to the seven main cost categories/activities. We calculated the total costs (financial and economic costs) of each activity cluster applicable for the design and pilot implementation phase and report here the total costs first by year of implementation and then by activity cluster and across cost-categories (such as human resources, room rental, transportation and consumables).

The list of core activities relevant to the economic evaluation of the GHI is described in **Table 34**.

Table 34 List of GHI Core Activities

Activity No.	List of Core Activities (aggregated)	Phase	Description
1	General Coordination and Management	Design	All general activities during the design phase of the GHI (e.g., inception workshop, stakeholder engagement, governance committee meeting, planning meetings to define the strategy, to develop the concept note, internal workshops/meetings held by the GIZ team with GHS and MoH representatives.
2	General Coordination and Management	Pilot Implementation	All general coordination, management, supervision activities performed during the pilot implementation phase across the GAR covering 41 health facilities (e.g., informational meetings with the various stakeholders (GHS, MoH, external consultants) and other stakeholders.
3	National CVD Guideline Development		Development, planning and peer-review meetings and workshop to develop the national guidelines for the management of CVD in Ghana.
4	Training		Training of doctors, nurses and other health workers on the guidelines for CVD management. Training of health workers on the Basic Life Support (BLS) and Advanced Cardiovascular Life Support (ACLS).
5	Equipment Support		All activities related to the procurement/storage of equipment, and distribution to the health facilities in the GAR.
6	Akomacare App Development		Development of mobile or tablet based android application to promote wider dissemination/uptake of the CVD management guidelines for the healthcare workers in Ghana.
7	CVD Support and Call Center		All activities relevant to the establishment of CVD support and call center, related infrastructure/equipment support and training of health workers on CVD support and call center to manage patients with CVD.
8	Data Management Support		Development of the data collection programme, questionnaire, selection of CVD related indicators and planning meeting to integrate CVD indicators in the DHIMS2 database and training of health management information officers (HMIOs) on data management and monitoring of aggregate facility level data on hypertension and CVD services.
9	Monitoring & Evaluation		All monitoring and quality control activities.

ECONOMIC COST OF GHI ACTIVITIES

In **Table 35**, we present the economic costs of the GHI components, disaggregated by activity clusters and intervention phase (design and implementation). Overall, the GHI incurred a total cost of 1.740,853 Euro, which included a design cost of 148,558 Euro (8.5% of total cost) and an implementation cost of 1.592,295 Euro (91.5% of total cost). Around 8.5% of the total budget was allocated to the design phase, mostly incurred towards coordination and management activities. Total costs over four years (2018-2022) of the project varied, and substantial resources and expenses were consumed during the second and third years of the project, which were related to the major activities of: 1) preparation workshops and the development of a guideline in year 2 (2019), 2) the training of the health workers, and the procurement of equipment and distribution in the third year (2020), respectively. Economic costs may be underestimated, as we did not fully account for the travel costs and other related opportunity costs for all non-GIZ staff who may have contributed to the design/implementation of the GHI.

The composition of the implementation costs is shown in **Figure 19**. During the design phase, which consisted of general coordination and management activities, human resources accounted for the largest share of cost (68%), followed by consumables (13%), transportation (10%), and room rental

(8%). During the implementation period, general coordination and management activities, training activities, and equipment support were the three activities accounting for the major share of costs at 29%, 24%, and 17%, respectively. Data management support, the Akomacare app, and the CVD support and call center accounted for a much lower share of costs at 2%, 5% and 7%.

Figure 19 Composition of GHI Implementation Costs

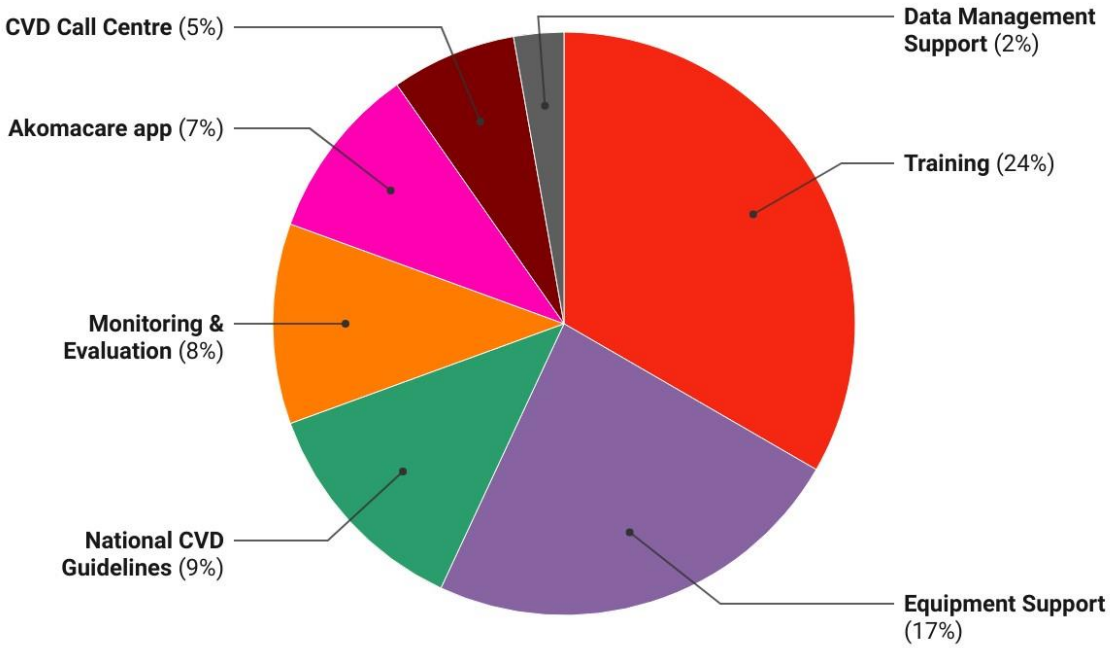


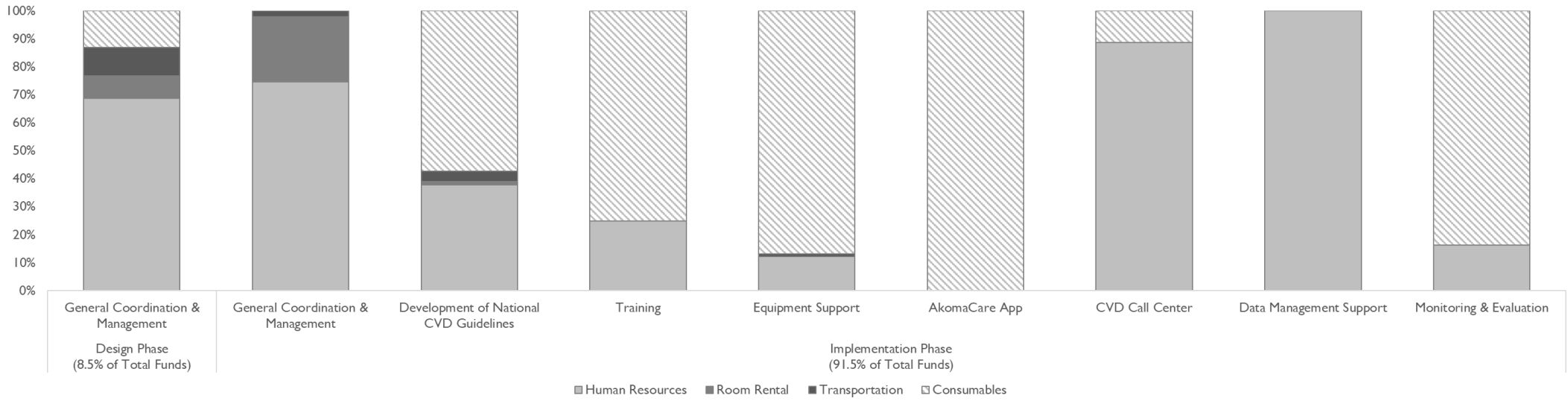
Table 35 Economic and Financial Costs of The Activities Included in the GHI

Activity Cluster	Total Costs	Percentage (%)	Financial Costs	Percentage (%)	Economic Costs	Percentage (%)
Design Phase						
General Coordination and Management	*148558*		*143950*		*4608*	
Implementation Phase (Pilot)						
General Coordination and Management	461070	29%	461070	30%	0	0%
Guidelines Development	136518	9%	133317	9%	3201	8%
Training	376893	24%	357653	23%	19240	47%
Equipment Support	272110	17%	272110	18%	0	0%
Akomacare App	103665	7%	103665	7%		
CVD Support and Call Center	76569	5%	72960	5%	3609	9%
Data Management Support	38714	2%	23727	2%	14987	37%
Monitoring & Evaluation ***	126757	8%	126757	8%	0	0%
Sub-Total Implementation Phase	*1592295*	*100%*	*1551259*	*100%*	*41036*	*100%*
Total						

Figure 20 illustrates the distribution of costs within various categories for both financial and economic aspects across clusters of GHI activities. The data clearly indicates that human resources play a predominant role in driving costs during both the design and implementation phases. Following closely behind in terms of cost influence, for activities related to the development of national CVD guidelines, the Akomacare app, and equipment procurement, are consumable materials.

Since we did not specify the transportation costs for the monitoring and evaluation related work, all consumables are presented as a whole.

Figure 20 Overall Distribution by Category of Costs by The Financial and The Economic Costs Across Clusters of GHI Activities



SUMMARY OF GHI COSTS AND ECONOMIC EVALUATION OUTCOMES

The overall economic and financial costs, including both design and implementation phases, for a span of 4 years (2018-2022) are summarised in **Table 36**. The total financial cost per intervention facility over a four-year period was €41,346.60. This translates to an annual cost of €10,337.00 per facility. Based on the data from the health facility survey, each facility reported an average of 12 healthcare providers trained by the GHI. Therefore, the annual cost per health provider targeted is €861.00. On average, 3,600 patients attended the out-patient clinic of the health facility each month, resulting in an annual cost of €34.50 per patient, as revealed by the health facility assessment survey.

Table 36 Summary of GHI Costs and Economic Evaluation

Values in Euros (€) 2022	**Design & Implementation Phase**		**Implementation Phase**
	Economic Costs in Euros (€)	**Financial Costs in Euros (€)**	**Financial Costs in Euros (€)**
	1,740853	1,695209	1,551259
Total Cost per Health Facility (over 4 years, i.e., 2018-2022)	42459.8	41346.6	37835.6
Annual Cost per **Health Facility** (per year)	10615	10337	9459
Annual Cost per **Health Provider** Targeted	885	861	788
Annual Cost per Patient Attending **Outpatient Clinic**	35.4	34.5	31.5

BUDGET IMPACT ANALYSIS (BIA)

In this section, we present results from BIA, an analytical tool used to) assess expected changes in health expenditure of the budget holder as a result of implementing the GHI programme at a larger scale. The BIA was conducted to assess the financial consequences of the programme, given potential budget constraints. Annual costs per activity cluster, cost per facility and cost per health worker targeted for each of the intervention components, and then for three different scenarios were constructed to inform the scale-up or budget impact. The BIA also included a set of sensitivity analysis, which allow us to understand the impact of making alternative assumptions about important aspects of the study on the budget impact assessment. Here, we try to assist policymakers in understanding the budget impact changes according to alternative assumptions about inflation rates - by increasing total costs of GHI implementation by 30% and 20% for the varying coverage levels of 100%, 80%, 60%, 40%.

In our study, we evaluated three distinct budget scenarios:

- **Scenario 1 – Comprehensive Approach:**
  This scenario is the most comprehensive, encompassing all GHI activity clusters, except for the national guidelines and Akomacare app, which have already been launched and disseminated. However, there could still be additional costs associated with the long-term maintenance or updates/revisions to existing guidelines and the Akomacare App, although the frequency and timing of these activities are yet to be reviewed and confirmed.

- **Scenario 2 – Service Delivery Focus:**
  This scenario includes the selected activities that are most relevant for service delivery, namely the training of healthcare providers, equipment support, and CVD support through the call center. We assume that other parallel programmes focusing on NCDs could cover additional coordination and monitoring costs.

- **Scenario 3 – Design and Expansion:**
  This scenario includes the same activities as Scenario 1 but also encompasses costs associated with the design phase. Strategic stakeholder engagement and meetings may also be required during the expansion or scale-up phase.

Table 37 denotes, that expansion at the national level, covering 100% of the health facilities, was estimated to have a budget impact of €20.1 million, €10.7 million, and €26.7 million in scenarios 1, 2, and 3. When comparing scenario 2 to scenario 1, the total financial costs decreased by 53.5%, which is equivalent to €9.4 million. Similarly, when comparing scenario 2 to scenario 3, the costs decreased by 59.8%, which is equivalent to €15.9 million. The budget impact for scenario 1 was estimated to be €10,685 per health facility and €890 per health provider, based on an overall annual cost of €438,092. A more conservative approach, that is 60% coverage, would cost €12.1 million in scenario 1, €6.4 million in scenario 2, and €16.0 million in scenario 3 (Table 37).

Table 37 Budget Impact Analysis Per Implementing Facility and Per Healthcare Provider from the Health Systems Perspective

	Scenario 1: Expansion of training, equipment, CVD support and call center, data support, coordination and monitoring and evaluation.	**Scenario 2:** Expansion of training, equipment and CVD support and call center.	**Scenario 3:** Expansion of training, equipment, CVD support and call center, data support, coordination and monitoring and evaluation. Plus, design costs.
Annual costs	438 092 €	234 241 €	582 042 €
Cost per Implementing Health Facility	10 685 €	5 713 €	14 196 €
Cost per Health Provider Targeted	890 €	476 €	976 €
Percentage of Ghana Total Health Budget ($1.1 Billion)	1.8%	1.0%	2.4%
Expansion at the National Level			
100% coverage (1,883 facilities)	20 120 192 €	10 757 946 €	26 731 359 €
80% coverage (1,506 facilities)	16 096 153 €	8 606 357 €	21 385 087 €
60% coverage (1,130 facilities)	12 072 115 €	6 454 768 €	16 038 815 €
40% coverage (753 facilities)	8 048 077 €	4 303 179 €	10 692 544 €

The sensitivity analyses showed that, maintaining other parameters as constant values, in the worst-case scenario i.e., inflation rate as high as 30%, the GHI would cost €26.1 million to scale up the intervention nationwide in scenario 1 and €13.9 million in scenario 2.

ECONOMIC EVALUATION: HIGHLIGHTS (SUMMARY)

- The GHI project demonstrated a total commitment of 1,740,853 Euros, with a notable 8.5% (148,558 Euros) dedicated to the design phase and an overwhelming 91.5% (1,592,295 Euros) directed towards the implementation phase. A substantial portion (8.5%) of the budget was wisely invested in the design phase, primarily to facilitate coordination and efficient management activities.
- During the four-year period from 2018 to 2022, the total financial cost per intervention facility over this span was €41,346.60, equating to an annual cost of €10,337.00 per facility. Impressively, each facility reported an average of 12 healthcare providers trained through the GHI programme, resulting in an annual cost of just €861.00 per health provider targeted. Furthermore, **the programmes reach extended to an average of 3,600 patients attending outpatient clinics at these facilities each month**, with an annual cost per patient amounting to a reasonable €34.50 as revealed by the health facility assessment survey.
- From a health system perspective, the first-year budget impact was €20.1 million in scenario 1 – encompassing all recurrent GHI activities, €10.7 million in scenario 2 (selected GHI activities focused on training, equipment and CVD support and call center), and €26.7 million in scenario 3 (all recurrent GHI activities together with the design costs associated with stakeholder engagement and planning meeting). The annual total cost of GHI for a nationwide scale-up, i.e.,100% coverage would cost around 2.4% of Ghana's annual health budget in scenario 3, this reduces to 1% in scenario 2. Thus, scaling up the programme to the national level would require a 2.4% share of total health budget allocated in Ghana.
- **Our findings underscore that the multicomponent CVD intervention could be a viable strategy depending upon the willingness to pay value in Ghana to respond to the growing CVD epidemic in LMICs, and should qualify as a priority intervention**.

KEY ACHIEVEMENTS OF THE GHANA HEART INITIATIVE (PILOT PHASE)

This comprehensive scientific evaluation of the Ghana Heart Initiative (GHI), a health-system strengthening programme seeking to improve hypertension and CVD care delivery across primary, secondary, and tertiary healthcare facilities, demonstrates the complexity of assessing a multi-factorial intervention across diverse settings and variable data environments. **Despite the challenges faced during the Covid-19 pandemic and in the post-Covid-19 period, as well as a weak health system, the findings from this evaluation show that the GHI has led to a higher percentage of patients having their blood pressure (BP) measured in the intervention facilities. In the GAR, based on aggregated data from round 1 and round 2 health facility survey data collection, 68% of all OPD patients underwent screening for hypertension over a 3-month period.** The percentage of patients who achieved controlled BP, defined as <140/90 mmHg, was higher in the intervention facilities compared to the control facilities. However, a smaller number of patients were referred for specialist / higher-level of care, which suggests some limitations of the screening programme, however, we cannot rule out that documentation and/or maintenance of clinical records in the long-run is challenging. The development of national CVD guidelines represents a notable accomplishment in national policy guidance, with far-reaching implications for healthcare facilities. Similarly, the revision of DHIMS2 has resulted in the incorporation of crucial data pertaining to non-communicable diseases (NCDs).

Thus, appraising the GHI programme at once is not straightforward, considering the multiple indicators included and the variety of effects observed across these indicators. Nevertheless, as we conclude this report, we try to draw a storyline to bring together what can be learned from the GHI supply-side intervention experience. In doing so, we look at general patterns across similar indicators, focusing primarily, but not exclusively on indicators for which we detected statistical significance (see pages xx to xx). In this section, we purposely refer to existing literature only to a minimal extent when really needed, since our objective is to explain findings and recommendations in the light of the country contextual elements related to the implementation of GHI in Ghana. We begin by highlighting the achievements of the programme:

- **The GHI succeeded at the task of increasing national awareness about CVDs and the importance of improving service delivery models for CVD at all levels of care, starting with primary healthcare**. The programme also enhanced relevant stakeholder engagement. The presence of high leadership and effective stakeholder engagement played a pivotal role in the success of the GHI. The project gained substantial momentum through the involvement of the Health Minister and top government officials who pledged their support. This high-level support was further reinforced by the active engagement of representatives from the Ghana Health Service and NCD department. Importantly, official letters of invitation and support, authored by government figures and authorities, not only underscored the national importance of the project but also fostered a sense of collective ownership and responsibility.
- **The buy-in from the Ghana Health Services proved instrumental in propelling the GHI programme forward. With a strong commitment from Ghana Health Services, the intervention received in-kind support**. This infusion of resources facilitated the integration of the project into the wider healthcare system, aligning its objectives with broader healthcare goals. This not only bolstered the credibility of the project but also facilitated the forging of collaborative partnerships that contributed to the successful implementation of the CVD intervention strategies.

- **The Ghanaian National CVD Guidelines and the introduction of the Akomacare app have been seen as a key milestone of the programme.** Before these resources were created and made available, Ghanaian clinicians lacked a single, organised resource for managing CVDs. The national guidelines have been launched and endorsed by the Ministry of Health (MoH), allowing them to be currently implemented. This launch marked a pivotal moment in the healthcare sector, enhancing coordination and consistency in the management, treatment, and prevention of CVDs. The guidelines have since served as a beacon for healthcare providers and institutions, guiding them in their efforts to combat the growing burden of CVDs in Ghana.

- **Procuring equipment for the management of CVDs in over 40 facilities in the GAR resulted in higher usage of validated and calibrated equipment, particularly blood pressure (BP) monitors and ECG machines, at intervention facilities.** This increase in usage can be attributed to improved access and availability of equipment, as well as the training that was provided.

- **Training more than 500 healthcare workers at various levels of care in managing hypertension and CVDs, including non-physicians at primary healthcare facilities, equipping them with the knowledge and tools necessary to address CVD issues more effectively.** Despite the challenges of high staff turnover, intervention facilities showed a significant increase in knowledge of stroke symptoms. Additionally, intervention facilities demonstrated relatively higher knowledge of heart attack symptoms and CVD treatment. Gaps in knowledge and misinformation on the part of the provider highlight the challenge of effectively communicating and implementing new knowledge.

- **The adoption of GHI has resulted in remarkable improvements in healthcare, with reports from healthcare providers who engaged in GHI activities underscoring a notable boost in their confidence in caring for patients with hypertension and CVD.** Notably, the intervention group witnessed a substantial increase in the utilisation of treatment guidelines, including the National CVD guidelines, and standard treatment protocols.) Moreover, those who used the equipment provided by GHI rated it an impressive 8.5 out of 10, underscoring its influence in screening, diagnosing, and managing hypertension and CVD cases. Despite persisting challenges such as medication adherence and availability issues, as well as the high prevalence of hypertension and CVD, intervention facilities have witnessed an increase in the number of hypertension and CVD cases addressed during each outpatient clinic visit. It is important to recognise that the adoption of guidelines, training, and equipment takes time, with limited awareness of the guidelines and the Akomacare App largely attributed to non-financial incentives. The effect of high health worker attrition rates in the health system has also been observed, potentially affecting the noticeable changes in guidelines, equipment, and training utilisation. Nevertheless, this achievement aligns with the typical adoption curve of a new healthcare innovation, which often starts slowly before gaining momentum over time.

- **Prescribing patterns revealed that intervention facilities favoured the use of dual and triple combinations of BP-lowering medications compared to control facilities.** This practice is in line with the recent inclusion of fixed-dose combinations for hypertension and CVD management in the WHO essential medicine list. It is also encouraging to see the fast adoption of combination therapy for effective risk factor control by the healthcare providers in the intervention facilities.

- **Hypertension screening has improved at facility-level and there is slight**

improvement in BP control in the intervention facilities. Complementing the GHS agenda of wellness clinics in most implementing facilities, GHS Wellness Clinics have established hypertension clinics in all health facilities, which aims to encourage people to get screened for hypertension.

- **Healthcare providers who took part in the acceptability survey and had prior experience with the GHI components tended to provide favorable ratings or expressed a higher level of acceptance and satisfaction** regarding the guidelines, training, and equipment utilisation. This high rating showcases the substantial improvement in their technical proficiency when it comes to screening, diagnosing, and managing patients with hypertension and/or CVDs, as well as identifying CVD risk factors. It also emphasises the importance of ongoing and thorough training for healthcare providers, including physician assistants and nurses. This widespread capacity building across the healthcare workforce translated to tangible benefits in patient care, leading to improved satisfaction for patients affected by hypertension and CVDs. The resounding call for additional training sessions underscores the commitment of healthcare providers to continuously increase their understanding and knowledge of CVDs, demonstrating a proactive approach to further improving healthcare delivery.

- **Patients consistently reported higher satisfaction with service delivery at intervention facilities.** This finding likely results from improved service availability and quality, as reflected in our other quality of care process indicators. Overall, our findings demonstrate that the GHI successfully enhanced patient-centeredness by improving health service delivery models. This underscores the importance of patient satisfaction as a measure of healthcare effectiveness and suggests that GHI's efforts to enhance patient experiences positively influence treatment adherence, overall well-being, and satisfaction levels. This information provides valuable guidance to healthcare providers and policymakers within the GHI program, helping them improve healthcare experiences for individuals with hypertension and CVDs.

- **The CVD Support and Call Center** and additional indicators for DHIMS2 are being established in the initial phase. While there are indications of success, there is limited evidence for a comprehensive evaluation.

Underpinning these achievements was a high level of project governance, facilitated through a dedicated governance committee. This committee served as a conduit for communication and collaboration among various stakeholders, both within and outside of the government. The committee's efforts were pivotal in conveying the importance of the project to government officials and advocating for their support. This governance structure was an effective means through which voices from various sectors were channelled, bolstering the project's visibility and securing the necessary backing for its skilful implementation. **Integral to the success of the GHI project was its ability to work within the existing healthcare system and structures.** By aligning project activities with the national healthcare system, the initiative ensured long-term sustainability and avoided the creation of parallel systems. This alignment also resonated positively within the system, as stakeholders recognised the project's contribution to the system's efficacy. Despite occasional challenges and frustrations, the commitment to working within the existing system ultimately yielded benefits that transcended momentary obstacles.

One of the greatest achievements of the GHI project was the demonstration of ownership. The Ghana Health Services embraced the intervention as an integral part of their ongoing programmes, highlighting their commitment to its success. This sense of

ownership reverberated through the ranks, with stakeholders acknowledging the project as their collective responsibility. This dedication was underscored by the Minister of Health during the project's launch, solidifying the notion that the GHI's influence would extend far beyond its initial phases. This ownership ethos has paved the way for sustained efforts and continuous progress, embodying the spirit of collaboration and shared responsibility that defines the success of the GHI.

CHALLENGES AND RECOMMENDATIONS FOR IMPROVEMENT

The implementers, healthcare providers, and policymakers of the GHI programme deserve commendation for their efforts thus far, despite the challenges encountered during the implementation of the pilot phase. The GHI has established a framework of improved care delivery systems to manage hypertension and CVD within the public sector in Ghana. This progress should be capitalised, continued, and expanded to other regions as well as areas of healthcare in Ghana. We present the perceived challenges and recommendations for scale-up of the GHI programme below:

- **Challenge: Retention of Training Gains and High Mobility of Healthcare Providers**
  The **high mobility and migration of healthcare workers** and the pilot nature of the study make it impossible to retain the gains from training at the level of healthcare where the training was conducted. This challenge can be partially overcome by expanding and scaling up the GHI programme.

  Recommendation to address workforce challenges:
  - Develop retention strategies to mitigate the attrition of healthcare workers. Offer non-financial incentives, professional development opportunities, and career growth pathways to encourage healthcare workers to stay engaged with the GHI programme. This might include offering refresher courses or creating a community of practice where healthcare providers can share experiences and best practices. This could be coordinated by professional bodies and/or societies e.g., the Ghanaian Cardiological Society. Recognition / awards by the GHS for the best healthcare worker or health facility may also boost healthy competition to improve care delivery and health outcomes.
  - Explore partnerships with educational institutions to incorporate CVD management into the curricula for medical and nursing students. Develop continuing professional development programmes for practicing healthcare professionals.
  - Encouraging the adoption and expansion of a "*train-the-trainer*" approach including a mentoring plan or supervisory visits could create a network of local experts who can sustain training efforts within their respective facilities.

- **Challenge: High Out-of-Pocket Expenses (OOPE) for Patients**
  While people generally express satisfaction with the quality of CVD consultation and medication services, the direct costs borne by individuals remain high. Our study data indicate higher OOPE in intervention facilities compared to control group facilities. To address this issue, the GHI programme should continue its advocacy efforts. They might consider acknowledging their crucial role in advocacy and lobbying while promoting alignment between the supply-side and demand-side. This is important because expanding health financing programmes to include social health protection schemes could potentially cover a broader range of outpatient chronic care services, medication costs, and even account for opportunity costs related to absenteeism or reduced productivity.

- **Challenge: Monitoring Adherence to National CVD Guidelines**
  Once the equipment is delivered and the training is received, it becomes **challenging to monitor the adherence of healthcare workers** to the national treatment guidelines and their ability to provide optimal care as stated in the guidelines. To ensure that healthcare workers closely adhere to the preferred standards of care, we suggest increasing supportive supervision. Additionally, we recommend enhancing clinical governance systems, such as conducting clinical audits, to ensure that guidelines and protocols are followed at lower levels of care.

Recommendation to Enhance Supportive Supervision and Clinical Governance:

- Increase supportive supervision through regular visits by experienced healthcare professionals to assess adherence to guidelines and provide feedback.
- Strengthen clinical governance systems, such as introducing routine clinical audits, to ensure that healthcare providers are following protocols and guidelines.
- Leverage digital tools for remote monitoring and reporting to improve real-time oversight and accountability.

Recommendation to Improve GHI Visibility and Recognition:

- While GHI is content with healthcare providers using the knowledge, it is important to ensure that the GHI's support and funding are recognised. Consider implementing strategies to increase brand visibility during the training, such as prominently displaying GHI's logo or providing certificates that acknowledge GHI's involvement.
- Develop a clear and concise communication strategy to inform healthcare providers about the GHI's role in supporting training initiatives. This could include regular reminders, newsletters, or follow-up communications after training sessions.

- **Challenge: Variability in Healthcare Provider Preferences and Technology Adoption**

Open and honest communication between the GHI implementers and healthcare providers should be encouraged. For instance, different groups have varying perceptions about the use of technology. This can lead to notable variations between districts, resulting in **major shortcomings in meeting expectations when using the Akomacare app**. It is crucial to consider the preferences of healthcare providers when utilising the Akomacare app, even if it entails the possibility of reverting to the traditional practice of printing hard copies of the national CVD guidelines or making post-launch revisions to certain app features.

Recommendation: To maximise adoption and adherence to the national CVD guidelines and technology platform (Akomacare app), we propose a balanced approach that recognises the varying circumstances and preferences of healthcare providers:

- **Hybrid Format**: Maintain both hard copies and digital resources, catering to the accessibility and preferences of healthcare providers. This ensures that those without smartphones or in remote areas are not excluded.
- **Targeted Support**: Explore options to provide smartphones or alternative access methods for healthcare providers lacking digital access. Consider subsidies, partnerships, or community initiatives to bridge the digital gap.
- **Gradual Transition**: Implement a phased transition from paper-based to digital resources, involving healthcare providers in decision-making. Their feedback will inform a smoother adoption process.
- **Customisation**: Make the Akomacare app customisable to accommodate the diverse needs and workflows of healthcare providers.

Recommendation to Track Knowledge Utilisation and Effect:

- Continuously monitor and evaluate the effect of the training programmes, not just in terms of participation but also in terms of how effectively healthcare providers apply their knowledge. This will help justify the GHI's investment and showcase the tangible benefits of its support.
- Establish feedback mechanisms to gauge healthcare providers' awareness of the GHI's involvement and their satisfaction with the training programmes. Use this feedback to

make continuous improvements in communication and training delivery.
- Continue to refine the user interface of the digital tool, the Akomacare app, while also offering traditional options like printed guidelines to accommodate different preferences.

- **Challenge: Addressing Both Supply and Demand Sides of Healthcare**
  The GHI has focused solely on the supply side, but addressing CVD requires also addressing the demand side. This can be done by encouraging individuals to seek care earlier through behavioural interventions that promote early screening and the adoption of healthy lifestyles. These interventions can be designed, developed, and integrated within the GHI. If we analyse the phases of the GHI, one of them initially focused on implementing policies to help manage the programme within the GAR. The GHI is currently transitioning from the health system to a more community-focused approach to detecting diseases. Going into the community, the current focus is on primary prevention, which means identifying individuals who present risk factors for CVD. This stage focuses on implementing healthcare policies that promote exercise, healthy eating, and address tobacco control and alcohol. **Referral and counter-referral processes for CVD cases often experience delays**. Monitoring these processes in research is challenging, and evidence of improvement is limited. However, the use of digital technology is expected to bring improvements in this area, although there is currently very little evidence to support this claim.

- **Challenge: Pandemic Readiness and Sustainability**
  The launch of certain components of the GHI pilot phase (i.e., the procurement and distribution of necessary equipment, as well as the start of training), were undoubtedly delayed due to the Covid-19 pandemic. This situation has underscored the need for greater readiness for pandemics. **The GHI has been supported through a sponsor or external grant-in-aid model, meaning that an external funding body pays the implementing partners to conduct their proposed work**. However, these may not be sustained without investments from national and local funding sources, including through mechanisms such as a subscription-based model wherein hospitals, payers, or both support the infrastructure and training costs for improving cardiovascular healthcare quality. Care must be taken to create funding models that do not widen health inequities.

  Recommendation to Build Resilience and Diversifying Funding

  - Develop pandemic preparedness plans to ensure smoother continuation of project activities during unforeseen disruptions, such as pandemics.
  - Transition from a solely external grant-based model to a hybrid funding approach that involves contributions from national and local sources.
  - Explore sustainable funding mechanisms, such as subscription-based models, to ensure long-term financial support.

- Create a steering group comprising representatives from key stakeholders, followed by the establishment of a technical committee to address day-to-day operational matters. The steering committee should work in close collaboration with the ministry and be overseen by the ministry's technical coordinator. This approach will streamline coordination and promote the efficient functioning of the committees.

- **Long-Term Monitoring:** To evaluate the sustained effect of the intervention, continuous monitoring of prescription patterns and patient outcomes is crucial. This will provide insights into whether the changes observed in prescription patterns translate into improved long-term health outcomes for patients. **Patient Adherence and Education**: The changes in

medication usage could indicate varying degrees of patient adherence and understanding. The GHI could focus on patient education, communication, and support to ensure that patients are aware of and committed to their treatment plans.

IMPLICATIONS FOR POLICY AND RESEARCH

IMPLICATIONS FOR POLICY

- The challenges regarding the mobility of health workers and the previous issue of a shortage of health workers are indicators of underlying weaknesses in the health system. This requires more extensive policy intervention to address the underlying causes.

- In a similar vein, while the GHI programme may actively advocate for the inclusion of CVDs within the national health insurance scheme's coverage, it is essential to recognise that individuals living with CVDs require immediate financial protection for out-of-pocket expenses (OOPE). Equally crucial is the long-term issue of OOPE for CVDs, which continues to be a pressing public concern. To address this, policymakers should consider expanding the health benefit package to adequately address these needs.

- Prescription practices can be influenced by the reimbursement levels set by the National Health Insurance Scheme (NHIS), which may need to be revised. This can be addressed by implementing more effective strategic purchasing strategies. These strategies enable healthcare providers to prescribe and start certain modes of treatment at lower levels of care.

- The completeness and quality of clinical documentation, especially related to CVD, were found to be below the desired level. This emphasises the importance of prompt intervention from GHS at all facilities, whether they use manual or digital records. The use of digital documentation creates an additional barrier because of the high workload, which once again requires prompt intervention from GHS.

- The MoH / GHS should explore other possible sources of funding, mainly domestic, to sustain and advance the ideals of the GHI. The results of the evaluation do not suggest this is occurring, thus presenting a threat to the sustainability of the project.

IMPLICATIONS FOR RESEARCH

In the course of conducting this evaluation, we have gleaned valuable insights that can guide future research endeavours concerning CVDs and non-communicable diseases (NCDs) in Ghana. To begin, we delve into the realm of continuous learning healthcare management systems, which hold substantial potential for enhancing the efficacy and efficiency of healthcare management. However, the successful development and implementation of such systems entail specific steps.

First and foremost, it is imperative to invest in the technological infrastructure required to support continuous learning healthcare management systems. This encompasses ensuring the availability of requisite hardware and software, alongside establishing secure and dependable data storage and communication networks.

Secondly, healthcare organisations must prioritise data collection and analysis. The continuous accumulation and scrutiny of data enable these organisations to discern patterns, identify trends, and pinpoint areas ripe for improvement. This wealth of information can then serve as the bedrock for informed decision-making and ongoing enhancements.

In addition, healthcare institutions, such as the GHS should place a premium (i.e., user fee) on staff training and development. The effectiveness of continuous learning healthcare management systems hinges on the knowledge and competencies of the workforce. By dedicating resources to training programmes and fostering opportunities for professional growth, organisations can equip their personnel to adeptly harness and derive benefits from these systems.

Furthermore, fostering collaboration and communication among diverse stakeholders within the healthcare ecosystem is of paramount importance. This collaborative tapestry includes healthcare providers, administrators, researchers, and policymakers. Through synergy, these stakeholders can share knowledge, exchange best practices, and collectively contribute to the evolution and deployment of continuous learning healthcare management systems.

Lastly, a crucial facet of this endeavour is the ongoing evaluation and iteration of these systems. Technology and healthcare are perpetually evolving domains, necessitating adaptability and flexibility in continuous learning healthcare management systems. Regular assessments and feedback mechanisms are instrumental in pinpointing areas ready for improvement, thus ensuring the systems' sustained relevance and effectiveness.

By rigorously adhering to these steps, healthcare organisations can cultivate and implement continuous learning healthcare management systems poised to revolutionise the delivery and administration of healthcare services.

Turning our focus to patient empowerment, it becomes evident that addressing the scarcity of healthcare professionals, especially specialists, in certain regions of the country is paramount. To combat the burgeoning burden of CVDs, patient empowerment through educational materials and tools that reinforce healthy lifestyle modifications is imperative. Enhancing quality and safety in healthcare necessitates widespread engagement with patients, families, physicians, non-physician healthcare workers, administrators, government leaders, and payers. Collaborative efforts on this scale are essential to drive substantial change.

The preliminary findings from the GHI evaluation offer promise, though they also reveal complexity. To fully capitalise on the potential of this quality improvement initiative in reducing CVD-related deaths and disability, scalability to other regions is imperative. This expansion will enable us to harness the opportunities presented by the initiative and make major strides in the battle against CVDs.

Below is a list of possible immediate venues for further research:

- Continuous learning healthcare management systems:
  What could be the key indicators and processes to follow given this experience?

  Creating a monitoring framework that uses key indicators is essential in establishing a learning health system model. This model allows us to continuously learn and improve care by analysing data at regular intervals.

- Consider creating groups, such as cohorts, that include both facilities and the patients assigned to those facilities.

- Evaluate the actual success of the CVD Support and Call Center.

- Understanding users' preferences for electronic medical record (EMR) design and Akomacare app usage. In order to better understand what users' prefer in terms of EMR design and app usage, we

aim to explore their preferences and gather valuable insights. This will help us enhance the users' experience and tailor the products to meet their needs.

- Monitor the progress of the DHIMS2 system, including the addition of indicators specifically related to CVD, and utilise the data.

CONCLUSION

This evaluation offers a comprehensive analysis of the effect of the GHI on hypertension and cardiovascular diseases (CVD) care across multiple sites at the primary-, secondary- and tertiary care levels in Ghana. Using the RE-AIM framework, this evaluation has yielded a wealth of insights into the programme's reach, effectiveness, adoption, implementation, maintenance, and economic implications, highlighting achievements and challenges, with the objective of drafting recommendations for both policy and future research. Collectively, our findings provide valuable insights into the acceptability and sustainability of the GHI pilot programme, and offer substantial insights on the enablers and barriers to the successful implementation of the health system strengthening intervention in a resource constraint setting.

Reach: One notable achievement of GHI is its considerable reach within the Greater Accra Region. The programme extended its influence on numerous health facilities, healthcare providers, and patients, demonstrating a commitment to addressing a widespread health concern. However, the study revealed gaps in implementation among participating facilities, demonstrating the need for a more consistent and equitable approach. Despite these gaps, GHI markedly improved equipment availability and hypertension services across these facilities.

Effectiveness: In terms of effectiveness, GHI has made commendable progress. It has led to improvements in medication availability, prescription patterns, blood pressure control, care delivery processes, healthcare provider knowledge, and patient satisfaction among the intervention facilities. These positive outcomes underscore GHI's potential to enhance the quality of CVD care and the overall healthcare experience for patients. Improvements in patients' satisfaction also indicate capacity to move toward patient-centered care.

Adoption: GHI's favourable adoption among healthcare providers is a noteworthy finding. Healthcare workers who participated in GHI activities reported increased confidence and adherence to national CVD guidelines, which is a promising sign of the programme's influence. It is crucial to acknowledge the dedication and enthusiasm displayed by these providers in embracing the training and equipment offered by GHI. However, the study also revealed challenges related to high attrition rates among healthcare workers, which could jeopardise sustained adoption. These findings emphasise the importance of developing strategies to retain and continually support trained healthcare personnel.

Implementation: The success of GHI's implementation can be attributed to several key factors, including effective project governance, integration within existing healthcare systems, non-parallel implementation, ownership, and institutional adoption. GHI navigated the complex healthcare landscape in Ghana and integrated hypertension management into routine health services. Implementation of the GHI reflects a delicate balance between factors that have propelled the programme forward and obstacles that have hindered its progress. Addressing these challenges and building upon the GHI's strengths will be crucial for its sustainable success and, ultimately, the improvement of cardiovascular healthcare in Ghana.

Maintenance: GHI's innovative approach, including the introduction of digital tools like the Akomacare app, demonstrates forward-thinking strategies to address hypertension and CVD. However, challenges related to sustainability remain, particularly concerning healthcare worker mobility and funding. While recognising CVD as a priority in Ghana's health sector strategy is a positive

step, ongoing efforts are necessary to ensure long-term impact. The economic evaluation examined the financial aspects of GHI, revealing the costs and potential budget implications of scaling up the programme. This study underscores the importance of strategic decision-making to maximise effect while also emphasising the need to reduce out-of-pocket expenses for patients. It offers policymakers valuable insights into the financial considerations necessary for sustaining and expanding GHI.

GHI's achievements are substantial and encompass increased awareness, the development of national guidelines, healthcare worker training, equipment procurement, improved prescribing patterns, enhanced hypertension screening, and the establishment of a CVD support and call center. These achievements serve as a testament to the programme's contributions to advancing cardiovascular health in Ghana. However, our study also uncovered several challenges. These challenges encompass issues such as healthcare worker mobility, adherence to treatment guidelines, high out-of-pocket expenses, communication gaps, supply-demand imbalances, pandemic preparedness, and the need for improved stakeholder collaboration. These challenges are not insurmountable, and our study offers comprehensive recommendations to address these issues, providing a roadmap for continued success in the programme's mission to improve cardiovascular health in Ghana.

We did not find an incremental benefit of GHI over usual care in the prescription of evidence-based guidelines for the conditions studied. However, this study has important lessons for health systems in terms of the management of CVDs and hypertension in primary care settings. The most important lessons are providing an allied health worker (nurses, physician assistants) to support the physician in the management of hypertension and CVDs, ensuring continuous availability of essential equipment for diagnosis, and supportive supervision of healthcare professionals on guideline-directed care. The findings emphasise that addressing healthcare worker mobility, out-of-pocket expenses, treatment guideline adherence, and health system documentation are critical policy considerations. Policymakers are encouraged to adopt a holistic approach to healthcare reform, recognizing the need for comprehensive healthcare system improvements. Research recommendations focus on monitoring, cohort formation, evaluation of specific programme components, user preferences, and data-driven decision-making. These research directions aim to enhance the effectiveness and sustainability of GHI.

In conclusion, the evaluation of GHI has not only provided a detailed assessment of the programme's effect, but has shown possible ways forward to achieve greater hypertension and CVD control in Ghana. The achievements and lessons learned from GHI serve as a foundation for policymakers, stakeholders, and researchers to continue the journey toward enhanced CVD care and a healthier future for the people of Ghana.

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ANNEX V: SUPPLEMENTARY TABLES

TABLE 1. LIST OF HEALTH FACILITIES VISITED IN THE INTERVENTION AND CONTROL REGIONS

Count	ID	Facility Name	Owner	Facility Level	Arm	Region	District
1	TI002	Korle Bu Teaching Hospital and Polyclinic	Public	Tertiary hospital	Intervention	Greater Accra	Ablekuma South
2	TI003	Legon Hospital	Quasi	District hospital	Intervention	Greater Accra	Ayawaso West Municipal
3	TI004	Police Hospital	Quasi	District hospital	Intervention	Greater Accra	La Dade Kotopon Municipal District
4	TI005	Greater Accra Regional Hospital (GARH)	Public	Regional hospital	Intervention	Greater Accra	Osu Klottey
5	SI006	GPHA/Maritime Hospital	Quasi	District hospital	Intervention	Greater Accra	Tema Metropolitan District
6	SI007	Tema General Hospital	Public	Regional hospital	Intervention	Greater Accra	Tema Metropolitan District
7	PI008	Achimota Hospital	Public	District hospital	Intervention	Greater Accra	Okaikoi North
8	PI009	Ada East District Hospital	Public	District hospital	Intervention	Greater Accra	Dangbe West
9	PI010	Adabraka Polyclinic	Public	Polyclinic	Intervention	Greater Accra	Osu Klottey
10	PI011	Amanfrom Polyclinic	Public	Polyclinic	Intervention	Greater Accra	Ga South Municipality,
11	PI012	Atomic Clinic	Quasi	District hospital	Intervention	Greater Accra	Ga East District
12	PI013	Dansoman Polyclinic	Public	Polyclinic	Intervention	Greater Accra	Ashiedu Keteke Sub-Metro
13	PI014	Ga West Municipal Hospital	Public	District hospital	Intervention	Greater Accra	Ga West Municipal
14	PI015	Kaneshie Polyclinic	Public	Polyclinic	Intervention	Greater Accra	Okaikoi
15	PI017	LEKMA Hospital	Public	District hospital	Intervention	Greater Accra	Kpeshie Sub-Metro
16	PI018	LEKMA Polyclinic	Public	Polyclinic	Intervention	Greater Accra	Kpeshie Sub-Metro
17	PI019	Maamobi General Hospital	Public	District hospital	Intervention	Greater Accra	Ablekuma South
18	PI020	Madina Polyclinic (Kekele)	Public	Polyclinic	Intervention	Greater Accra	La Nkwantanang Madina
19	PI021	Madina Polyclinic (Rawlings circle)	Public	Polyclinic	Intervention	Greater Accra	La Nkwantanang Madina
20	PI022	Mamprobi Polyclinic	Public	Polyclinic	Intervention	Greater Accra	Ablekuma South Sub-Metro

21	PI023	Pentecost Hospital GA	CHAG	District hospital	Intervention	Greater Accra	La Nkwantanang Madina
22	PI024	Prampram Polyclinic	Public	Polyclinic	Intervention	Greater Accra	Ningo Prampram district
23	PI025	Shai Osu Doku District	Public	District hospital	Intervention	Greater Accra	Dangbe West
24	PI026	Taifa Polyclinic	Public	Polyclinic	Intervention	Greater Accra	Ga East District
25	PI027	Tema Polyclinic	Public	Polyclinic	Intervention	Greater Accra	Tema West Municipal
26	PI029	Ussher Polyclinic	Public	Polyclinic	Intervention	Greater Accra	Ashiedu Keteke
27	PI030	Weija Gbawe Municipal Hospital	Public	District hospital	Intervention	Greater Accra	Weija Gbawe Municipal District
28	HI031	Abokobi Health Center	Public	Health center	Intervention	Greater Accra	Ga East Municipal
29	HI032	Danfa Health Center	Public	Health center	Intervention	Greater Accra	Ga East Municipal
30	HI033	Kpone Health Center	Public	Polyclinic	Intervention	Greater Accra	Kpone Katamanso District
31	HI034	Manhean Health Center	Public	Polyclinic	Intervention	Greater Accra	Tema Metropolitan District
32	HI035	Mayera Health Center	Public	Health center	Intervention	Greater Accra	Ga West
33	HI036	Nima Government clinic	Public	Polyclinic	Intervention	Greater Accra	Ayawaso
34	HI037	Oduman Health Center	Public	Polyclinic	Intervention	Greater Accra	Ga West
35	HI038	Pokuase Health Center	Public	Health center	Intervention	Greater Accra	Ga West
36	CI039	Akpomanboi- Ga East	Public	CHPS compound	Intervention	Greater Accra	Ga East
37	CI040	Asutuare Junction-Shai Osu Doku	Public	CHPS compound	Intervention	Greater Accra	Shai Osu Doku District
38	CI041	Domsapaman Ga-West	Public	CHPS compound	Intervention	Greater Accra	Ga West
39	CI042	Hobor Ga South	Public	CHPS compound	Intervention	Greater Accra	Ga South
40	CI043	New Ningo- Ningo Prampram	Public	CHPS compound	Intervention	Greater Accra	Ningo Prampram
41	CI044	Seduase-Kpone Katamanso	Public	CHPS compound	Intervention	Greater Accra	Kpone Katamanso District
42	SC045	Effia Nkwanta Regional Hospital	Public	Regional hospital	Control	Western	Sekondi-Takoradi
43	SC046	Trauma And Specialist Hospital,Winneba	Public	Regional hospital	Control	Central	AWUTU
44	PC048	Ankaful Leprosy General Hospital	Public	District hospital	Control	Central	KEEA

45	PC049	Kwesimintsim Hospital	Public	District hospital	Control	Western	Effia-Kwesimintsim
46	PC050	Nana Hima Dekyi Hospital	Public	District hospital	Control	Western	Ahantamana
47	PC051	University of Cape Coast (UCC) Hospital	Quasi	District hospital	Control	Central	OGUAMAN
48	PC052	Volta River Authority (VRA) Hospital	Quasi	Regional hospital	Control	Western	Shama
49	PC053	Kasoa Polyclinic	Public	Polyclinic	Control	Central	AWUTU
50	PC054	Winneba Municipal Hospital	Public	District hospital	Control	Central	AWUTU
51	PC055	St Luke Catholic Hospital - Apam	CHAG	District hospital	Control	Central	GOMOAMAN
52	PC056	Half Assini Government Hospital	Public	District hospital	Control	Western	Jomoro
53	PC057	Pentecost Hospital Wr	CHAG	District hospital	Control	Western	Tarkwa-Nsuem
54	PC058	Essikado Hospital	Public	District hospital	Control	Western	Sekondi-Takoradi
55	PC059	Tarkwa Municipal Hospital	Public	District hospital	Control	Western	Wassa-West
56	PC060	St Francis Xavier Hospital	CHAG	District hospital	Control	Central	ASSIN NORTH
57	PC061	Our Lady Of Grace Catholic Hospital	CHAG	District hospital	Control	Central	ASIKUMA ODOBEN BRAKWA
58	PC062	St Gregory Catholic Clinic	CHAG	District hospital	Control	Central	GOMOAMAN
59	PC063	Ghana Manganese Company (GMC) Hospital	Quasi	Polyclinic	Control	Western	Tarkwa-Nsuem
60	PC066	Ankaful Psychiatric Hospital	Public	Tertiary hospital	Control	Central	KEEA
61	PC067	Axim Government Hospital	Public	District hospital	Control	Western	Nzema East
62	PC069	Mercy Women's Catholic Hospital	CHAG	District hospital	Control	Central	MFANTSIMAN
63	PC072	Tarkwa Mines Hospital	Quasi	Polyclinic	Control	Western	Tarkwa-Nsuem
64	PC073	Elmina Urban Health Centre	Public	Polyclinic	Control	Central	KEEA
65	PC077	Nagel Memorial Adventis Hospital	CHAG	District hospital	Control	Western	Sekondi-Takoradi
66	PC078	Saltpond Municipal Hospital	Public	District hospital	Control	Central	MFANTSIMAN
67	PC079	Prestea Govt Hospital	Public	District hospital	Control	Western	Wassa-West
68	PC080	Salvation Army Polyclinic (Agona Dunkwa)	CHAG	Polyclinic	Control	Central	AGONA

69	PC082	Wassa Akropong Government Hospital	Public	District hospital	Control	Western	Wassa Amenfi East
70	PC083	Coast For Christ Baptist Hospital	CHAG	District hospital	Control	Central	AWUTU
71	PC085	Ghana Ports and Harbors Authorities (GPHA) Hospital	Quasi	District hospital	Control	Western	Sekondi-Takoradi
72	PC088	Apinto Government Hospital	Public	District hospital	Control	Western	Tarkwa-Nsuem
73	PC089	Holy Child Health Center (Fijai)	CHAG	District hospital	Control	Western	Sekondi-Takoradi
74	PC090	Ajumako District Hospital	Public	District hospital	Control	Central	AJUMAKO
75	PC092	Municipal Hospital, Agona Swedru	Public	District hospital	Control	Central	AGONA
76	HC093	Abura Health Centre	Public	Health center	Control	Western	Shama
77	HC094	New Takoradi Health Center	Public	Health center	Control	Western	Sekondi-Takoradi
78	HC096	Agona Nkwanta Health Centre	Public	Health center	Control	Western	Shama
79	HC097	Supomu-Dunkwa Health Centre	Public	Health center	Control	Western	Shama
80	HC106	Bogoso Health Centre	Public	Health center	Control	Western	Wassa-West
81	HC107	Shama Health Centre	Public	Health center	Control	Western	Shama
82	HC109	Diabene CHPS	Public	CHPS compound	Control	Western	Sekondi-Takoradi
83	HC113	Kojokrom CHPS Compound	Public	CHPS compound	Control	Western	Sekondi-Takoradi
84	HC114	Adientem CHPS	Public	CHPS compound	Control	Western	Sekondi-Takoradi
85	HC115	Apremdo CHPS	Public	CHPS compound	Control	Western	Effia Kwesimintsim Municipality
86	PC121	Dunkwa Municipal Hospital	Public	District hospital	Control	Central	UPPER DENKYIRA
87	HC122	Whindo Health Centre	Public	Health center	Control	Western	Shama
88	TC136	Cape Coast Teaching Hospital	Public	Tertiary hospital	Control	Central	Cape coast
89	PC137	Abura Dunkwa Hospital	Public	District hospital	Control	Central	Abura-Asebu-Kwamankese
90	PC138	Bawjiasie Polyclinic	Public	Polyclinic	Control	Central	Awutu Senya
91	PC139	Dawurampong Polyclinic	Public	Polyclinic	Control	Central	Gomoa West
92	PC140	Ewim Polyclinic	Public	Polyclinic	Control	Central	Cape Coast

93	PC141	Sunkwa Polyclinic	Public	Polyclinic	Control	Central	Upper Denkyira East
94	PC142	Twifo Praso Government Hospital	Public	District hospital	Control	Central	Twi Ati Morkwa
95	HC143	Adisadel Health Center	Public	Health center	Control	Central	Cape coast
96	HC144	Moree Health Center	Public	Health center	Control	Central	Abura-Asebu-Kwamankese District
97	CC145	Kakumdo CHPS	Public	CHPS compound	Control	Central	Cape coast
98	CC146	Kwaporow CHPS (Behind UCC)	Public	CHPS compound	Control	Central	Cape coast
99	PC149	Ami Memorial Hospital, Tarkwa	Public	District hospital	Control	Western	Tarkwa-Nsuaem Municipal
100	HC154	Bawdie Health center	Public	Health center	Control	Western	Amenfi East District

TABLE 2. LIST OF QUANTITATIVE INDICATORS AND QUALITATIVE THEMES UNDER EACH OF THE RE-AIM DOMAINS

REACH: INDICATORS	TOOL / DATA
Total number of patients registered at the outpatient department in the intervention vs control facilities.	Health Facility Survey
Total number of individuals (proportions) screened for hypertension in the intervention vs. control facilities.	Health Facility Survey
Total number of patients with hypertension managed or received care at intervention vs control facilities.	Health Facility Survey
Total number of patients with hypertension referred to other facilities at intervention vs control facilities.	Health Facility Survey
Total number of patients with CVD managed / received care at intervention vs control facilities.	Health Facility Survey
Total number of patients with stroke managed or received care at intervention vs control facilities.	Health Facility Survey
Total number of patients with heart failure managed or received care at intervention vs control facilities.	Health Facility Survey
Total number of patients with CVD referred to other facilities at intervention vs control facilities.	Health Facility Survey
Provision of hypertension screening available at the intervention vs. control facilities.	Health Facility Survey
Provision of CVD care services available at the intervention vs control facilities.	Health Facility Survey
Total number of patients with CVD admissions in the intervention vs control facilities.	Health Facility Survey
Available health work force (per category) by intervention and control facilities: i) doctors, ii) nurses, iii) physician assistants, iv) others.	Health Facility Survey
Total number of healthcare providers trained on hypertension management.	Health Facility Survey
Total number of healthcare providers trained on CVD management.	Health Facility Survey
Available equipment for hypertension/CVD diagnosis by intervention and control facilities: i) BP digital monitor, ii) BP sphygmomanometer, iii) ECG, iv) cardiac defibrillator, vi) ECHO, v) Glucometer, vi) CVD risk charts.	Health Facility Survey
Total number of intervention facilities reported having / using equipment supplied by GHI (availability of equipment supplied by GHI and their functional status).	Health Facility Survey
Availability of designated area for CVD (including hypertension) emergency between intervention vs control facilities.	Health Facility Survey

REACH: INDICATORS	TOOL / DATA
Patient's primary reason to visit health facility between intervention and control facilities.	Exit Survey
Patient's preference to visit the current health facility between intervention and control facilities.	Exit Survey
Type of health services availed by the patients between the intervention and control facilities.	Exit Survey
Patient obtained all prescribed medicines at the facility between intervention and control group.	Exit Survey
Prescription of BP lowering medications at the current visit between the intervention and control facilities.	Exit Survey
Referrals received by the patient at the current visit between intervention and control facilities.	Exit Survey
Type of health facility referred to between intervention and control facilities.	Exit Survey
Type of health services that required referral to another facility between intervention and control regions.	Exit Survey
Did the health worker provide lifestyle modification advise/counselling during the current visit between the intervention and control groups.	Exit Survey

EFFECTIVESS: INDICATORS	TOOL / DATA
Total number of patients newly diagnosed with hypertension i.e., blood pressure >140/90 mmHg.	Health Facility Survey
Total number of hypertension patients with controlled blood pressure <140/90 mmHg.	Health Facility Survey
Total number of hypertension patients with systolic blood pressure >140 mmHg.	Health Facility Survey
Total number of hypertension patients with diastolic blood pressure > 90 mmHg.	Health Facility Survey
Total number of in-hospital deaths among patients admitted with cardiovascular causes.	Health Facility Survey
Total number of patients with stroke managed or received care at intervention vs control facilities.	Health Facility Survey
Prescription patterns for patients with hypertension (out-patient).	MRR-OPD
Prescription patterns for patients with CVD (out-patient).	MRR-OPD
Prescription patterns for patients with hypertension (in-patient).	MRR-IPD
Prescription patterns for patients with CVD (in-patient).	MRR-IPD
Mean systolic blood pressure.	MRR-OPD / IPD
Mean diastolic blood pressure.	MRR-OPD / IPD
Mean fasting blood glucose.	MRR-OPD / IPD

EFFECTIVESS: INDICATORS	TOOL / DATA
Knowledge of care providers on stroke symptoms	KAP Survey
Knowledge of care providers on modifiable CVD risk factors	KAP Survey
Knowledge of providers on CVD treatment	KAP Survey
Patient centred care: patient's satisfaction with the care received at this facility between the intervention and control regions	Patient Exit Survey
Patient's satisfaction with the health care seeking experience at this facility between the intervention and control regions.	Patient Exit Survey
Patient's satisfaction with the quality of care received at this facility between intervention and control regions.	Patient Exit Survey
Patient's adherence to prescribed medication between intervention and control facilities.	Patient Exit Survey
Patient's motivation to follow treatment plan between intervention and control regions.	Patient Exit Survey
Continuity of care: patient's repeat visit to the health facility between intervention and control facilities.	Patient Exit Survey
Patient's average out-of-pocket expenditure between intervention and control facilities.	Patient Exit Survey
Time spent waiting to see the doctor between intervention and control facilities.	Patient Exit Survey
Time spent waiting to see the nurse to check vitals between intervention and control facilities.	Patient Exit Survey

ADOPTION: INDICATORS	TOOL / DATA
Provider's attitudes towards hypertension (ability / confidence to manage HTN).	KAP Survey
Provider's attitudes towards CVD (ability / confidence to manage CVD).	KAP Survey
Prescribing behaviour or preference of providers to manage CVD risk factors.	KAP Survey
Provider's perception or acceptability of providers regarding CVD management guidelines.	KAP Survey / Provider Acceptability Survey
Acceptability of providers regarding training provided by the GHI.	KAP Survey / Provider Acceptability Survey
Acceptability of providers regarding equipment support provided by the GHI.	KAP Survey / Provider Acceptability Survey
Acceptability of providers regarding 24x7 CVD support and call center support provided by the GHI.	KAP Survey / Provider Acceptability Survey
Barriers to implementation of CVD guidelines.	KAP Survey / Provider Acceptability Survey
Barriers to optimising hypertension / CVD management.	KAP Survey / Provider Acceptability Survey
Perceived barriers and facilitators to the adoption of GHI from diverse stakeholder perspectives.	Qualitative Interview

IMPLEMENTATION: INDICATORS	TOOL / DATA
We have the necessary support in terms of capacity such as laboratory services and pharmacy at this health facility to provide evidence-based care for hypertension and CVD as per the GHI guidelines, equipment use, and 24x7 CVD support and call center support.	KAP Survey / Provider Acceptability Survey
We have the necessary support in terms of staffing at this health facility to provide evidence-based care for hypertension and CVD as per the GHI guidelines, equipment use, and 24x7 CVD support and call center support.	KAP Survey / Provider Acceptability Survey
We have the necessary support from the Ghana Health Service at this health facility to provide evidence-based care for hypertension and CVD as per the GHI guidelines, equipment use, and 24x7 CVD support and call center support.	KAP Survey / Provider Acceptability Survey
The senior leadership of the Ghana Health Services support to provide evidence-based care for hypertension and CVD as per the GHI guidelines, use equipment, and 24x7 CVD support and call center support.	KAP Survey / Provider Acceptability Survey
Perceived barriers and facilitators to the implementation of GHI from diverse stakeholder perspectives.	Qualitative Interviews
Perceived provider job satisfaction (motivation).	Qualitative Interviews

MAINTENANCE: INDICATORS	TOOL / DATA
Facility needs additional equipment for the management of hypertension.	Health Facility Survey
Facility needs additional equipment for the management of CVD.	Health Facility Survey
Facility needs additional training for health workers for the management of hypertension.	Health Facility Survey
Facility needs additional training for health workers for the management of CVD.	Health Facility Survey
OVERALL PATIENT AND PROVIDER SATISFACTION AND SUSTAINABILITY	
Improvement in the overall hypertension care behaviour (screening, diagnosis, and treatment).	
Improvement in the overall cardiovascular disease care behaviour (screening, diagnosis, and treatment).	
The GHI activities i.e., training, guidelines, and equipment support helpful in terms of screening for hypertension.	KAP Survey / Provider Acceptability Survey
The GHI activities i.e., training, guidelines, and equipment support helpful in terms of management of hypertension.	KAP Survey / Provider Acceptability Survey
The GHI activities i.e., training, guidelines, and equipment support helpful in terms of diagnosis of cardiovascular diseases.	KAP Survey / Provider Acceptability Survey
The GHI activities i.e., training, guidelines, and equipment support helpful in terms of prescribing treatment for cardiovascular disease.	KAP Survey / Provider Acceptability Survey
Sustainability of the Ghana Heart Initiative	KAP Survey / Provider Acceptability Survey
Patient satisfaction and experiences of care.	Exit Survey
Perceived barriers and facilitators to the maintenance of GHI from diverse stakeholder perspectives.	Qualitative Interviews

TABLE 3. SOCIODEMOGRAPHIC CHARACTERISTICS OF PATIENTS (EXIT SURVEY)

	Total N=577	Control N=364	Intervention N=213	p-value
Age (Years)	61.7 (12.0)	61.7 (12.0)	61.8 (12.1)	0.95
Age (Years) Categories				0.20
Up to 44 years	52 (9.0%)	28 (7.7%)	24 (11.3%)	
45 to 54 years	107 (18.5%)	74 (20.3%)	33 (15.5%)	
55 to 64 years	148 (25.6%)	90 (24.7%)	58 (27.2%)	
65 to 74 years	193 (33.4%)	128 (35.2%)	65 (30.5%)	
Over 75 years	77 (13.3%)	44 (12.1%)	33 (15.5%)	
Sex				0.89
Male	145 (25.1%)	90 (24.7%)	55 (25.8%)	
Female	430 (74.5%)	273 (75.0%)	157 (73.7%)	
Other	2 (0.3%)	1 (0.3%)	1 (0.5%)	
Ghana Health Insurance Membership				0.49
No	35 (6.1%)	24 (6.6%)	11 (5.2%)	
Yes	542 (93.9%)	340 (93.4%)	202 (94.8%)	
Marital Status				***0.021***
Never Married	13 (2.3%)	4 (1.1%)	9 (4.2%)	
Cohabiting - living with partner	6 (1.0%)	6 (1.6%)	0 (0.0%)	
Married	306 (53.0%)	198 (54.4%)	108 (50.7%)	
Separated / Divorced	72 (12.5%)	40 (11.0%)	32 (15.0%)	
Widow / Widower	180 (31.2%)	116 (31.9%)	64 (30.0%)	
Highest Level of Schooling				**<0.001**
No formal schooling.	116 (20.1%)	84 (23.1%)	32 (15.0%)	
Primary	75 (13.0%)	43 (11.8%)	32 (15.0%)	
Middle	104 (18.0%)	67 (18.4%)	37 (17.4%)	
JSS / JHS	59 (10.2%)	41 (11.3%)	18 (8.5%)	
SSS / SHS (O-Level / A-Level)	112 (19.4%)	47 (12.9%)	65 (30.5%)	
Vocational / Technical School	54 (9.4%)	42 (11.5%)	12 (5.6%)	
University	54 (9.4%)	37 (10.2%)	17 (8.0%)	
Don't know	3 (0.5%)	3 (0.8%)	0 (0.0%)	

Religion				0.73
Christian	507 (87.9%)	320 (87.9%)	187 (87.8%)	
Muslim	62 (10.7%)	38 (10.4%)	24 (11.3%)	
Traditional Beliefs	6 (1.0%)	5 (1.4%)	1 (0.5%)	
Other	2 (0.3%)	1 (0.3%)	1 (0.5%)	
Language				**<0.001**
English	8 (1.4%)	3 (0.8%)	5 (2.3%)	
Akan	399 (69.2%)	291 (79.9%)	108 (50.7%)	
Ewe	23 (4.0%)	7 (1.9%)	16 (7.5%)	
Ga	70 (12.1%)	8 (2.2%)	62 (29.1%)	
Sefwi	3 (0.5%)	3 (0.8%)	0 (0.0%)	
Nzema	20 (3.5%)	20 (5.5%)	0 (0.0%)	
Hausa	33 (5.7%)	19 (5.2%)	14 (6.6%)	
Other	21 (3.6%)	13 (3.6%)	8 (3.8%)	
Work Status				0.32
No, I have no paid work.	335 (58.1%)	217 (59.6%)	118 (55.4%)	
Yes, I have paid work.	242 (41.9%)	147 (40.4%)	95 (44.6%)	
Locale				**<0.001**
Urban	306 (53.0%)	154 (42.3%)	152 (71.4%)	
Periurban	193 (33.4%)	135 (37.1%)	58 (27.2%)	
Rural	78 (13.5%)	75 (20.6%)	3 (1.4%)	

TABLE 4. HEALTHCARE PROVIDER CHARACTERISTICS (KAP SURVEY)

Provider KAP Survey	Overall (N=523)	Control (N=367)	Intervention (N=156)	p-value
Demographic characteristics				
Age, mean (SD)	33.2 (6.4)	33.0 (6.5)	33.6 (6.3)	0.34
Female, N (%)	370 (70.9%)	255 (69.5%)	115 (73.7%)	0.54
Type of health workers, N (%)				<0.001
Specialist doctor	3 (0.6%)	0 (0.0%)	3 (1.9%)	
Primary care doctor	66 (12.6%)	31 (8.4%)	35 (22.4%)	
Nurse	326 (62.4%)	243 (66.2%)	73 (46.8%)	
Physician assistant	70 (13.4%)	44 (12.0%)	26 (16.7%)	
Others	57 (13.2%)	40 (12.3%)	17 (8.8%)	
Level of healthcare facility, N (%)				<0.001
Primary care	182 (39.6%)	98 (30.6%)	84 (60.4%)	
Secondary care	239 (52.1%)	194 (60.6%)	45 (32.4%)	
Tertiary hospital	38 (8.3%)	28 (8.7%)	10 (7.2%)	
Type of clinical practice, N (%)				<0.001
Outpatient only	204 (39.1%)	158 (43.1%)	46 (29.5%)	
Inpatient only	120 (23.0%)	106 (28.9%)	14 (9.0%)	
Both	197 (37.7%)	102 (27.8%)	95 (60.9%)	
No. of hypertension patients seen per outpatient clinic, mean (SD)	57.0 (81.0)	51.2 (71.3)	73.1 (100.6)	0.008
No. of hypertension patients seen per outpatient clinic, median (IQR)	30.0 (10.0, 75.0)	30.0 (5.0, 68.0)	50.0 (20.0, 85.0)	<0.001
No. of CVD patients seen per outpatient clinic, mean (SD)	25.0 (60.0)	22.3 (43.9)	32.1 (89.2)	0.12
No. of CVD patients seen per outpatient clinic, median (IQR)	7.0 (1.0, 25.0)	5.0 (0.0, 20.0)	10.0 (4.0, 25.0)	0.016
Training in hypertension management, N (%)	423 (81.0%)	278 (75.7%)	145 (92.9%)	<0.001
Training in CVD management, N (%)	405 (77.6%)	263 (71.7%)	142 (91.0%)	<0.001
Use of treatment guidelines for patients with hypertension or cardiovascular diseases	398 (76.5%)	285 (77.7%)	113 (72.4%)	0.20
Ghanian National Guidelines for the manage ment of CVD	75 (20.5%)	32 (8.7%)	43 (27.6%)	<0.001
Standard Treatment Guidelines (Ghana)	359 (92.1%)	261 (71.1%)	98 (62.8%)	0.84
AHA/ACC Guidelines only*	66 (17.8%)	35 (9.5%)	31 (19.9%)	<0.001
European Society of Cardiology (ESC) Guidelines only	22 (6.2%)	10 (2.7%)	12 (7.7%)	<0.001
Others	27 (7.9%)	14 (3.8%)	13 (8.3%)	<0.001

TABLE 5. AVAILABILITY OF EQUIPMENT, LABORATORY AND DIAGNOSTIC SERVICES (REACH)

		Control	Intervention	p-value
		N=55	N=40	
EQUIPMENT AVAILABILITY				
Adult weighing scale available, N (%)		54 (98.2%)	38 (95.0%)	0.24
No. available, mean (SD)		7.1 (5.7) (n=53)	4.7 (3.3) (n=38)	0.023
No. in functional status, mean (SD)		6.7 (5.8) (n=53)	4.0 (2.7) (n=37)	0.009
Calibration/standardization done		41 (74.5%)	34 (85.0%)	0.066
Source of equipment supply				
	Self-owned	26 (47.3%)	10 (25.0%)	0.11
	Government	34 (61.8%)	24 (60.0%)	0.96
	GHI	0 (0.0%)	12 (30.0%)	<0.001
	Other	2 (3.6%)	2 (5.0%)	0.59
Height measuring scale available, N (%)		49 (89.1%)	37 (92.5%)	0.46
No. available, mean (SD)		3.8 (3.0) (n=48)	3.4 (2.9) (n=36)	0.54
No. in functional status, mean (SD)		3.6 (3.2) (n=48)	2.9 (2.2) (n=37)	0.26
Calibration/standardization done		26 (47.3%)	30 (75.0%)	0.009
Source of equipment supply				
	Self-owned	22 (40.0%)	10 (25.0%)	0.27
	Government	30 (54.5%)	20 (50.0%)	0.45
	GHI	0 (0.0%)	12 (30.0%)	<0.001
	Other	2 (3.6%)	1 (2.5%)	0.83
Blood pressure – digital monitor, N (%)		50 (90.9%)	39 (97.5%)	0.082
No. available, mean (SD)		7.8 (8.3) (n=49)	7.3 (6.7) (n=39)	0.74
No. in functional status, mean (SD)		6.8 (5.5) (n=49)	6.8 (6.1) (n=39)	0.99
Calibration/standardization done		35 (63.6%)	38 (95.0%)	0.003
Source of equipment supply				
	Self-owned	24 (43.6%)	15 (37.5%)	0.97
	Government	32 (58.2%)	23 (57.5%)	0.56
	GHI	0 (0.0%)	14 (35.0%)	<0.001
	Other	3 (5.5%)	5 (12.5%)	0.16
Blood pressure - sphygmomanometer, N (%)		42 (76.4%)	27 (67.5%)	0.46
No. available, mean (SD)		5.6 (5.5) (n=41)	4.8 (5.8) (n=27)	0.60
No. in functional status, mean (SD)		5.0 (5.1) (n=41)	4.0 (4.7) (n=26)	0.41
Calibration/standardization done		31 (56.4%)	22 (55.0%)	0.19
Source of equipment supply				
	Self-owned	21 (38.2%)	12 (30.0%)	0.81
	Government	23 (41.8%)	12 (30.0%)	0.29
	GHI	0 (0.0%)	2 (5.0%)	0.072
	Other	0 (0.0%)	3 (7.5%)	0.026

ECG Machine- ordinary, N (%)		**12 (21.8%)**	**18 (45.0%)**	**0.011**
No. available, mean (SD)		1.4 (0.9) (n=12)	1.1 (0.2) (n=18)	0.11
No. in functional status, mean (SD)		1.0 (0.6) (n=12)	1.0 (0.0) (n=18)	1.00
Calibration/standardization done		10 (18.2%)	17 (42.5%)	0.081
Source of equipment supply				
	Self-owned	3 (5.5%)	1 (2.5%)	0.31
	Government	10 (18.2%)	2 (5.0%)	0.001
	GHI	0 (0.0%)	13 (32.5%)	<0.001
	Other	0 (0.0%)	2 (5.0%)	0.14
Electrocardiogram (ECG) Machine- computerized, N (%)		**23 (41.8%)**	**15 (37.5%)**	0.69
No. available, mean (SD)		2.0 (2.5) (n=22)	1.1 (0.3) (n=15)	0.16
No. in functional status, mean (SD)		1.9 (2.4) (n=22)	1.1 (0.3) (n=15)	0.20
Calibration/standardization done		19 (34.5%)	15 (37.5%)	0.23
Source of equipment supply				
	Self-owned	13 (23.6%)	2 (5.0%)	0.026
	Government	8 (14.5%)	1 (2.5%)	0.070
	GHI	0 (0.0%)	11 (27.5%)	<0.001
	Other	2 (3.6%)	2 (5.0%)	0.48
12 Channel Stress ECG Treadmill, N (%)		2 (3.6%)	2 (5.0%)	0.74
No. available, mean (SD)		1.5 (0.7) (n=2)	1.0 (0.0) (n=2)	0.42
No. in functional status, mean (SD)		1.5 (0.7) (n=2)	1.0 (0.0) (n=2)	0.42
Calibration/standardization done		2 (3.6%)	2 (5.0%)	
Source of equipment supply				
	Self-owned	53 (96.4%)	38 (95.0%)	
	Government	1 (1.8%)	1 (2.5%)	1.00
	GHI	0 (0.0%)	1 (2.5%)	0.083
	Other	1 (1.8%)	0 (0.0%)	0.39
Cardiac Monitor, N (%)		**23 (41.8%)**	**14 (35.0%)**	0.46
If yes, no. available, mean (SD)		3.9 (5.3) (n=22)	5.9 (8.8) (n=14)	0.39
If yes, no. in functional status, mean (SD)		2.8 (2.3) (n=22)	5.9 (8.8) (n=14)	0.13
Calibration/standardization done		19 (34.5%)	12 (30.0%)	0.73
Source of equipment supply		11 (20.0%)	3 (7.5%)	0.34
	Self-owned	13 (23.6%)	10 (25.0%)	0.20
	Government	0 (0.0%)	1 (2.5%)	0.099
	GHI			
	Other			
Cardiac Monitor with Defibrillator, N (%)		15 (27.3%)	22 (55.0%)	0.004
No. available, mean (SD)		2.9 (5.0) (n=14)	1.1 (0.5) (n=22)	0.10
No. in functional status, mean (SD)		2.6 (4.5) (n=14)	1.1 (0.3) (n=22)	0.13
Calibration/standardization done		2 (3.6%)	1 (2.5%)	0.34
Source of equipment supply				
	Self-owned	7 (12.7%)	2 (5.0%)	0.060
	Government	8 (14.5%)	3 (7.5%)	0.034

	GHI	0 (0.0%)	16 (40.0%)	<0.001
Echocardiogram, N (%)		4 (7.3%)	2 (5.0%)	0.62
No. available, mean (SD)		2.0 (2.0) (n=4)	1.0 (0.0) (n=2)	0.54
No. in functional status, mean (SD)		**2.0 (2.0) (n=4)**	**1.0 (0.0) (n=2)**	0.54
Calibration/standardization done		2 (3.6%)	1 (2.5%)	0.12
Source of equipment supply				
	Self-owned	2 (3.6%)	1 (2.5%)	0.36
	Government	1 (1.8%)	1 (2.5%)	0.17
	GHI			
	Other	1 (1.8%)	0 (0.0%)	
X-ray, N (%)		27 (49.1%)	22 (55.0%)	0.63
No. available, mean (SD)		1.2 (0.5) (n=26)	1.0 (0.0) (n=22)	0.041
No. in functional status, mean (SD)		1.1 (0.5) (n=26)	1.0 (0.2) (n=22)	0.28
Source of equipment supply				
	Self-owned	9 (16.4%)	4 (10.0%)	0.76
	Government	17 (30.9%)	15 (37.5%)	0.66
	GHI	0 (0.0%)	1 (2.5%)	0.17
	Other	2 (3.6%)	3 (7.5%)	0.18
CT scan, N (%)		5 (9.1%)	3 (7.5%)	0.79
No. available, mean (SD)		1.2 (0.4) (n=5)	1.0 (0.0) (n=3)	0.48
No. in functional status, mean (SD)		0.8 (0.4) (n=5)	1.0 (0.0) (n=3)	0.48
Calibration/standardization done		4 (7.3%)	3 (7.5%)	0.36
Source of equipment supply				
	Self-owned	1 (1.8%)	1 (2.5%)	0.12
	Government	4 (7.3%)	2 (5.0%)	0.49
	GHI			
	Other			
Glucometer, N (%)		52 (94.5%)	39 (97.5%)	0.74
No. available, mean (SD)		6.4 (5.6) (n=51)	5.1 (5.8) (n=39)	0.29
No. in functional status, mean (SD)		6.5 (5.6) (n=50)	5.1 (5.8) (n=39)	0.27
Calibration/standardization done		37 (67.3%)	32 (80.0%)	0.091
Source of equipment supply				
	Self-owned	**33 (60.0%)**	**15 (37.5%)**	0.098
	Government	24 (43.6%)	20 (50.0%)	0.74
	GHI	0 (0.0%)	9 (22.5%)	<0.001
	Other	**3 (5.5%)**	**2 (5.0%)**	**0.99**
How is the equipment at your facility maintained?		25 (45.5%)	24 (60.0%)	0.30
Own technicians/staff		21 (38.2%)	24 (60.0%)	0.013
Private technicians		33 (60.0%)	17 (42.5%)	0.75
Engineers from the district/region		2 (3.6%)	1 (2.5%)	0.85

TABLE 6. AVAILABILITY OF MEDICINES FOR HYPERTENSION AND CARDIOVASCULAR DISEASES (EXTERNALITIES)

	Control N=55	Intervention N=40	p-value
AVAILABILITY OF MEDICINES FOR HYPERTENSION/CVD			
Angiotensin Converting Enzyme (ACE) - Inhibitors	**44 (80.0%)**	**33 (82.5%)**	0.76
Ramipril	3 (5.5%)	3 (7.5%)	0.71
Enalapril	2 (3.6%)	3 (7.5%)	0.42
Perindopril	1 (1.8%)	3 (7.5%)	0.18
Fosinopril	1 (1.8%)	1 (2.5%)	0.84
Lisinopril	**43 (78.2%)**	**32 (80.0%)**	**0.84**
Angiotensin II Receptor Blockers	39 (70.9%)	32 (80.0%)	0.31
Candesartan	10 (18.2%)	6 (15.0%)	0.49
Valsartan	**38 (69.1%)**	**32 (80.0%)**	**0.36**
Losartan	7 (12.7%)	2 (5.0%)	0.14
Anti-coagulant / Anti-platelets Drugs	42 (76.4%)	32 (80.0%)	0.67
Warfarin	11 (20.0%)	8 (20.0%)	0.91
Acetylsalicylic acid	42 (76.4%)	29 (72.5%)	0.043
Prophylactic LMWH	14 (25.5%)	17 (42.5%)	0.087
Therapeutic LMWH	15 (27.3%)	15 (37.5%)	0.33
Subcutaneous unfractionated heparin	10 (18.2%)	9 (22.5%)	0.67
IV unfractionated heparin	12 (21.8%)	8 (20.0%)	0.73
Dabigatran	1 (1.8%)	0 (0.0%)	0.38
Rivaroxaban	16 (29.1%)	6 (15.0%)	0.071
Apixaban	1 (1.8%)	1 (2.5%)	0.84
Anti-arrhythmic Drugs	23 (41.8%)	16 (40.0%)	0.86
Amiodarone	4 (7.3%)	3 (7.5%)	0.98
Digitoxin/Digoxin	18 (32.7%)	8 (20.0%)	0.041
Dilitazem	2 (3.6%)	1 (2.5%)	0.74
Flecainide	1 (1.8%)	1 (2.5%)	0.83
Propafenone	0 (0.0%)	1 (2.5%)	0.24
Procainamide	0 (0.0%)	2 (5.0%)	0.091
Verapamil	4 (7.3%)	1 (2.5%)	0.28
Beta-Blockers	30 (54.5%)	30 (75.0%)	**0.041**
Carvedilol	23 (41.8%)	18 (45.0%)	0.17
Biosprolol	17 (30.9%)	10 (25.0%)	0.069
Nebivolol	0 (0.0%)	3 (7.5%)	0.076
Metoprolol	5 (9.1%)	5 (12.5%)	1.00

Calcium Channel Blockers	**48 (87.3%)**	**36 (90.0%)**	**0.68**
Amlodipine	48 (87.3%)	32 (80.0%)	0.018
Felodipine	43 (78.2%)	35 (87.5%)	0.18
Nifedipine	0 (0.0%)	2 (5.0%)	0.098
Diuretics Oral	**45 (81.8%)**	**34 (85.0%)**	0.68
Chlorthalidone	0 (0.0%)	1 (2.5%)	0.25
Hydrochlorothiazide	27 (49.1%)	13 (32.5%)	0.055
Furosemide	44 (80.0%)	32 (80.0%)	0.40
Indapamide	5 (9.1%)	5 (12.5%)	0.63
Bumetanide	0 (0.0%)	2 (5.0%)	0.099
Nitrates	**21 (38.2%)**	**17 (42.5%)**	0.67
Nitro-glycerine	13 (23.6%)	6 (15.0%)	0.075
Nitroprusside	2 (3.6%)	1 (2.5%)	0.64
Amyl nitrate	14 (25.5%)	3 (7.5%)	**0.002**
Isosorbide	1 (1.8%)	0 (0.0%)	0.35
Alpha Blockers	**25 (45.5%)**	**24 (60.0%)**	0.16
Doxazosin	2 (3.6%)	4 (10.0%)	0.38
Terazosin	1 (1.8%)	1 (2.5%)	1.00
Prazosin	1 (1.8%)	0 (0.0%)	0.31
Methyldopa	24 (43.6%)	23 (57.5%)	0.55
Lipid Lowering Agents	**38 (69.1%)**	**32 (80.0%)**	0.23
Atorvastatin	37 (67.3%)	30 (75.0%)	0.46
Simvastatin	7 (12.7%)	3 (7.5%)	0.28
Rosuvastatin	11 (20.0%)	9 (22.5%)	0.94
Ezetimibe	1 (1.8%)	0 (0.0%)	0.36
Aldosterone Antagonists	**19 (34.5%)**	**17 (42.5%)**	0.43
Aldactone	15 (27.3%)	6 (15.0%)	0.005
Finerenone	0 (0.0%)	1 (2.5%)	0.30
Eplerenone	1 (1.8%)	1 (2.5%)	0.97
Oral Hypoglycaemic Agents	**48 (87.3%)**	**36 (90.0%)**	0.68
Metformin	48 (87.3%)	36 (90.0%)	
Sulfonylurea-Glimepiride	36 (65.5%)	31 (77.5%)	0.21
Sulfonylurea-Gliclazide	15 (27.3%)	9 (22.5%)	0.53
Sulfonylurea-Glipizide	2 (3.6%)	5 (12.5%)	0.11
SGLT2-inhibitors (dapagliflozin, canagliflozin, empagliflozin)	5 (9.1%)	5 (12.5%)	0.63
Pioglitazone	14 (25.5%)	12 (30.0%)	0.68
Alpha-glucosidase inhibitors (acarbose, miglitol, Voglibose)	4 (7.3%)	5 (12.5%)	0.42
DPP-4 inhibitors (Gliptins)	**9 (16.4%)**	**6 (15.0%)**	0.81
Insulin	**39 (70.9%)**	**32 (80.0%)**	0.31

TABLE 7. PATIENT EXPERIENCE BETWEEN INTERVENTION AND CONTROL FACILITIES

	Total	Control	Intervention	p-value
	N=575	N=362	N=213	
Dignity: How satisfied were you with the level of respect the health worker showed?				0.084
No Respect	52 (9.0%)	27 (7.5%)	25 (11.7%)	
Respect	523 (91.0%)	335 (92.5%)	188 (88.3%)	
Autonomy / Shared Decision Making: How would you rate your experience of involved in making decisions for your treatment?				**<0.001**
No Autonomy	171 (29.8%)	128 (35.5%)	43 (20.2%)	
Autonomy	403 (70.2%)	233 (64.5%)	170 (79.8%)	
Confidentiality: Was privacy maintained throughout the duration of your treatment?				0.17
No	17 (3.0%)	7 (1.9%)	10 (4.7%)	
Yes	553 (96.2%)	352 (97.2%)	201 (94.4%)	
Don't know	5 (0.9%)	3 (0.8%)	2 (0.9%)	
Confidentiality: Were your medical records / history kept confidential?				0.21
No	8 (1.4%)	7 (1.9%)	1 (0.5%)	
Yes	502 (87.3%)	318 (87.8%)	184 (86.4%)	
Don't know	65 (11.3%)	37 (10.2%)	28 (13.1%)	
Confidentiality: How would you rate the way that the health facility ensured that you could talk privately to health care workers?				0.010
Limited Privacy	66 (11.5%)	32 (8.8%)	34 (16.0%)	
Privacy	509 (88.5%)	330 (91.2%)	179 (84.0%)	
Clear Communication: How often did the health worker explain things in a way that you could understand?				0.010
Unclear Communication	104 (18.1%)	54 (14.9%)	50 (23.5%)	
Clear Communication	471 (81.9%)	308 (85.1%)	163 (76.5%)	
Clear Communication: How often did the health worker give you time to ask questions?				0.10
Unclear Communication	145 (25.3%)	83 (23.0%)	62 (29.1%)	
Clear Communication	429 (74.7%)	278 (77.0%)	151 (70.9%)	

Clear Communication: How often did the health worker listen to you carefully?				0.003
Unclear Communication	79 (13.7%)	38 (10.5%)	41 (19.2%)	
Clear Communication	496 (86.3%)	324 (89.5%)	172 (80.8%)	
Choice of Provider: How would you rate the ease with which you could see a health care worker you were happy with?				**<0.001**
Not Easy	196 (34.1%)	150 (41.4%)	46 (21.6%)	
Easy	379 (65.9%)	212 (58.6%)	167 (78.4%)	
Choice of Provider: How would you rate the ease with which you could see a health care worker of a gender you preferred?				**<0.001**
Not Easy	198 (34.4%)	154 (42.5%)	44 (20.7%)	
Easy	377 (65.6%)	208 (57.5%)	169 (79.3%)	
Prompt Attention: How would you rate the length of wait time at the facility before you were seen?				0.17
Short Wait	300 (52.2%)	181 (50.0%)	119 (55.9%)	
Long Wait	275 (47.8%)	181 (50.0%)	94 (44.1%)	
Prompt Attention: How would you rate the reasonableness of distance and travel time to your home to this facility?				0.13
Not Reasonable	13 (2.3%)	9 (2.5%)	4 (1.9%)	
Reasonable	61 (10.6%)	47 (12.9%)	14 (6.6%)	

	Total N=575	Control N=362	Intervention N=213	p-value
Dignity: How satisfied were you with the level of respect the health worker showed?				0.084
No Respect	52 (9.0%)	27 (7.5%)	25 (11.7%)	
Respect	523 (91.0%)	335 (92.5%)	188 (88.3%)	
Autonomy / Shared Decision Making: How would you rate your experience of involved in making decisions for your treatment?				**<0.001**
No Autonomy	171 (29.8%)	128 (35.5%)	43 (20.2%)	
Autonomy	403 (70.2%)	233 (64.5%)	170 (79.8%)	
Confidentiality: Was privacy maintained throughout the duration of your treatment?				0.17
No	17 (3.0%)	7 (1.9%)	10 (4.7%)	
Yes	553 (96.2%)	352 (97.2%)	201 (94.4%)	
Don't know	5 (0.9%)	3 (0.8%)	2 (0.9%)	
Confidentiality: Were your medical records / history kept confidential?				0.21
No	8 (1.4%)	7 (1.9%)	1 (0.5%)	
Yes	502 (87.3%)	318 (87.8%)	184 (86.4%)	
Don't know	65 (11.3%)	37 (10.2%)	28 (13.1%)	
Confidentiality: How would you rate the way that the health facility ensured that you could talk privately to health care workers?				0.010
Limited Privacy	66 (11.5%)	32 (8.8%)	34 (16.0%)	
Privacy	509 (88.5%)	330 (91.2%)	179 (84.0%)	
Clear Communication: How often did the health worker explain things in a way that you could understand?				0.010
Unclear Communication	104 (18.1%)	54 (14.9%)	50 (23.5%)	
Clear Communication	471 (81.9%)	308 (85.1%)	163 (76.5%)	
Clear Communication: How often did the health worker give you time to ask questions?				0.10
Unclear Communication	145 (25.3%)	83 (23.0%)	62 (29.1%)	
Clear Communication	429 (74.7%)	278 (77.0%)	151 (70.9%)	

	Total	Control	Intervention	p-value
	N=575	N=362	N=213	
Basic Amenities: How would you rate the cleanness (clean, hygiene) of the health facility?				<0.001
Not Clean	130 (22.7%)	59 (16.4%)	71 (33.3%)	
Very Clean	443 (77.3%)	301 (83.6%)	142 (66.7%)	
Basic Amenities: How would you rate the waiting room of the health facility?				<0.001
Not Clean	110 (19.2%)	48 (13.3%)	62 (29.1%)	
Very Clean	464 (80.8%)	313 (86.7%)	151 (70.9%)	
Basic Amenities: How would you rate access to clean water at the health facility?				<0.001
Not Clean	138 (24.0%)	62 (17.2%)	76 (35.7%)	
Very Clean	436 (76.0%)	299 (82.8%)	137 (64.3%)	
Basic Amenities: How would you rate the cleanliness (clean, hygiene) of the toilets of the health facility?				<0.001
Not Clean	209 (36.4%)	98 (27.1%)	111 (52.1%)	
Very Clean	365 (63.6%)	263 (72.9%)	102 (47.9%)	
Basic Amenities: How would you rate the facilities for people with disabilities?				<0.001
Not Good	193 (34.1%)	78 (22.1%)	115 (54.0%)	
Very Good	373 (65.9%)	275 (77.9%)	98 (46.0%)	
Basic Amenities: How would you rate the smell in healthcare units?				<0.001
Not Good	96 (16.7%)	29 (8.0%)	67 (31.5%)	
Very Good	479 (83.3%)	333 (92.0%)	146 (68.5%)	
Basic Amenities: How would you rate access to soap and handwashing areas?				0.094
No Access	147 (25.6%)	84 (23.3%)	63 (29.6%)	
Very Good Access	427 (74.4%)	277 (76.7%)	150 (70.4%)	

TABLE 8. KEY FACILITATORS TO IMPLEMENTING THE GHI

Themes	Sub-themes/Nodes	Illuminating Quotes
Enablers to implementation (GHI Project)	A high level of project governance.	'*The key thing is that, one, we involved the Minister. We involved the Ghana Health Service and NCD. So even invitation to be to be a contributor to the guideline, those letters came from the ministry. So, the Director General. Yes, the Chief Director of ministry, he wrote the letters to the consultants and to all the stakeholder who were involved in the guideline. So it gave it that national flavour, a bit of national importance*.' (1)
		'*This governance committee it helped to bring out some of the voices outside government to tell them this is a good project that has to be supported. So the committee members, those are government representative on the committee actually carry out the message to the government and from there they had to support the project and I am sure it was a good thing they did*.'
	Working within the framework of the system and the existing structures.	'*What has made this possible has been that, initially they wanted to do something on their own in terms of the data side, but I think they aligned and saw that it makes sense with the national system. So that's what helped them. Because then it is sustainable*.' (03)
		'*Trying to work within the system is a plus, although I think that sometimes from the way they behave sometimes, you can sense sometimes their frustration in working within the system*.' (3)
		'*We are not creating a parallel system, so letters for even training, letters for facility to be part of, it was not coming from Ghana Heart Initiative, it was not coming from Juliette and Mariam, or from Fionn or any other person; it was coming from them. So, [the] letters were written by Minister of Health, letters were written by Director General of Ghana Health Service, letters were written by Regional Director; and so, we were facilitating*.' (1)
	Ownership	'*As a service we have taken up the intervention as our program, and we are implementing it*.' (5)
		'*So, we have experienced a lot of support for the implementation of the project and also ownership. So, they do know that it is their project and it's their responsibility to continue with the activities, and that has been clearly said by the Minister of Health in the statement at the launch*.' (4)

TABLE 9. GHI IMPLEMENTATION CHALLENGES VERSUS THE HEALTH SYSTEM'S BUILDING BLOCKS – SUMMARISED TABLE

Leadership / Governance	Complex health system	*"The health system in Ghana is a bit complex…"*
	Signing the Memorandum of Understanding (MoU) delayed	*"The initial delay was coming from the MoU. The MoU was supposed to be signed between [the] Ministry of Health, Ghana Health Service, and Korle Bu Teaching Hospital as the key national stakeholders and then GIZ on the hand. And each institution, Ghana Health Service has their own legal team, Korle Bu legal team, Ghana Health Service legal team, and then the Ministry of Health legal team. So, each unit, and they have to sign and it moves to the next institution. So, it is not like you give copies; you sign your part; it is one document you move from minister's side, they have to go through, make sure they are okay with the MoU and without the MoU there are certain activities you cannot implement. Then you can … spend two months just to have the MoU signed by the Minister of Health and you move to Ghana Health Service, the same process, same due diligence and then you move to Korle Bu Teaching Hospital. So, these are some of the things that delayed."*
	Interest and involvement in leadership	*"Once you have the commitment and the total buy-in of leadership they ensure that things are running. But if you have someone else in a leadership position that is not very committed or cardiovascular disease is not their topic, then you can see from the results from the facilities that it is very different. There are some facilities where the data collection is so accurate and, months on months we are receiving the data and there are some that are poor that the M&E [Monitoring & Evaluation] officer has to chase and chase and chase and make sure that this is working."*
		"I was telling you that if leadership is not committed for example, if I'm here and I'm not committed to ensure that DVT [Deep Vein Thrombosis] is managed in a particularly way it will never be implemented."
		"When you have trainings and some participants are not able to turn up because they didn't get the clearance to attend."
Human Resource	Staff attrition (turnover)	*"A lot of people that were trained during the pilot phase have been moved around. So, you try to contact some of these people and they are on study leave."*
		"Just recently whiles you are here doing the evaluation, if you ask for the list of our contact persons in the facilities, they have moved; last week I got call a from Elom, he said they are at the Ghana Police Hospital, and nobody seems to know [anything about the project], so the whole management of the Police Hospital has changed. So, our focal person from the Police Hospital now works with Korle Bu [Teaching Hospital]. The head of Police [Hospital], the administrator, everybody has changed and whoever Elom met didn't have a clue."
		"That's a great point [training institution and constant of providers], because you know, some of those we trained have left. We don't mind because they will take it away anywhere, we have to ensure that we keep the expertise on the ground, but it's a problem. And it's not only that, even rotation of nurses it's also a problem. Nurses going on leave it's also a problem."
	Stakeholder availability	*"My key challenge is always the scheduling. We have operational plan, we have a schedule, we want to do this at this time, is never happening because people just are not available."*
Medicines, Equipment and Vaccines		*"You also have situations where like the equipment that we provided, there were some facilities that were too impatient to wait for installation, tried to do that on their own and broke them. The equipment manager goes around routinely to check them."*
Others	Discrepancies between what is seen 'on the ground' and what is heard	*"There is a big gap, as you are implementing it…. On the table you plan that this [health] facility has this, this district has this and that, and you actually get to the [health] facility, get there and realize that no, there is nothing"*
	Bureaucratic (red tape) system	*"Bureaucratic hurdles we have also in the Ghanaian system, not only in the German system."*
		"Most people could not identify anything they can get personally from it; they were developing some cold feet towards the project [Ghana Heart Initiative]."

TABLE 10. SUMMARY OF THE KEY FACILITATORS AND THE BARRIERS / CHALLENGES TO IMPLEMENTING THE GHI

Facilitators	Themes / Nodes Identified
Health System Level	• A high level of project governance.
	• Working within the framework of the system and the existing structures.
	• Local ownership.
Barriers	
Health System Level	• Attrition of staff (human resources).
	• Complexity of the health system in Ghana.
	• Scheduling and availability of stakeholders.
	• Delay in signing the Memorandum of Understanding (MoU).
	• Leadership commitment and interest is not coherent.
	• No attendance by selected participants to training days.
	• Impatient – some facilities were keen on using equipment without adequate
	• Gaps between what is happening 'on the ground' and what you are told.
	• Red tape and/or bureaucracies.
	• Competing interests.
	• The internal politics of the departments / divisions within the Ghana Health Service.
Programme Level	• Sub-optimal entry / engagement by the Ghana Heart Initiative Programme Team.
	• The role of the Ministry of Health.
	• Lack of understanding of the structure of the Ghana Health System.
	• Buy-in and political ownership.
	• Managing stakeholder interests.
	• Health facility data collection.
	• Lack of counterpart funds from the Ghana Health Service.
	• Marketing and/ or communication about the Ghana Heart Initiative.
	• Red tape and/or bureaucracies.

TABLE 11. ADDITIONAL RESOURCE REQUIREMENT – HEALTH FACILITY SURVEY

PRIMARY LEVEL of CARE

ADDITIONAL RESOURCE REQUIREMENT (Sustainability) N (%)	**Control (n=24)**	**Intervention (N=25)**
Additional Health workers required for hypertension management	18 (75.0%)	21 (84.0%)
Additional Health workers required for CVD management	17 (70.8%)	22 (88.0%)
Additional Training required for hypertension management	22 (91.7%)	25 (100.0%)
Additional Training required for CVD management	21 (87.5%)	25 (100.0%)
Additional Equipment required for hypertension management	19 (79.2%)	19 (76.0%)
Additional Equipment required for CVD management	17 (70.8%)	19 (76.0%)
Additional Lab/diagnostics required for hypertension management	0 (0.0%)	24 (96.0%)
Additional Lab/diagnostics required for CVD management	0 (0.0%)	24 (96.0%)
Additional No. of health workers required for hypertension management		
Doctors	1.0 (1.2) (n=17)	2.8 (2.6) (n=21)
Nurses	4.5 (3.7) (n=17)	10.6 (12.5) (n=19)
Other health workers	2.5 (2.3) (n=17)	7.1 (7.7) (n=20)
Additional No. of health workers required for CVD management		
Doctors	1.2 (1.2) (n=16)	3.0 (2.5) (n=22)
Nurses	5.3 (4.3) (n=16)	10.0 (12.3) (n=20)
Other health workers	3.1 (2.4) (n=16)	7.6 (7.4) (n=21)

SECONDARY LEVEL of CARE

ADDITIONAL RESOURCE REQUIREMENT (Sustainability) N (%)	**Control (n=26)**	**Intervention (N=12)**
Additional Health workers required for hypertension management	23 (88.5%)	7 (58.3%)
Additional Health workers required for CVD management	23 (88.5%)	7 (58.3%)
Additional Training required for hypertension management	25 (96.2%)	12 (100.0%)
Additional Training required for CVD management	25 (96.2%)	12 (100.0%)
Additional Equipment required for hypertension management	22 (84.6%)	9 (75.0%)
Additional Equipment required for CVD management	22 (84.6%)	10 (83.3%)
Additional Lab/diagnostics required for hypertension management	0 (0.0%)	12 (100.0%)
Additional Lab/diagnostics required for CVD management	0 (0.0%)	12 (100.0%)
Additional No. of health workers required for hypertension management		
Doctors	3.7 (1.9) (n=23)	3.7 (3.1) (n=7)
Nurses	10.0 (6.9) (n=23)	14.3 (19.1) (n=7)
Other health workers	4.3 (2.8) (n=23)	6.0 (3.8) (n=7)
Additional No. of health workers required for CVD management		
Doctors	3.2 (1.8) (n=23)	3.7 (3.1) (n=7)
Nurses	9.2 (6.7) (n=23)	14.3 (19.1) (n=7)
Other health workers	5.0 (2.9) (n=23)	6.0 (3.8) (n=7)

TERTIARY LEVEL of CARE

ADDITIONAL RESOURCE REQUIREMENT (Sustainability) N (%)	**Control (n=5)**	**Intervention (N=3)**
Additional Health workers required for hypertension management	5 (100.0%)	1 (33.3%)
Additional Health workers required for CVD management	5 (100.0%)	1 (33.3%)
Additional Training required for hypertension management	5 (100.0%)	3 (100.0%)
Additional Training required for CVD management	5 (100.0%)	3 (100.0%)
Additional Equipment required for hypertension management	5 (100.0%)	3 (100.0%)
Additional Equipment required for CVD management	5 (100.0%)	3 (100.0%)
Additional Lab/diagnostics required for hypertension management	0 (0.0%)	2 (66.7%)
Additional Lab/diagnostics required for CVD management	0 (0.0%)	2 (66.7%)
Additional No. of health workers required for hypertension management		
Doctors	10.8 (10.9) (n=5)	5.0 (.) (n=1)
Nurses	12.0 (5.7) (n=5)	20.0 (.) (n=1)
Other health workers	11.6 (8.1) (n=5)	25.0 (.) (n=1)
Additional No. of health workers required for CVD management		
Doctors	11.0 (10.7) (n=5)	5.0 (.) (n=1)
Nurses	14.0 (8.2) (n=5)	20.0 (.) (n=1)
Other health workers	11.6 (8.1) (n=5)	25.0 (.) (n=1)

Patient Experience & Satisfaction Defined

The terms patient satisfaction and patient experience are often used interchangeably, but they are not the same thing. To assess patient experience, one must find out from patients whether something that should happen in a healthcare setting (such as clear communication with a provider) actually happened or how often it happened. Satisfaction, on the other hand, is about whether a patient's expectations about a health encounter were met. Two people who receive the exact same care, but who have different expectations for how that care is supposed to be delivered, can give different satisfaction ratings because of their different expectations. There is a total of 27 questions in the patient exit survey. To condense the information for each domain, we created a new variable that reduced the categories from 5 to 2, which the respondent rated for example: 'Not Good' or 'Very Good'. We opted to examine the responses in this categorical manner rather than as continuous averages because (1) Likert scales from very bad to very good are not truly continuous and (2) research shows that patients typically rate facilities favourably, and therefore the important distinction is achieving the very highest ratings. If a patient did not answer a given question, we took the per cent among the questions that were answered.

The patient experience and satisfaction domains are as follows:

- Overall experience (comprising 17 separate questions on dignity, autonomy, confidentiality, clear communication, choice of provider, prompt attention, and basic amenities)

- Overall satisfaction (comprising 7 separate questions)

Likert Scales

Likert Scales offer a range of answer options — from one opposing perspective to another using either five, seven or nine options. For example, two opposing perspectives on a Likert scale might range from, "not all satisfied" to "extremely disagree." Likert scales also need to include a neutral midpoint, "moderately satisfied" for respondents that do not hold a positive or negative opinion on a particular topic.

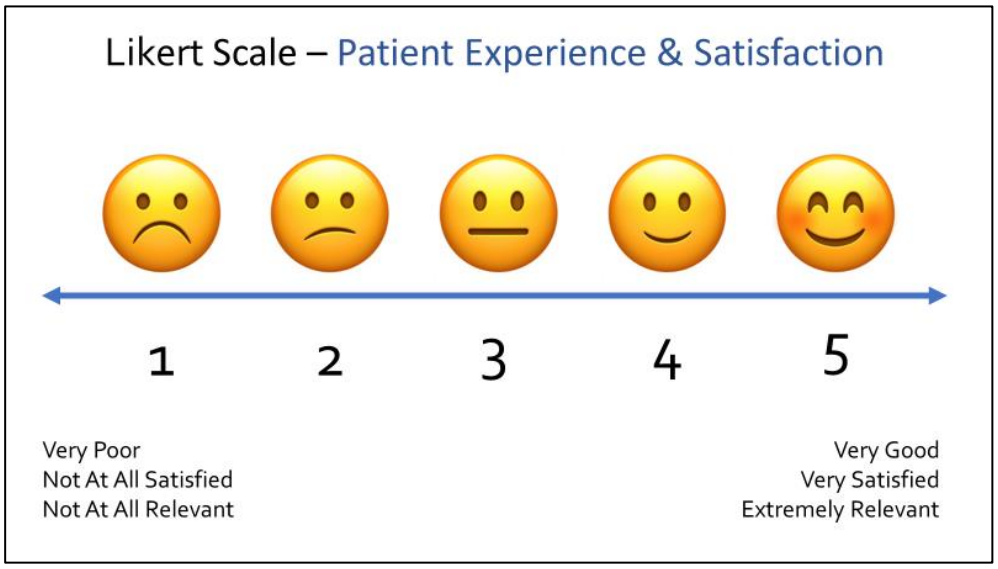
Example of one type of Likert Scale answer choices in the exit survey:

1—Not at all satisfied
2—Slightly satisfied
3—Moderately satisfied
4—Very satisfied
5—Extremely satisfied

Likert scales allowed us to uncover degrees of opinion that can make a difference in understanding the feedback we are getting and can help the GHI team pinpoint the areas where they might want to improve health services in facilities. For example, when we asked a heart disease patient whether or not they received quality health services, we may have received a response indicating the degree to which they received quality health care, providing the programme team with valuable information as to how to strengthen the health facilities.

Figure 7 is an example of the image that was provided to the respondents prior to answering the measures, indicating which Emoji should be selected to provide their intended response.

Likert scale with emojis



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