

Models for Integrated HIV-Hypertension Care: Comparative Analysis of Six Integration Approaches from Implementation Research Projects Across Africa

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Abstract

Introduction: In 2020, the National Heart, Lung and Blood Institute formed the Heart, Lung, and Blood Co-morbidities Implementation Models in People Living with HIV (HLB SIMPLe) Alliance, funding implementation research projects in six countries in Africa including Botswana, Mozambique, Nigeria, South Africa, Uganda and Zambia to test diverse models for integrating hypertension services into routine HIV care. We describe key similarities and differences amongst the integration models.

Methods: This sequential explanatory mixed-methods study used online structured questionnaires and meetings to gather quantitative and qualitative data from each project. Integration was defined as the delivery of HIV and hypertension care concurrently for people living with HIV, specifically across the WHO health system building blocks: service delivery (care delivered at the same time/same location), health workforce (same team of healthcare providers), health information systems (merging of information systems), access to essential medicines (medications for both HIV and hypertension in the same pharmacy), and health financing (integrated funding). Data were analyzed using descriptive statistics and rapid deductive content analysis. We then used this data together with the WHO Health System Building Blocks framework to describe HIV-hypertension integration models across key aspects of the health system.

Results: All models fully integrated service delivery and health workforce, often using task sharing to address workforce shortages. Full integration of health information systems was observed in 5/6 projects, and integrated access to essential medication in all projects. Integration occurred at the primary healthcare level and excluded complicated hypertension cases. Only 2/6 projects had integrated health financing for HIV/hypertension care.

Conclusions: This examination highlights high convergence in the design of HIV and hypertension care integration models across WHO Health System Building Blocks despite different study settings, with the main difference being divergent mechanisms of health financing for integrated HIV/hypertension care. Lessons learned will help develop a core set of guidelines for building country-specific models for integrating hypertension and HIV care across different African settings.

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Background

HIV continues to be a serious public health issue, with an estimated 39.9 million people living with HIV (PLWH) worldwide, over half (52%) living in Africa [1]. The scale-up of antiretroviral therapy (ART) has been immensely successful, transforming HIV from a life-threatening condition to a manageable chronic disease with life expectancy now comparable to that of the general population [2, 3]. However, due to inflammation and activation of the innate and adaptive immune responses amplified by chronic HIV, PLWH are developing other chronic conditions, such as hypertension and cardiovascular disease (CVD), at rates higher than the general population [4–6]. Addressing hypertension, a modifiable contributor of CVD, is an important step towards reducing excess CVD morbidity and mortality among PLWH [7, 8].

This more common multi-morbidity has led to a push for integrated health care to address gaps in access to effective care [9–11]. Recent WHO guidelines define integrated care as high-quality comprehensive health services delivered by multidisciplinary teams throughout the life course of an individual with the goal of using resources effectively and strengthening people-centered health systems [12, 13]. In practice, researchers in Port-au-Prince, Haiti [14], Uganda [15–18], Tanzania [18], and Kenya [16, 17] integrated hypertension care into existing HIV clinics [14, 15], or created distinct chronic disease clinics [16–18]. In most studies, integration of HIV and CVD care improved hypertension and CVD outcomes, access to HIV services, reduced HIV stigma, and improved ART adherence [9, 10]. WHO guidelines now recommend that HIV care be integrated with hypertension, diabetes, and mental health services, however there is limited guidance on how to achieve this integration and which strategies may be most effective for supporting implementation [12, 19, 20]. With the abrupt disruptions to global HIV funding commitments in early 2025 and concerns about sustainability of vertical single-disease programs, many countries are urgently grappling with the most effective ways to integrate HIV and general primary health systems, including hypertension care.

In 2020, the National Heart, Lung and Blood Institute formed the **Heart, Lung, and Blood Co-morbidities Implementation Models in People Living with HIV** (HLB SIMPLe) Alliance [21] to support implementation research studies in six countries [22–27]. The Alliance’s primary objective was to assess how effective different models of HIV-hypertension integration were across diverse low- and middle-income (LMIC) settings at improving clinical outcomes. Each project independently developed and applied a context-specific integration model, tailored to the available resources, the HIV service delivery structure and national health system context. HLB-SIMPLe included two phases: 1) UG3: development and pilot testing strategies/model to achieve integrated HIV and hypertension care, and 2) UH3: implement and test UG3 strategies in real-world settings.

The objective of this study is to characterize and compare each country project’s model of integrated HIV and hypertension care developed in the UG3 phase. The WHO Health System Building Blocks framework was chosen to provide a comprehensive organization of key healthcare system components and a basis for comparison [28]. Insights from this study are important to identifying integration models and strategies for HIV and hypertension that can improve patient outcomes and resource allocation in LMICs.

Methods

Overview of Study Design and Methods

We designed a sequential explanatory mixed methods study using online structured questionnaires to collect quantitative data from each HLB SIMPLE Alliance project, followed by meetings with co-authors from different projects to gather qualitative data to better understand similarities and differences observed in the quantitative data. Quantitative and qualitative data were synthesized into a cohesive narrative using the WHO Health Systems Building Blocks framework. This study was conducted by the Dissemination and Implementation (D&I) Committee of the HLB SIMPLE Alliance with representatives from each of the six HLB-SIMPLE projects and the HLB-SIMPLE Research Coordinating Center.

Study Setting

Integration of HIV and hypertension services occurred in the HIV public primary health care setting in Zambia - TASKPEN [26], Uganda – PULESA [22], South Africa – iHEART-SA [23], Mozambique – SCALE-SAIA-HTN [24], Nigeria – MAP-IT [25], and Botswana - InterCARE [27]. Three projects (InterCARE, PULESA, TASKPEN) integrated hypertension services into pre-existing HIV clinics and one (MAP-IT) integrated hypertension services into a general primary care clinic. Two projects were conducted in settings where HIV and hypertension care were already integrated (SCALE-SAIA-HTN, iHEART-SA). These two projects focused on strengthening and sustaining integrated care to ensure high-quality and comprehensive care for PLWH and hypertension [29, 30].

Study Population

Primary data collection involved questionnaires and meetings with co-authors representing each of the six projects.

Data Collection

We used the WHO Health System Building Blocks to design the questionnaire and as an analytical framework to describe integrated care across models. This framework is comprised of six core components of a health system, adapted and defined as follows: 1) *Integrated service delivery* as the co-localization of HIV and hypertension care delivery at the same primary healthcare location at the same time. 2) *Integrated health workforce* as HIV and hypertension care administered by the same healthcare provider team (physician [completed medical school and residency], medical officer [MO - completed medical school and an intern year], or advanced practice providers [APP - prescribers under supervision of a physician or MO] and nurses, community health workers (CHWs) and ancillary staff). 3) *Integration of health system financing* as hypertension and HIV care and medications funded by the same entity. 4) Integrated medical products, vaccines, and technology was narrowed to *integrated access to essential*

medications and/or basic equipment, as the disbursement of both HIV and hypertension medications at the same pharmacy. Finally, 5) *integration of health information systems* as use of the same medical record to document both HIV and hypertension clinical history, physical exams, and management plans. 6) *Integration within leadership and governance* across the health system was beyond the scope of the projects (Table 1).

Table 1
Integration Intervention Models by Project

Project	WHO Health System Building Blocks addressed	Evidence-based Implementation Interventions for Individuals Living with HIV and Hypertension
Integrating hypertension services into primary care HIV clinics		
InterCARE [27] (Botswana)	-Health workforce -Service delivery -Access to basic equipment -Health information systems	Four core strategies: 1) Healthcare provider training and coaching in hypertension diagnosis and management 2) Modification of the electronic health record to enhance hypertension and cardiovascular disease care 3) Provision of basic equipment (such as blood pressure monitors) and hypertension guidelines 4) Support from treatment partners (education and counseling) for hypertension
PULESA [22] (Uganda)	-Health workforce -Service delivery -Health system financing -Access to medications	Randomization into one of two core models using the following strategies in each model: A) Hypertension Basic: consistent access to diagnostic equipment and three evidence-based antihypertensive drugs free to hypertensive patients B) Hypertension-plus: Hypertension-Basic plus more intensive activities for clinic staff including training on Hypertension management, differentiated service delivery, remote patient monitoring and a performance improvement program
TASKPEN [26] (Zambia)	-Health workforce -Service delivery -Access to medications -Health information systems	Adapted version of WHO Package of Essential Non-Communicable Disease (NCD) with five core strategies: 1) Co-location of Hypertension and HIV services (participants were able to access care for both conditions at the same place in the same visit) 2) Training non-physician healthcare workers to accurately measure, diagnose, categorize hypertension, diabetes, and dyslipidemia. 3) Adapting the electronic medical records used at HIV clinics to include data collection fields and decision support for NCDs. 4) Strengthen lab point of care systems for diabetes and dyslipidemia diagnosis and monitoring. 5) Work with the Zambia Ministry of Health to improve tracking and delivery of NCD medications to the ART clinics.

Project	WHO Health System Building Blocks addressed	Evidence-based Implementation Interventions for Individuals Living with HIV and Hypertension
Integrating hypertension services into primary health centers		
MAP-IT [25] (Nigeria)	-Health workforce	Using practice facilitation to implement a task-shifting strategy (nurses) to integrate hypertension management and treatment into primary health centers
Optimizing hypertension services in already fully integrated primary care clinics		
SCALE SAIA-HTN [24] (Mozambique)	-Service delivery	An evidence-based implementation strategy that combines system engineering tools into a multi-step, facility-level package to give clinic staff and managers information on system-wide service delivery and tools to identify and prioritize areas of improvement and to test workflow modifications to achieve optimized hypertension care delivery
iHEART-SA [23] (South Africa)	-Health workforce -Service delivery -Health information systems	Five core strategies 1) Identifying and preparing champions (clinic care coordinators) to support and drive implementation of hypertension screening and treatment 2) Training healthcare workers to measure, diagnose and treat hypertension 3) Providing patient education 4) Improving clinic flow to reduce wait times 5) Incorporating information systems to ensure the new processes listed above are being followed

Online questionnaires included questions across five WHO Health System Building Blocks about the integrated care model designed by each study (Appendix). Online questionnaires were e-mailed to study Principal Investigators (PIs) in early May 2024. PIs identified the appropriate study team member to fill out each questionnaire. Each questionnaire was identified by country but the individual filling out the questionnaire remained anonymous to those conducting the study.

During an in-person late May 2004 HLB SIMPLe D&I Committee meeting including members from all projects, questionnaire results were reviewed and responses were clarified. Additionally, a list of follow-up questions was created to better understand each integration model based on feedback and queries raised from the meeting (Appendix). Virtual zoom meetings were scheduled with each co-author (representing each individual project team). Two researchers (two physician-scientists PG and AM) led semi-structured discussions on the selected five WHO Health System Building Blocks in usual care and integration intervention models. Meetings were conducted in English from June-August 2024 and were audio-recorded and transcribed to capture each integration model in detail.

Data Analysis:

Questionnaire responses were summarized using descriptive statistics. The percentage of projects that integrated services within each WHO building block was reported. Two investigators (PG, AM) reviewed all the transcripts and conducted a rapid deductive content analysis of the meeting transcripts [31]. A template was tested for usability and relevance during a D&I Committee Meeting. Two investigators (PG and AM) divided the transcripts and entered summarized data directly into the template. Both analysts reviewed all recorded interviews and transcripts, discussed summarized data and reached consensus on points of disagreement through frequent discussions. The findings were discussed amongst D&I Committee members and the templates were transferred into tables and figures. Study participants provided feedback on the findings of the qualitative analysis.

Mixed methods data integration was conducted throughout the process of data collection and analysis [32]. During qualitative interviews, responses from the quantitative questionnaire were reviewed with the interviewee to provide direct clarification, feedback, and expansion on the pre-identified WHO Building Block themes. During analysis, similarities and differences between project models were also highlighted and qualitative data was used to further explain and expand on the quantitative data collected. Findings were reviewed with the co-authors to validate the results. We adhered to the GRAMMS checklist to report mixed methods results in this manuscript [33, 34].

Results

Six questionnaires and seven meetings (two for iHEART-SA) were completed.

Integration Models

The definition of integration within each WHO Health Systems Building Blocks was consistent across projects (Table 2). Similar strategies to achieve integration were used by many projects to strengthen health workforce including practice facilitation [22, 25, 27], task shifting [25–27], and provider training [22, 23, 27]. PULESA prioritized integrated health system financing and access to medications [22, 35, 36]. Unique to SCALE-SAIA-HTN, integrated service delivery was optimized using an iterative quality improvement strategy that included clinic staff identifying and prioritizing areas of improvement and testing out workflow modifications [24] (Table 1).

Table 2

Models of Integration of HIV and hypertension services as designed by each of the six projects using the WHO Health Systems Building Blocks Framework

WHO Building Blocks	Defined Integration Model	Integration Model Operationalized
Health Workforce	-Same prescribing provider or clinical team for uncomplicated hypertension and HIV	-All six projects had the same prescribing provider for hypertension and HIV ⁺⁺ -All six projects included nonclinical staff* as part of the clinic team to provide for routine hypertension screening and follow-up blood pressure measurement ⁺⁺
Service Delivery	-Same clinic, same visit for HIV and hypertension care	-3 projects (InterCARE, PULESA, TASKPEN) added hypertension services to stand-alone HIV clinics [#] -3 projects (iHEART-SA, SCALE-SAIA-HTN, MAP-IT) delivered HIV and hypertension together in the general primary care clinic ⁺
Access to Medications	-Access to essential medications with same disbursement pharmacy for HIV and hypertension medications	-All six projects dispensed HIV and hypertension medications through the same pharmacy ⁺⁺ -The option to fill either HIV or hypertension medications at different local pharmacies was also available at participating study clinics (InterCARE, SCALE-SAIA-HTN and only HIV medications for iHEART-SA) ⁺
Health System Financing	-Using same procurement method (financing source) for both HIV and hypertension care and medications	-Two (InterCARE, iHEART-SA) projects had pre-existing integrated public sector financing and procurement for both HIV and NCD medications and care delivery ⁺ -Four (SCALE-SAIA-HTN, MAP-IT, PULESA, TASKPEN) projects leveraged public/private partnerships for funding integrated hypertension care ⁺⁺ -Two (PULESA, TASKPEN) projects used study funding to ensure access for hypertension medications [#]
Health Information Systems	-Use of the same medical record to document both HIV and hypertension clinical data and management plan	-Five projects used the same medical record to document both HIV and hypertension management ⁺⁺ (2 electronic health records (InterCARE, SCALE-SAIA-HTN), 1 paper and electronic (TASKPEN), 2 (MAP-IT, PULESA) paper records)

⁺Existing infrastructure was also optimized

#New infrastructure added for the projects

*In addition to nurses in usual care for InterCARE, MAP-IT, TASKPEN, PULESA, nonclinical staff such as lay workers, CHWs and nurse assistants were included in integrated care. However, to assist in data collection, iHEART-SA included study nurses.

WHO Health System Building Blocks

*MO: Medical Officer, APP: advanced practice provider – prescribers such as nurse practitioners (focused on adults), clinical officers, and medical technicians under the supervision of a medical officer or physician

Health workforce

Four projects expanded workforce for screening by task sharing to lay workers and CHWs and/or task shifting to nurses for initial management of hypertension (InterCARE, PULESA, MAP-IT, TASKPEN) to achieve integrated care. Before and during the intervention period, referrals to MOs, physicians, or APPs occurred for uncontrolled hypertension in all projects (Appendix).

In qualitative interviews, task shifting emerged as important to strengthen the health workforce and expand access to hypertension care delivery. Existing CHWs and community organizations strengthened screening and linkage to care (MAP-IT). TASKPEN, PULESA, and InterCARE used lay workers trained on the job, CHWs with basic formal training, and volunteers (peers) to perform hypertension screening and support patients in the integrated intervention. In InterCARE and MAP-IT, nurses who often staffed primary care clinics without additional support, were empowered to treat uncomplicated hypertension in the intervention compared to usual care (Fig. 1).

Service Delivery

In four projects (MAP-IT, PULESA, InterCARE, TASKPEN), prior to the intervention, HIV and hypertension services were provided separately. During the intervention, all projects provided HIV and initial hypertension services (screening, diagnosis, initial treatment, refills for controlled hypertension) in the same clinic visit. For complicated hypertension (patient on more than three medications), or complications due to hypertension, patients were referred to tertiary level care for further management.

In qualitative interviews, integration was described in detail. For MAP-IT, due to staff limitations at primary health care facilities, prior to the intervention, hypertension diagnosis, treatment and refills were only available at secondary care centers. During the intervention, with task shifting these services were provided along with HIV services in primary care settings by nurses (Fig. 1).

Access to Medications

In usual care, there was no consistent model for disbursement of hypertension and HIV medications amongst projects. Only three projects (iHEART-SA, InterCARE, SCALE-SAIA-HTN) disbursed hypertension and HIV medications at the same pharmacy (Fig. 2). Stock outs were common in three projects (SCALE-SAIA-HTN, TASKPEN, PULESA). In integrated care, all projects supported the disbursement of hypertension and HIV medications at the same pharmacy. Stock outs became less frequent except in SCALE-SAIA-HTN.

Qualitative interviews highlighted that patients who could afford to, purchased hypertension medications at external pharmacies when stock outs occurred. Additionally, while HIV medications were free, hypertension medications were out of pocket in usual care for most projects (except InterCARE and iHEART-SA). In integrated care, all projects strengthened medication access by ensuring all medications were available in the same pharmacy at low or no cost.

Health System Financing

In usual care, HIV and hypertension clinic visits were paid for by the government for five projects. HIV medications and hypertension medications were paid for fully by the government in two projects (InterCARE and iHEART-SA) in usual care and the intervention period. For the remaining projects, medications were paid for by a combination of the government/state, NGOs, pharmaceuticals and patients (Fig. 2). To achieve a model of integrated care, most projects did not change existing health system financing. However, PULESA leveraged an existing pharmaceutical program [35] to provide access to antihypertensives, and when this program closed, continued to procure generic medications at a relatively higher cost. TASKPEN supplemented medicines using a buffer stock when usual supplies ran out. The iHEART-SA study added study-funded staff (nurses and research assistants) to perform initial blood pressure and vitals measurements.

Health Information Systems

From usual care to integrated care, the use of the same health record system for HIV and hypertension increased from three (2 paper, 1 electronic and paper) to five projects (2 electronic, 2 paper, 1 both electronic and paper) (Fig. 2). Most projects had some form of referral system between primary centers and secondary and tertiary centers, often in the form of letters. This process was not modified by any of the integration interventions.

Qualitative interviews highlighted electricity and internet outages as barriers to consistent usage of an electronic health record (EHR). For SCALE-SAIA-HTN and iHEART-SA, the EHR was used as a tool for data collection and to generate country/district reports to guide quality improvement initiatives. It was not used by clinicians for medical decision making. InterCARE optimized the EHR for clinician documentation and medical decision making. Projects using EHRs increased uptake and optimization of existing systems, but did not build new systems.

Discussion

We describe six integration models of HIV and hypertension care that are currently being studied in African settings through the NHLBI-funded HLB SiMPLe Alliance [21–27]. Projects used similar strategies to prioritize models that integrated care HIV and hypertension care within the WHO Building Blocks of medication disbursement, health workforce and service delivery. A major challenge to achieving consistent integration of HIV and hypertension care was ensuring a consistent and integrated source of health system financing.

Our findings were consistent with other studies (e.g., INTE-AFRICA, SEARCH) that also defined integrated care through the lens of integrated service delivery (same waiting room, same clinic visit for both hypertension and HIV), health workforce (same prescriber and clinical team managing both hypertension and HIV), and medication disbursement (same pharmacy) [14, 16–18, 37].

Similar to our study, multiple studies identified challenges with integrating health system financing for HIV and hypertension, a critical component to achieving full integration [9, 38–40]. In 2021, almost half of countries in Africa relied on external funding for more than a third of their health expenditures [41]. While HIV has historically received high levels of funding both from domestic and international sources, it was estimated that this funding was 29.3 billion dollars short in 2025 of the funding needed to control HIV/AIDS even before major cuts were made to USAID and PEPFAR [1]. The changing, uncertain funding landscape internationally adds an additional strain in obtaining sufficient funding for consistent access to the medications and equipment needed to achieve full integration of HIV and hypertension care delivery. Medication affordability, particularly, is a major barrier to hypertension treatment persistence and, unless addressed, threatens scale-up and effectiveness of integrated hypertension treatment programs (2). Providing antihypertensives and study staff to take vitals through study funding (e.g., PULESA, iHEART-SA) helped with implementation fidelity. However, for real-world implementation and scale up of the integrated models, countries where medications are not readily accessible or staffing is limited will require more stable, long-term funding sources from the government, NGOs or public-private partnerships to provide medications at a subsidized rate to patients and increase staffing.

Overall, the projects in the HLB SiMPLe Alliance ranged in their generalizability, a natural tension in implementation science trials, often dependent on setting of implementation and local resource availability. Though, as many of the projects in this study have done, leveraging existing HIV infrastructure and resources and choosing practical implementation strategies may be the most feasible way of meeting the funding and infrastructural needs of treating hypertension in PLWH and maintaining integration after the study period [38].

In regards to implementation strategies, our study does not delve deeply into the implementation strategies used by different projects to achieve integration (reported in separate publications), but common trends emerged. Capitalizing on successful strategies employed for HIV care, task shifting was broadly used across projects [42, 43]. Task shifting is a widely used method of providing counseling [44] and prescribing ART to improve access to care for HIV [45–47]. There is growing evidence of the benefits of task shifting for hypertension and CVD [48, 49]. Many projects in our study used ancillary staff,

volunteer and paid lay workers to improve screening for hypertension, and trained nurses to strengthen uncomplicated hypertension management for PLWH and hypertension. This is similar to the approach used by the SEARCH study in Uganda and Kenya to facilitate integration, which used a nurse-driven triage system to tailor visits and follow-up that included appointment reminders, telephone access to clinicians, and flexible clinic hours to reduce patient level barriers [17]. To facilitate task shifting, the implementation strategy of practice facilitation, the use of coaches or experts involved in tailored training and support, was also used across projects [25, 43].

Community and Ministry of Health (MoH) engagement were commonly used strategies to guide integration model development, and to strengthen and to deliver the integrated interventions. In MAP-IT, community engagement and the use of case managers and community health extension workers was central to achieving integrated care and improving quality of care delivery [50] [51]. Though, scale up of paid and continued engagement of unpaid lay workers may also be challenging without stable financing from the government, NGOs or public-private partnerships.

Finally, the use of an iterative improvement strategy at the clinic level as used in the SCALE-SAIA-HTN project can improve clinic and system readiness to integrate services and support scale up of integration. The building blocks of the health system are continuously in flux so systems thinking powered by quality improvement can support health system resilience and continued innovation. This allows integration to continue to improve and also adjust to the always changing local context [52].

Strengths and Limitations

Strengths of this study were the use of both questionnaires and semi-structured qualitative interviews to better understand the nuanced differences between models and the impact of environmental and logistical factors on the components of each model. Another strength was the HLB SIMPLE research community's participation (D&I Committee) and representation from each project in designing the study and study tools. Finally, the use of the WHO Building Blocks Framework provided an appropriate and effective outline to organize and describe similarities and differences in models of HIV and hypertension integration. This framework is used widely to design, summarize and evaluate health systems strengthening initiatives. The use of this framework provides a basis for creating a uniform and reproducible model(s) of integration of HIV and hypertension care with comprehensive inclusion of the key structural components of a healthcare system [53].

A major limitation of this study was not fully evaluating leadership and governance. This building block is fundamental to maintenance and scale-up of each integration intervention. However, most projects engaged with local and/or national leadership and governance at every step of designing and getting approval for their projects. We hope to collect more data on this engagement in future work with the HLB SIMPLE Alliance.

In this study we describe the intended care models, but are not able to provide data on whether these models were implemented as intended, the degree of integration attained, or the strategies that were

used to achieve and improve integration. Each project will publish this information individually as trials are completed. As individual trials are reported, additional frameworks such as the Rainbow model [54] and the Comprehensive Health Integration Framework [55] put forth recently by SAMHSA will be useful to evaluate integration quality and the degree of integration actually achieved across levels of the health system. These evaluation frameworks will also help detail the strategies used to achieve integration, explain the mechanisms by which integration happens, and describe how health systems adapt integrated care models in real-world settings [49].

Conclusion

Our study highlights high convergence in how six implementation projects from diverse settings with differing baseline resources defined integrated care across half of the WHO Health Systems Strengthening Building Blocks. Implementation projects diverged the most for health systems financing. And, while projects were similar in describing what was being integrated, they varied in which implementation strategies were used to achieve integration. Each project adapted to the local context, a process that dictated the design of each implementation science project and integrated care model. Lessons learned from these models could help develop a common framework identifying feasible and essential building blocks for integrating NCD care into HIV programs in different (and possibly diverse) African contexts.

Abbreviations

- APP: advanced practice provider
- ART: antiretroviral therapy
- CHW: community health workers
- CVD: cardiovascular disease
- D&I: dissemination and implementation
- HIV: human immunodeficiency virus
- HLB SIMPLE Alliance: Heart, Lung, and Blood Co-morbidities Implementation Models in People Living with HIV immunodeficiency virus
- MO: Medical Officer
- WHO: World Health Organization
- PLWH: people living with HIV

Study Acronyms:

- iHEART-SA (South Africa): Integrating HIV and hEART health in South Africa
- InterCARE (Botswana): Integrating Hypertension and Cardiovascular Care into Existing HIV Services Package

- MAP-IT (Nigeria): Managing Hypertension Among People Living with HIV: an Integrated Model
- PULESA (Uganda): Pressure Urgent Living Experience Strengthening Alliance
- SCALE-SAIA-HTN (Mozambique): Scaling Out and Scaling Up the Systems Analysis and Improvement Approach to optimize the Hypertension
- TASKPEN (Zambia): Task-shifted Adaptation of the WHO PEN package

Declarations

Ethics approval and consent to participate

This study was carried out by the D&I Committee within the HLB SIMPLe Alliance and collected information from Alliance investigators about each project's model. Each individual project received local institutional review board (IRB) ethics approval and research for the parent UG3/UH3 trials was performed in accordance with the Declaration of Helsinki. This study was not designated as human subjects research. Team members from each of the studies were interviewed, but the focus was on understanding the care models themselves, not individual opinions or perspectives.

Individual Project IRB Approval

- **Botswana:** Approved by the University of Botswana (UB) IRB and Botswana Ministry of Health Research and Development Committee (HRDC)
- **South Africa:** Approved by the Research Committee of Johannesburg Health \District and the University of the Witwatersrand Human Research Ethics Committee (Medical)
- **Zambia:** Approved by the University of North Carolina IRB, the University of Zambia Biomedical Research Ethics Committee, and the National Health Research Authority of Zambia
- **Mozambique:** Approved by the Universidade Eduardo Mondlane Maputo Central Hospital IRB and the University of Washington in Seattle, USA
- **Uganda:** Approved by the Makerere University School of Medicine Research Ethics Committee and the Uganda National Council for Science and Technology
- **Nigeria:** Approved by NYU Grossman School of Medicine (NYUGSOM) and the Nigerian Institute of Medical Research (NIMR) Institutional Review Boards (IRB)

Consent for publication

Not applicable

Competing interests

No conflicts of interests declared for all authors.

Availability of data and materials

Data available on request from the authors.

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Authors' contributions:

The study was designed and implemented by PG, AM, MH, and LH. PG, AM, and MH collected data and PG, AM, MH, CO, LH analysed and interpreted the data. PG and AM wrote the first draft. MH, CO, SG, KG, SLE, JK, DH, GM, AA, AK, FS, and LH reviewed drafts and provided critical feedback. PG and AM revised the manuscript and wrote the final draft.

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Figures

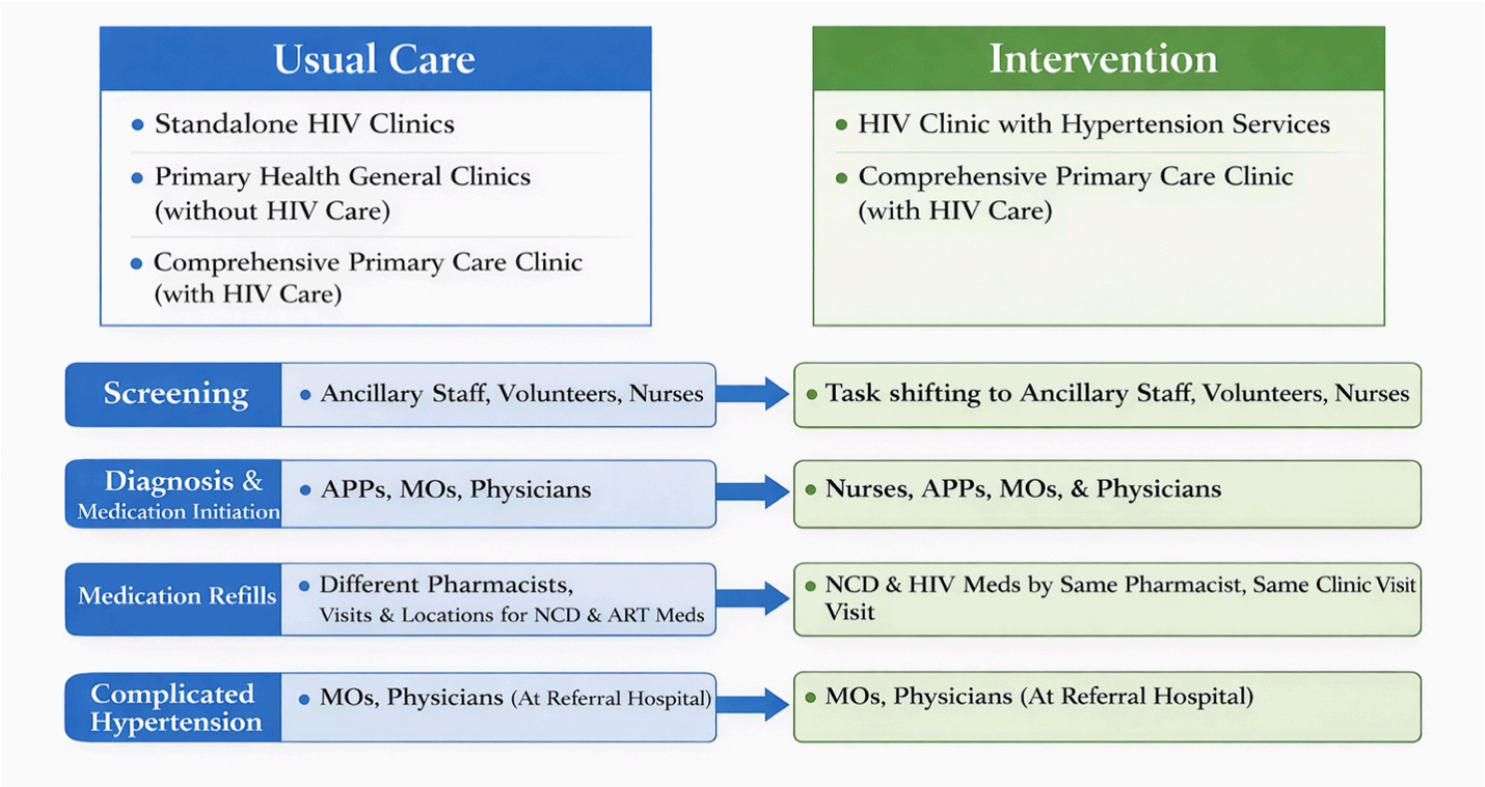


Figure 1

Summary of Integration of Service Delivery and Healthcare Workforce for All Six Projects

*MO: Medical Officer, APP: advanced practice provider – prescribers such as nurse practitioners (focused on adults), clinical officers, and medical technicians under the supervision of a medical officer or physician

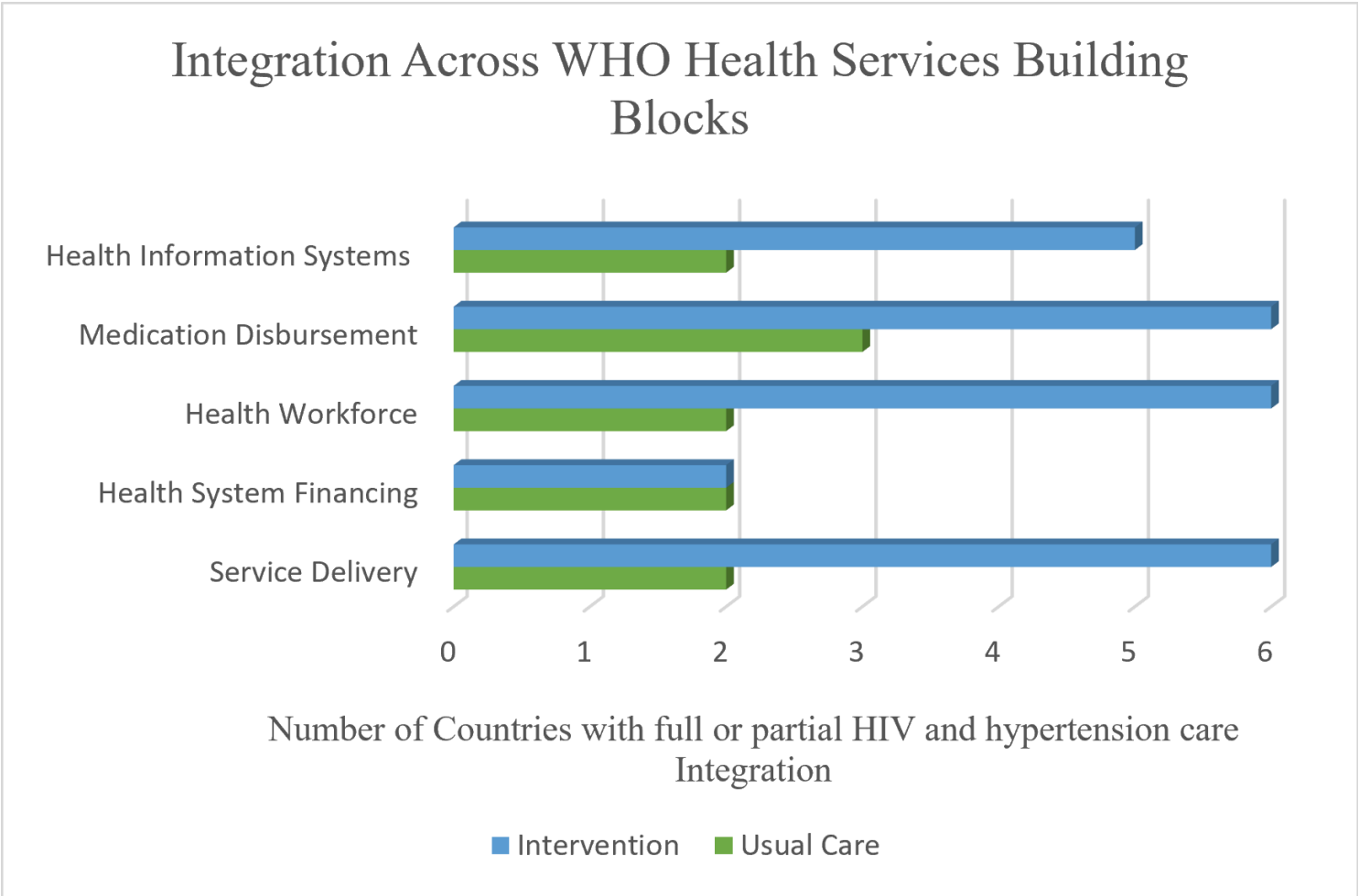


Figure 2

Integration across WHO Health Services Building Blocks

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