

## Review

# Non-communicable diseases and HIV care and treatment: models of integrated service delivery

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## Abstract

**OBJECTIVES** Non-communicable diseases (NCD) are a growing cause of morbidity in low-income countries including in people living with human immunodeficiency virus (HIV). Integration of NCD and HIV services can build upon experience with chronic care models from HIV programmes. We describe models of NCD and HIV integration, challenges and lessons learned.

**METHODS** A literature review of published articles on integrated NCD and HIV programs in low-income countries and key informant interviews were conducted with leaders of identified integrated NCD and HIV programs. Information was synthesised to identify models of NCD and HIV service delivery integration.

**RESULTS** Three models of integration were identified as follows: NCD services integrated into centres originally providing HIV care; HIV care integrated into primary health care (PHC) already offering NCD services; and simultaneous introduction of integrated HIV and NCD services. Major challenges identified included NCD supply chain, human resources, referral systems, patient education, stigma, patient records and monitoring and evaluation. The range of HIV and NCD services varied widely within and across models.

**CONCLUSIONS** Regardless of model of integration, leveraging experience from HIV care models and adapting existing systems and tools is a feasible method to provide efficient care and treatment for the growing numbers of patients with NCDs. Operational research should be conducted to further study how successful models of HIV and NCD integration can be expanded in scope and scaled-up by managers and policymakers seeking to address all the chronic care needs of their patients.

**keywords** healthcare delivery, HIV services, integration, models of HIV care, non-communicable diseases

## Introduction

While HIV continues to be a global health priority, non-communicable diseases (NCDs), such as diabetes, cardiovascular disease and cancer, have been recognised as a growing source of morbidity and mortality in low-income countries. NCDs cause 36 million deaths annually; 80% of these deaths occur in low-income countries [1]. NCD prevalence is expected to increase significantly and may exceed communicable diseases as the most common causes of death worldwide by 2030 [2]. As people living with HIV (PLHIV) in low-income countries are living longer due to successful

ART treatment, NCDs have become a leading cause of morbidity for this population [1]. While data on comorbidity rates are scarce, some studies have found a higher incidence of NCDs among PLHIV than HIV-negative patients [3, 4]. This rising comorbidity presents a threat to progress achieved in reducing global mortality due to HIV.

The success of antiretroviral treatment (ART) in decreasing mortality has resulted in a growing number of PLHIV in low-income countries over 50 years of age who are at risk for developing chronic NCDs [5]. According to the Joint United Nations Programme on HIV/AIDS, in 2012, an estimated 2.9 million people over 50 were HIV-

positive and living in low-income countries [6], few of which have the resources or capacity to address this growing need effectively [7]. In most low-income countries, NCDs are managed episodically placing patients at risk for long-term complications and death [8, 9]. In comparison, patients who have access to long-term care and treatment to manage NCDs experience reduced morbidity and mortality [10]. In contrast, HIV programmes have demonstrated success in establishing longitudinal care models, which focus on continuity and retention, routine monitoring and healthy lifestyle promotion, care attributes necessary to achieve successful outcomes for both NCDs and HIV [9, 11–13]. Integration of NCD and HIV services could capitalise on the foundation built with HIV treatment scale-up to improve the quality and efficiency of care and treatment for NCDs among PLHIV. Integration may also increase retention in care for HIV/NCD patients through reduced appointment frequency, reduce neglect of other health needs that often are ignored through vertical programme implementation, and may be more cost-effective as resources are shared instead of siloed and better suited to comprehensively address the multiple needs of patients [12, 14–16].

WHO has recently called for integrated people-centred health services [17] including for NCD treatment, but little operational guidance is available on how to achieve this goal. [18]. This review describes existing models of NCD and HIV care and treatment service integration in low-income countries, discusses implementation challenges and offers suggestions to improve integrated service delivery. The lessons identified can help strengthen health systems struggling to provide universal, sustainable and quality care in low-income countries for their ageing population living with HIV [17].

## Methods

### Study design

We combined two approaches to identify and learn from programmes offering integrated NCD and HIV services. These included [1] a review of the literature describing integrated programmes and [2] key informant interviews with leaders of selected integrated programmes.

### Literature review

We searched the electronic databases of PubMed and Cochrane Library; abstracts from the International AIDS Society Conference from 2006 to 2014, the HIV Implementers Meeting from 2006 to 2012, and the

International Association of Physicians in AIDS Care from 2005 to 2012.

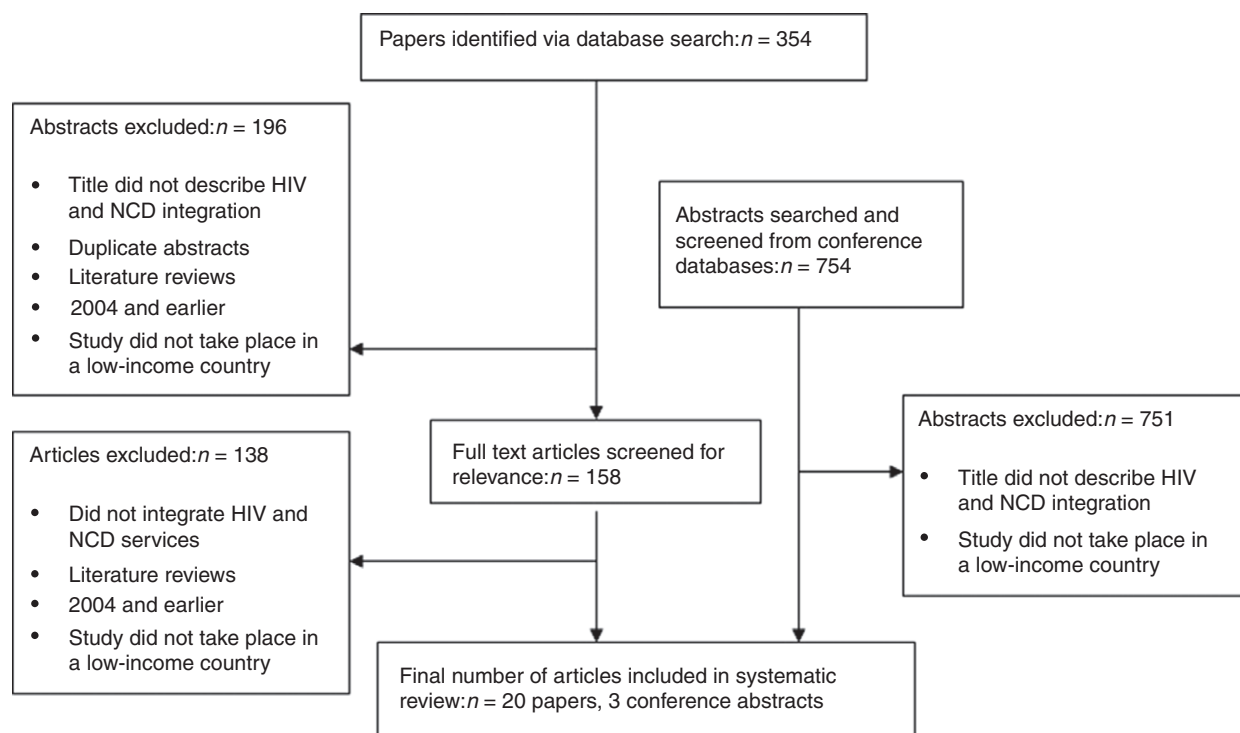
The following medical subject heading (MeSH) terms were used: ‘HIV’ and/or ‘Acquired Immunodeficiency Syndrome’ combined with one or more of the terms ‘hypertension’, ‘heart diseases’, ‘cardiovascular diseases’, ‘diabetes’ ‘early detection of cancer’, ‘lung disease’, ‘pulmonary disease, chronic obstructive’, ‘asthma’ and ‘primary health care’. Additionally, we used the non-MeSH search terms ‘non-communicable diseases’ and ‘outpatient department and integration’.

Each abstract was reviewed for its relevance to the topic independently by a team of two researchers. Abstracts that were determined to be irrelevant were discarded. Relevant abstracts were included for a full article review. Each article that was identified as relevant was also reviewed for additional relevant references, which were also reviewed. Literature was included if the paper discussed HIV and NCD programme integration, HIV and NCD shared programme models or guidance for HIV and NCD integration; the paper was published between 2005 and 2016; and the report was written in English. Literature was excluded if the paper discussed integration but was not specific to HIV and NCDs; the paper was published before 2005; or the study was not written in English.

Twenty papers and three conference abstracts were included covering 14 programmes (Figure 1). An additional programme was identified via referral from a programme expert for a total of 15 programmes included in this review.

### Key informant interviews

All corresponding authors of included papers identified via the literature search were e-mailed three times with interview requests. Five key informants identified through the literature review from Zambia, Kenya, Uganda and Cambodia agreed to participate. Informants were programme managers, administrators, or directors. Each completed an online survey on programme design, systems, tools, human resources, financing, monitoring and evaluation, infrastructure, organisation and implementation challenges, and process and outcome data. The survey was distributed to informants via email. After survey completion, telephone interviews, which lasted between 45 and 60 min, were conducted to capture additional details. Thematic analysis was conducted by the two researchers using survey and telephone interview findings. Survey responses and telephone interviews took place between February 2013 and August 2014.



**Figure 1** Literature and abstract review flow chart.

## Results

Fifteen programmes were identified (Table 1): four in Kenya; two each in Nigeria, Uganda, Zambia, Tanzania; one each in Cambodia, Malawi and Lesotho. The scope of integrated services varied widely between programmes, with some only integrating screening services while others comanaged multiple NCDs and HIV. Cervical cancer screening was included as an NCD as there were several integration examples.

## Integration models

Three common models were identified (Table 2). In Model 1, NCD services integrated into centres originally providing HIV care, programmes began as HIV clinics and evolved to integrate screening, care and/or treatment of NCDs. Therefore, patients accessing HIV services were able to receive at least one NCD service from that same programme. The scope of services integrated in this model was generally limited with six of eight programmes only integrating cervical cancer screening into HIV care. Two programmes, AMPATH and Mildmay, provided integrated care for multiple NCDs in addition to HIV services. In Model 2, HIV care was integrated

into existing NCD care at primary healthcare delivery sites where patients receiving NCD care were also provided HIV testing and counselling (HTC), and if positive, HIV care and treatment. In Model 3, NCD and HIV care and treatment were simultaneously introduced and integrated during outreach or at the same clinic site.

Across all models, the scope of services offered within each programme varied. For HIV, some programmes only offered HTC whereas others offered a full range of HIV care and treatment services. Similarly, some only offered screening for certain NCDs whereas others offered screening and treatment. These services are outlined in Table 2.

### Model 1: NCD services integrated into centres originally providing HIV care

Eight programmes originally solely provided HIV care and/or treatment and eventually integrated NCD screening and/or management to address all chronic care needs when implementers recognised high rates of NCD-HIV comorbidity.

PIH and the Ministry of Health in Malawi created Integrated Chronic Care Clinics (IC<sup>3</sup>), based on the previous, successful HIV programming. Teams from base

**Table 1** Summary of integrated programmes for people living with HIV

Model number	Country, programme	Author(s)	Site of care	Services offered	Eligible	Year(s) of analysis	Number of sites	Key process indicators or outcomes
Model 1: NCD Integrated Into HIV	Kenya, AMPATH	Edwards <i>et al.</i>	Primary care clinics originally providing HIV care and treatment	HIV, diabetes, hypertension, cervical cancer screening, chronic respiratory disease	Patients with HIV and/or NCD	2010–2013	Nine clinics, local dispensaries and households in 20 catchment areas	Blood pressure results improved from 161/94 to 147/87 over six months Reduced blood sugar average results were also reported
Model 1: NCD Integrated Into HIV	Uganda, Mildmay	Mukasa <i>et al.</i> Bukirwa <i>et al.</i>	HIV clinic	HIV, cervical cancer screening, sexual and reproductive health services, hypertension and diabetes	Patients with HIV or comorbid NCD/HIV	2013	One site well integrated	Of 10 285 active HIV-positive patients; 1085 have been diagnosed with hypertension and 8% with diabetes. Inadequate health education, waiting times, inadequate space and insufficient numbers of trained human resources (HR) to carry out cervical cancer screening impedes uptake
Model 1: NCD Integrated Into HIV	Kenya, Nazareth Hospital ART Clinic	Memiah <i>et al.</i>	Hospital affiliated HIV clinic	HIV, cervical cancer screening	PLHIV	2009–2010	One ART clinic	Of 715 HIV-positive women receiving cervical cancer screening, 26.7% had pre-cancerous lesions. Patients not on ART were 2.21 times more likely to have a pre-cancerous lesion
Model 1: NCD Integrated Into HIV	Kenya, Family AIDS Care & Education Services	Rosser <i>et al.</i>	HIV Clinic	HIV, cervical cancer screening	PLHIV	2013	One health centre	99% of participants had heard of cervical cancer screening; 92% knew that screening can help prevent cervical cancer; 70% of HIV+ women felt at risk for cervical cancer
Model 1: NCD Integrated Into HIV	Nigeria, Global HIV/AIDS Initiative Nigeria (GHAIN)	Odafe <i>et al.</i>	District hospital affiliated HIV clinic	HIV, cervical cancer screening	PLHIV	2010–2011	One district hospital	96.5% of 834 HIV seropositive women receive cervical cancer screening. 6.5% were positive upon visual inspection and acetic acid
Model 1: NCD Integrated Into HIV	Nigerian Institute of Medical Research	Ezechi <i>et al.</i>	HIV Clinic	HIV, cervical cancer screening	PLHIV	2011	One clinical centre affiliated with a research institute	~25% were diagnosed with a sexually transmitted infection 79.8% of HIV seropositive women accepted cervical cancer screening as an integrated component of their visit

**Table 1** (*Continued*)

Model number	Country, programme	Author(s)	Site of care	Services offered	Eligible	Year(s) of analysis	Number of sites	Key process indicators or outcomes
Model 1: NCD Integrated Into HIV	Tanzania, HIV Clinics	McCree-Hale <i>et al.</i>	HIV clinics	HIV, cervical cancer screening	PLHIV	2006–2009	—	1440 HIV seropositive women were screened for cervical cancer 8.61% had squamous intraepithelial lesion 56 427 women screened for cervical cancer 27.7% positive using visual inspection with acetic acid
Model 1: NCD Integrated Into HIV	Zambia, Cervical Cancer Prevention Program in Zambia (CCPPZ)	Mwanahanuntu <i>et al.</i> Parham <i>et al.</i> Kapambwe <i>et al.</i>	Public health clinic providing primary healthcare services	HIV, cervical cancer screening	PLHIV	2006–2011	17 clinics	6781 patients on ART 721 patients with NCDs including 379 with hypertension, 187 with asthma, 144 with epilepsy and 76 with diabetes. HIV prevalence in NCD patients: 15.1% 87.7% on ART still alive and in care after 24 months. Median CD4 count increased from 53 at baseline to 218 at 12 months and 316 at 24 months.
Model 1: NCD Integrated Into HIV	Malawi, Partners in Health (PIH)	Wroe <i>et al.</i>	Integrated Chronic Care Clinics (ICCCs)	HIV, TB, Hypertension, Diabetes, Malnutrition	Patients with HIV and/or NCD	2014–2015	13 ICCCs	96% of all eligible patients started ART; 70% of patients on ART remained active after 12 months. NCD defaulters decreased from 37% to 30% 60% of women offered an HIV test Supply of HIV testing kits was a significant barrier
Model 2: HIV Integrated Into NCD At PHC	Kenya, Médecins San Frontières (MSF)	Edwards <i>et al.</i>	Primary care clinics	HIV, diabetes, hypertension, cervical cancer screening	Patients with HIV and/or NCD	—	Two MSF clinics	Successful integration HIV testing, care and treatment into outpatient services in Lusaka Zambia Integration increased efficiency of clinic space, resources and staff time, increased HIV case finding and decreased HIV-associated stigma also found
Model 2: HIV Integrated into NCD At PHC	Tanzania, Government Reproductive and Child Health Clinics	Plotkin <i>et al.</i>	Outpatient and Reproductive and Child Health Clinics	HTC, cervical cancer screening	All patients	2010–2013	21 government facilities	
Model 2: HIV Integrated into NCD At PHC	Zambia, Centre for Infectious Disease Research in Zambia (CIDRZ)	Topp <i>et al.</i>	Primary healthcare clinics providing general outpatient department services	HIV, NCD services offered during routine primary healthcare visits	All patients	2008–2011	12 primary healthcare facilities	

**Table 1** (*Continued*)

Model number	Country, programme	Author(s)	Site of care	Services offered	Eligible	Year(s) of analysis	Number of sites	Key process indicators or outcomes
Model 3: Simultaneous Integration of HIV and NCD Services	Cambodia, MSF	Janssens <i>et al.</i>	Chronic disease clinics	HIV, hypertension, diabetes treatment	Patients with HIV and/or NCD	2002–2005	Two rural clinics	87.7% of HIV seropositive adults on antiretroviral therapy still in care at 24 months (mean CD4 count: 316 cells/mm <sup>3</sup> ) 71% of diabetics still in care at 24 months 68% adults with hypertension still in care at 24 months (Dual diagnosis data not available)
Model 3: Simultaneous Integration of HIV and NCD Services	Lesotho, Ministry of Health	Tiam <i>et al.</i>	Mobile service delivery clinics	HTC, blood pressure and diabetes screening (No treatment)	All community members	2011	Mobile service delivery points	7% of adults HIV+; 68.5% received CD4 test with 36.6% linked to HIV care. 24.2% of adults with elevated blood pressure reading and linked to services. 3.1% of adults with elevated blood glucose screening and linked to services
Model 3: Simultaneous Integration of HIV and NCD Services	Uganda, Collaborative between University of California, San Francisco, Makerere University and Makerere University Joint AIDS Program	Chamie <i>et al.</i>	Community centres temporarily used for the campaign	Combined community-based screening for HIV, hypertension and diabetes Referrals for all positives. (No treatment)	All community members	2011	Three community centre settings	7.8% adult HIV prevalence (46% newly diagnosed; 39% linked to care) 28% adults with hypertension (65% newly diagnosed; 43% linked to care) 3.5% adults with diabetes (23% newly diagnosed; 61% linked to care)

**Table 2** Integrated HIV and NCD screening, care and treatment models

	Method of entry	Human resources required	Services offered
MODEL 1 NCD Integrated into HIV	Facilities that originated as HIV sites evolved to accept NCD patients. Patients brought into services via in-house diagnosis, referrals from external sites and case finding via community NCD and HIV screening. Patients are enrolled into care if they have HIV and/or an NCD. A dual diagnosis is not always required.	Human resource requirements vary and generally include: <ul style="list-style-type: none"> <li>• Physicians and primary care nurses trained in NCD and HIV diagnosis and management</li> <li>• Triage nurses trained to carry out routine screening for NCDs and rapid HIV tests</li> <li>• Community volunteers trained to carry out home-based NCD screening (blood pressure and blood glucose) and rapid HIV tests.</li> </ul>	The range of services varied across programmes. Some offer a full range of NCD and HIV services while others only integrated one NCD into routine HIV care. In addition to HIV services, this model integrates: <ul style="list-style-type: none"> <li>• Diabetes</li> <li>• Hypertension</li> <li>• Hypercholesterolaemia</li> <li>• Cervical cancer screening and early lesion treatment</li> <li>• Chronic pulmonary and respiratory disease</li> </ul>
MODEL 2 HIV Integrated into NCD Services at PHC	Patients accessing NCD services at primary health care are offered HTC. Patients who test positive are offered enrolment into an HIV programme location within a primary healthcare clinic	Human resource requirements vary across models and generally include: <ul style="list-style-type: none"> <li>• Triage nurses trained to conduct HTC</li> <li>• Physicians and primary care nurses trained to provide HIV care and treatment in addition to routine primary health services which include NCD care and treatment</li> <li>• HIV physicians and nurses in PHC trained to provide cervical cancer screening</li> </ul>	This model provides primary health services which include NCD diagnosis, care and treatment. The degree to which a chronic disease management model is utilised varies. In addition to general PHC services, this model integrates: <ul style="list-style-type: none"> <li>• HIV – HTC and referrals or on-site treatment</li> <li>• Diabetes</li> <li>• Hypertension</li> <li>• Cervical Cancer Screening and treatment</li> </ul>
MODEL 3 Simultaneous Introduction of Integrated HIV and NCD Services	Patients accessing integrated HIV and NCD screening services via community outreach are subsequently referred when patients screen positive to nearby non-integrated health facilities. In addition, this model also includes a clinic established to provide integrated HIV and NCD services for patients diagnosed with HIV or an NCD from nearby health facilities	Human resource requirements vary across models and generally include: <ul style="list-style-type: none"> <li>• Multidisciplinary teams of physicians, nurses, counsellors and nutritionists trained to conduct community screenings and patient education</li> <li>• Healthcare workers trained in HTC and cervical cancer screening.</li> </ul>	The range of services offered varies between programmes. Community campaigns provide a broad scope of screening opportunities. The facility-based programme offered a full range of integrated HIV and NCD screening and treatment services. <ul style="list-style-type: none"> <li>• HTC</li> <li>• Diabetes screening</li> <li>• Hypertension screening</li> <li>• Immunisation</li> <li>• Malaria screening</li> <li>• Tuberculosis screening</li> <li>• Service referrals</li> </ul>

hospitals travel to health centres to hold IC<sup>3</sup>s, where patients can be seen for a variety of conditions in one appointment including HIV and NCDs. The visit includes education on common conditions, as well as distribution of HIV and NCD medications [19].

The AMPATH Kenya programme originated by providing in-home and health dispensary-based HTC using trained community volunteers and health dispensary staff. Patients who tested HIV-positive were referred to the

clinic for care and treatment. The programme evolved to offer, in addition to HTC, diabetes and hypertension screenings at AMPATH hospital, health outposts and households in twenty catchment areas for all community members regardless of HIV status. Individuals with positive HIV tests, and/or elevated blood pressure and/or blood glucose levels are referred to the integrated AMPATH clinic in their catchment area. AMPATH and PIH are the only programmes in Model 1 that offer HIV



and/or NCD services; the other programmes in Model 1 only offer NCD services for PLHIV.

The Mildmay Uganda programme integrated hypertension and diabetes screening/treatment into their HIV clinics after observing high rates of these conditions among their HIV-positive patients. HIV patients with comorbid hypertension or diabetes visit the clinic during a weekly 'dual diagnosis day' to receive integrated services and educational messages [17]. Routine cervical cancer screening including treatment for early lesions and referrals for advanced lesions are also provided [3]. Six additional programmes, two in Kenya, two in Nigeria, one in Tanzania and one in Zambia, integrated cervical cancer screening within their HIV clinics. All sites provide treatment referrals for advanced cervical lesions [20–27].

Implementation requirements for all programmes in Model 1 include screening and referral procedures, patient tracking system development, adapted medical records and supply chain logistics [20–27]. AMPATH and Mildmay also required development of patient education materials, and clinical protocols to provide NCD services [17, 28].

Process and outcome data to monitor programme effectiveness were collected. Among all patients with hypertension and diabetes AMPATH Kenya noted improved blood pressure and reduced average blood glucose after six months of treatment. Among 10, 285 Mildmay Uganda HIV patients, 10% were diagnosed with hypertension and 8% were diagnosed with diabetes [28].

Clinics that integrated cervical cancer screening focused on rates of screening acceptance, prevalence of abnormalities and referrals. Of 834 women offered cervical cancer screening in Nigeria, 805 (96.5%) accepted and 6.5% screened positive for cervical abnormalities [22]. In Tanzania, HIV clinics provided 1440 women with cervical cancer screening; 9% screened positive and 4% sought treatment [24]. The Nazareth Hospital ART Clinic (Kenya) screened all women attending services during the 6-month study period ( $n = 715$ ) and found that 26.7% screened positive [20]. CCPPZ found that among 21, 110 women accessing cervical cancer screening at PHC, 31% were HIV-positive and 38% screened positive and were referred for treatment; 49% of these pursued referrals [25–27].

#### **Model 2: HIV care integrated into primary health care already offering NCD services**

Three programmes adopted Model 2 in which NCD services at Primary Health Care delivery sites were expanded to integrate HIV services for its patients. The CIDRZ programme model was established in 20 PHCs which routinely offer HTC for patients who may also be

accessing NCD services. Patients who test HIV-positive are offered enrolment into care and treatment, available within the PHC along with screening and treatment of NCDs [29–31]. Patients with a dual diagnosis could receive HIV and NCD services within a single visit. In the MSF Kenya programme, clinicians in two primary care clinics were trained to provide integrated HIV, diabetes, and hypertension care, and cervical cancer screening and treatment [30].

In Tanzania, a more limited model was implemented with the Government Reproductive Child Health Clinics offering HTC to women presenting for cervical cancer screening. Patients who test HIV-positive are referred to a separate care and treatment facility [32]. Women with abnormal cervical cancer screening results receive onsite treatment or a referral.

Model 2 implementation requirements include staff training on both HTC and patient sensitisation, which involved the development of adherence tools, referral protocols and patient education materials. In addition, medical records were adapted along with supply chain logistics management for HIV screening, care and treatment [29–33].

CIDRZ in Zambia found that of the 53% of outpatients agreeing to HTC, 13% were HIV-positive and 42% were enrolled in HIV services. At another site, 58% of outpatients accepted HTC with 25% positive and 58% enrolled in HIV services [29–31]. MSF Kenya found 96% of eligible patients diagnosed in the clinic started ART, and 70% on ART remained active after 12 months. NCD defaulters decreased from 37% to 30%. A study comparing outcomes for HIV-positive and -negative patients found that patients experienced similar diabetes and hypertension outcomes regardless of HIV status indicating that NCDs and HIV can be effectively comanaged [33]. Tanzanian Government Child and Reproductive Health Clinics screened nearly 25, 000 women for cervical cancer; 26% were known to be HIV-positive, a remaining 60% per cent were offered HTC and 94% accepted [32].

#### **Model 3: simultaneous introduction of integrated HIV and NCD services**

Three programmes simultaneously introduced integrated HIV and NCD services with both service types included in the initial full schedule of services available at care facilities. MSF Cambodia established two chronic disease clinics where all patients were offered integrated services. Patients with possible hypertension, diabetes and/or HIV were referred from nearby health facilities. At programme end, the clinics were managed by the Ministry of Health, but were dismantled due to lack of coordination among



NCD and HIV departments within the Ministry of Health [33].

In Uganda, a community mobilisation campaign integrated HIV, hypertension, diabetes, tuberculosis and malaria screenings. Laboratory testing was carried out at community-screening points or at nearby laboratory facilities. Clients with a positive result for any screen were provided counselling and a transportation stipend for clinic visits. Patients screening positive for an NCD or infectious disease were referred to separate clinics due to lack of integrated services at clinics [34].

The Lesotho Ministry of Health conducted a rural community campaign. Multidisciplinary teams of 30–40 health professionals carried out mobile HTC, blood pressure and blood glucose screenings during the 5-week campaign. Patients with positive HIV tests or elevated blood pressure or blood glucose were linked to separate HIV care and treatment or PHC sites [35].

Model 3 implementation required new clinical and referral protocol development, and hiring additional staff. MSF Cambodia developed separate medical records and clinical protocols for HIV and NCDs. The Lesotho and Uganda community campaigns temporarily hired previously trained staff and created screening tools while refining referral protocols [34–36].

MSF Cambodia found that among patients who started ART, 87.7% were alive and in care after 24 months. Median CD4 count increased from 53 at baseline to 218 at 12 months and 316 at 24 months. Among diabetics, 71% were still alive after 24 months of treatment. Nearly 8% of Ugandan Community Campaign attendees tested HIV-positive and 39% were linked to care. Twenty-eight percent had elevated blood pressure; 34% were linked to care. Nearly 4% of adults had an elevated blood glucose level; 61% were linked to care [34].

The Lesotho Ministry of Health integrated community-based screening campaign screened community members for HIV and NCDs and referred positive screens to separate clinics for follow-up. Among 8396 adults tested for HIV, 7% tested positive while 69% received follow-up CD4 cell testing and 37% were enrolled in HIV care and treatment. Of 4454 adults screened for hypertension, 24% had an elevated reading and were linked to care. Of 3045 adults screened for diabetes, 3% had elevated blood glucose and were linked to care [35].

### Overcoming integration challenges

*Supply chains.* While existing HIV programmes often have reliable drug supply chains, NCD drug supply chains are insecure and funding is often unavailable. A study examining medication availability in 36 low-

income countries found NCD medication availability at 36%, compared to 54% for acute diseases [37]. Lack of available laboratory equipment for diabetes and cervical cancer screening and treatment were widely noted. Solutions included developing new NCD medication funding streams, alternative supply chains to that of the government and community insurance schemes [31].

*Human resources.* Healthcare worker training is time- and resource-intensive, especially at programme start-up; follow-up mentoring may also be needed [38]. Staff turnover is a significant challenge. Shifts in health system planning and in the attitudes and actions of healthcare workers are required to expand clinical focus to increase patient motivation, self-management and commitment to adherence. It is critical to continually motivate staff to conduct integrated service delivery and to provide ongoing training to update staff knowledge and skills.

*Referral systems.* Many programmes have the ability to integrate HIV and NCD screening into routine services, but cannot provide specialised services when further treatment is needed, requiring patient travel [7, 15, 16, 18, 20, 39]. Referral protocols and linkages are often weak, and health systems lack follow-up strategies to determine whether patients complete referrals [24, 29]. Bidirectional referral protocol development in the planning stages of integration may improve screening response capacity.

*Patient education.* Patient education for HIV and NCDs requires similar approaches to build patient self-management skills needed for effective management of chronic illness. HIV patient education tools and approaches may be adapted for NCDs in an integrated programme, but most integrated programmes offered separate HIV and NCD patient education [40]. Several programmes have adopted a peer educator model to increase screening, adherence, monitoring and clinical follow-up of all chronic illnesses.

*Stigma.* Successful integration requires addressing stigma, both for HIV and for NCDs such as cancer, to increase service uptake. Where NCD services are integrated into an HIV programme as in Model 1, clients may fear being identified as HIV-positive [13]. Models 2 and 3 may reduce HIV stigma given that services are physically located outside of HIV facilities.

*Patient records.* All models required new or adapted patient records. AMPATH Kenya initially attempted to create integrated patient encounter forms, but providers

were overwhelmed by the amount of information requested within a single form. Forms were eventually separated by HIV, hypertension and diabetes. CIDRZ Zambia adapted the PHC service record to include HIV; MSF Cambodia and Kenya, and Mildmay Uganda maintain separate forms. Keeping systems and tools simple is a key element to successful integrated service delivery and to staff investment in the programme [11].

**Monitoring and evaluation.** HIV programmes have made significant progress towards designing monitoring and evaluation programmes that report results and increase programme accountability [41]. While not an HIV/NCD integration programme, Rabkin *et al.* in Ethiopia adapted HIV systems and tools, including monitoring and evaluation indicators, for diabetes services [37]. Adaption and standardisation of HIV monitoring and evaluation indicators to NCDs will avoid duplicate reporting and identify integrated programme indicators [29, 42, 43].

**Funding source.** While the topic of conflicting donor requirements between HIV and NCD programmes was not identified through the literature review or key informant interviews, when HIV and NCD programmes have separate donors, funding allocation and monitoring and reporting requirement challenges may arise.

## Discussion

Building on proven HIV tools and systems may help address the rising prevalence of NCDs among the general population in low-income countries. Integrated HIV and NCD services may also ensure PLHIV with a comorbid NCD can receive an early NCD diagnosis [33] and avoid morbidity and mortality related to comorbidities, many of which are increased risk for that population. In Ethiopia, HIV appointment systems and tools, clinical mentoring approaches, charting procedures, clinical aids, peer educator approaches, clear clinical protocols, a family-centred approach and NCD-specific indicators were adapted for diabetic services [37]. A six-month evaluation revealed significant increases in weight measurements, blood pressure testing, fundoscopic, foot and neurologic examinations adherence assessments, and increased patient satisfaction [44] building further evidence for the utility of HIV chronic care systems and tools to provide quality NCD services.

This article presents three models of NCD and HIV integration, associated challenges and practical suggestions. The models presented are most often based upon project-based initiatives which are donor-dependent and thus should be considered by programme planners in this

light. As low-income countries address the burgeoning NCD epidemic among PLHIV, programme planners and policymakers should look to the HIV response to inform their NCD response. Defining the scope and model will be important to plan for capacity building, systems and supplies needed to ensure early diagnosis and effective care and treatment leveraging lessons learned from adherence, retention and self-management needed for chronic diseases. While evidence for integration of NCD and HIV programmes is scarce, therein lies potential to address the chronic care needs of those suffering from NCDs.

Through use of HIV programme approaches—such as defaulter tracing; use of community engagement; adapted tools and systems, including longitudinal medical records to ensure continuity and coordination, optimised supply chain management; and referrals and linkages—sustainable solutions for reducing NCD-related morbidity may be discovered [29]. While MSF Cambodia was the only programme to highlight lack of coordination between HIV and NCD departments within the Ministry of Health, this possibility should be kept in mind. Further operational research should be conducted to investigate successful models of NCD and HIV integration that may be used for scale-up by other programmes seeking to address the chronic care needs of their patients.

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