POLICY RESEARCH REPORT

SPENDING WISELY

Exploring the economic and societal benefits of integrating HIV/AIDS and NCDs service delivery

NCD Alliance

RTI INTERNATIONAL

ACKNOWLEDGEMENTS

This policy research report was commissioned to RTI International by the NCD Alliance, and was made possible with the support of Viatris.

We would like to thank Brian Hutchinson, Lily Morrell, Garrison Spencer, and Gavin Allman from RTI International's Center for Global Noncommunicable Diseases for their research.

NCD Alliance developed the concept for the report, guided its production, and provided substantial review and feedback on draft versions of the report. We would like to thank João Monteiro, Grace Dubois and Alison Cox for their ideas, content guidance, and review.

Acknowledgement of Advisory Committee

An Advisory Committee composed of global health experts reviewed and provided input on a draft version of the report. We would like to thank the Committee members for their content guidance and review:

Dr. Ani Shakarishvili, UNAIDS

Ms. Dhwani Babla, HFI

Ms. Georgina Caswell, GNP+

Ms. Helen McGuire, PATH

Dr. Kaushik Ramaiya, NCDA Board

Suggested citation: Hutchinson B., Morrell L, Spencer G. Spending Wisely: Exploring economic and societal benefits of integrating HIV/AIDs and NCD service delivery. NCD Alliance Policy Research Report 2023

Edited by the NCD Alliance, September 2023.

Photo cover: Patients speak with a health professional at an integrated care clinic in the Dominican Republic. © Alfredo Fort/Photoshare

Editorial coordination: Jimena Márquez and Jennifer Bajdan
Design and infographics: Mar Nieto

NCD Alliance
31-33 Avenue Giuseppe Motta,
1202 Geneva, Switzerland

www.ncdalliance.org

Contents

EXECUTIVE SUMMARY

In the context of human immunodeficiency virus (HIV) and noncommunicable diseases (NCDs)[1], high rates of comorbidity create an opportunity for service integration. Leveraging the strong infrastructure and achievement of HIV programs may help to strengthen the care continuum for people living with NCDs. Stakeholders traditionally devoted to providing care for specific diseases or conditions, including the Global Fund and PEPFAR, are demonstrating growing commitment to providing integrated health services.

As enthusiasm around integrated care and its potential benefits for resource optimization and health outcomes grows, more evidence is needed to support implementation of HIV-NCD integrated care models — especially in resource-constrained environments. This report describes the results of a systematic literature review to identify HIV-NCD service delivery integration models across the continuum of care in low- and middle-income countries, and to assess the costs, impact, and cost-effectiveness of the identified models.

The search strategy —with eligibility criteria requiring studies to incorporate rigorous evaluation designs to assess program outcomes and/or provide evidence comparing the costs of integrated to non-integrated programs— identified 36 articles describing 28 HIV-NCD integration programs that have been implemented in 16 countries in Africa, and Central, East and South Asia. The review provided evidence to answer the following questions.

- **Which NCDs are commonly integrated with HIV service delivery, or vice-versa?** Most identified programs (22/28) integrated clinical service delivery for HIV and mental health conditions or substance use disorders. Some programs integrated service delivery for HIV and other NCDs or risk factors (7/28), although fewer than half of these programs provided evidence of the impact of the program on clinical outcomes.
- **What types of integration were represented within the programs?** All programs focused on clinical service delivery integration (i.e., providing care for two or more diseases along the same care continuum or in the same setting), although two out of 28 programs also integrated functional systems (e.g., aligning health information systems) and/or integrated care with organizations outside of the health system (e.g., schools).
- **What kinds of services did integrated programs provide, and in what settings was care delivered?** A variety of services were delivered across the care continuum, including education, screening and diagnosis, treatment, activities to link patients to care and follow-up, and activities to strengthen clinical service processes. The platform most often leveraged by programs for delivery of care services was health facilities (23 programs), followed by client homes (eight programs), remote service delivery (seven programs), and community settings (six programs). Half of all included programs provided care services at more than one location.
- **Did integrated programs improve clinical outcomes for people living with HIV and NCDs?** Integrated programs successfully improved clinical outcomes; 21 of 24 programs (88 percent) with relevant evidence generated at least one favorable and significantly different clinical outcome, while 19 out of 24 (79 percent) programs reported favorable and significant outcomes on at least half of the outcomes that they measured. Among programs with evidence on both HIV and NCD clinical outcomes, 11 out of 13 identified that 1) HIV outcomes either improved or did not change (i.e., HIV outcomes did not suffer or get worse due to integrated service delivery) and 2) NCD outcomes significantly improved.

1 Including cancers, cardiovascular diseases, chronic respiratory diseases, diabetes, mental health and substance use disorders.

- ➔ **What are the costs of integrated service delivery compared to non-integrated service delivery, and do integrated programs deliver on their promise to optimize resource use?** Costing evidence for eight HIV-NCD programs provided a glimpse into the potential of HIV-NCD integration programs to produce resource efficiencies that benefit patients and health systems. Studies of two programs that conducted costing from a societal perspective (i.e., considered both patient and health system costs) identified that integration can save costs compared to standalone service delivery. Around 85 percent of the savings related to patients —in large part because synchronized care visits, or care offered in locations closer to client homes, led to lower transportation, childcare, time, healthcare, and other costs. The remaining studies costed six integrated programs from a healthcare perspective. On average, they reported that integrated HIV-NCD interventions increased costs by an average of 16 percent compared to non-integrated interventions.

- ➔ **Are integrated HIV-NCD programs cost-effective?** Evidence on the cost-effectiveness of HIV-NCD integration remains thin. Only five of the 28 programs identified in the review provided evidence of both the costs of implementing programs and the impacts of implementing programs, and only three of the five programs formally produced cost-effectiveness studies. All cost-effectiveness studies identified that at least one integrated intervention that was studied was cost-effective considering 1x GDP per capita and more stringent country-specific cost-effectiveness thresholds.

- ➔ **What barriers or challenges did integrated programs encounter during implementation?** Case studies of programs highlighted challenges to implementation. These included clinical staff resistance to integration due to perceptions of higher workloads, continued challenges achieving equitable program reach even with patient-centered models, and medication shortages that precluded achieving better health outcomes.

Growing evidence demonstrates that integrated programs can deliver wider health impacts compared to standalone care delivery. Specifically, the clinical co-benefits and high success rate of integrating care for mental health conditions and substance use disorders demonstrate opportunities to investigate how to scale these programs within health systems. Evidence from a smaller number of studies on costs, suggests that integration holds significant potential to lower expenditures, especially out-of-pocket patient spending, or that from a health system perspective, the additional cost to integrate programs may be relatively marginal compared to the health outcomes that the programs generate. However, few studies have formally assessed the cost-effectiveness of integrated HIV-NCD programs. More evidence is needed to fill this gap. The report concludes with a series of recommendations to governments, donors, and researchers to generate continued momentum for integrated service delivery to fulfill its role as a key contributor to achieving universal health coverage goals worldwide.

1. INTRODUCTION

There is a growing commitment to provide integrated health services. Stakeholders traditionally devoted to providing care for specific diseases or conditions, including the Global Fund and PEPFAR, are moving toward people-centered approaches that deliver more holistic care [1]–[3]. The 2019 United Nations General Assembly Political Declaration on Universal Health Coverage (UHC) supported this shift, recognizing that integration within historically vertical programs and at the health-system level is key to achieving the ultimate goal of UHC [4].

Definitions of "integration" often center on clinical service integration, wherein people may access disease agnostic services (i.e. services that are not specific to a single condition but are capable of handling multiple comorbidities) [5]. Clinical service integration may occur in health system facilities or in the community and can span the continuum of care —including health promotion, screening and diagnosis, treatment, rehabilitation, and palliative care. Such services aim to meet the health needs of individuals throughout their lifetimes. Some definitions of integration also acknowledge opportunities to integrate functional systems across diseases (e.g., health information systems, medicine supply chains) and to coordinate healthcare delivery with organizations outside the health system [5].

In the context of human immunodeficiency virus (HIV) and noncommunicable diseases (NCDs)[2], there is recognition that high rates of comorbidity create an opportunity for service integration. Moreover, leveraging the strong infrastructure and achievements of HIV programs for NCD service delivery, which has historically been weaker in many low- and middle-income contexts, may be an opportunity to strengthen the NCD care continuum. There is potential for integration to maximize health outcomes for individuals, while efficiently using health system resources.

1.1 The pressing need to extend access to the continuum of care for NCDs

Worldwide, access rates across the continuum of care among people living with NCDs or with NCD risk factors are far lower than rates among people living with HIV [6]–[11]. For example, whereas nearly 69 percent of people who are estimated to be living with HIV are virally suppressed [7], worldwide only about 20 percent of people who are estimated to be living with hypertension achieve blood pressure control [6].[3] With over seven in 10 deaths due to NCDs globally, 30 percent of which occur "prematurely" before the age of 70 [12], the need to extend access to the NCD care continuum is clear.

In settings where health systems are developing and resources are limited, extending access to the NCD care continuum could start by linking to existing disease-specific initiatives such as HIV programs. Established HIV programs have many strengths, including developed systems for health (e.g., skilled human resources, laboratory services, proficient medicine supply chains, health information systems, community-based services, and monitoring and evaluation frameworks). Astounding progress in reducing HIV-attributable deaths signals a new era - and has opened new health challenges. Life expectancy for people living with HIV [13]–[15] has significantly increased. But, longer lifespans mean people living with HIV face increased NCD co-morbidities [16], not only because they are living into old age but also because they face a higher risk of many NCDs compared to the population without HIV [17]–[21]. Integrated HIV/NCD service delivery may not only offer a platform from which to build NCD care, but also ensure that mortality reduction achievements in people living with HIV do not erode from deaths due to NCDs.

In some settings, integration is an opportunity to move toward person-centered health systems built upon the principles of UHC [22], [23]. This may involve wider health system changes such as establishing new chronic care delivery models at the primary care level or linking health system building blocks that have been created under vertical programs to the wider health system, to reduce fragmentation. Efforts to integrate

2 Including cancers, cardiovascular diseases, chronic respiratory diseases, diabetes, mental health and substance use disorders.

3 Figures are the product of diagnosed, treatment, and control rates reported in the cited sources. For the hypertension care cascade, calculations are weighted averages combining care cascade data reported by sex in the supplement to NCD Risk Factor Collaboration, 2021 [6].


©Shutterstock

the HIV continuum of care can have profound implications for equity, since comparative advantages of services delivered to people living with HIV become accessible to wider demographic groups [24]. Similarly, establishing HIV-NCD services within existing population-wide health system structures and programs — as opposed to creating new vertical programs or attaching to old ones— widens health benefits because services are designed for and delivered to the whole population.

1.2 Optimizing resources through integrated service delivery

Another cited rationale for HIV-NCD integration is the opportunity to optimize available resources through efficiencies that relate to multi-disease care [25]. Approximately two percent of development assistance for health is designated for NCDs [26], meaning that the responsibility is on national governments to allocate resources to the NCD continuum of care. Yet, many governments are expected to decrease health spending through 2027 [27] and few lower-income countries have set budgets or protocols for protecting spending on health [28]. To achieve UHC goals, national governments will need to identify how to do more with existing budgets and pinpoint cost-effective pathways to service expansion.

Integrated programs may hold promise for optimizing resources; such as HIV and NCD continuums of care, focusing on health promotion, treatment adherence, and continuity and monitoring of care over time [22], [29]. Certainly, additional investment in resources is required for integration, for NCD medications, diagnostics, supplies, and training of health workers [22], [30]. Nevertheless, integrated care can leverage already expended resources and existing infrastructure (i.e. fixed costs invested in a health facility visit), creating potential for integrated care to deliver cost savings compared to vertical care for specific diseases [25]. Regardless of cost, improvements in health outcomes (e.g., movement from viral suppression only to viral suppression AND glycemic control) could justify additional expenditure. Integrated care is also attractive given its potential to reduce health system visits, and thereby associated time, transportation, and direct medical costs for patients [22]. However, efforts to integrate service delivery must take care not to overburden health workers, equipment, and facilities, especially given the risk of increased dropout rates among health workers [25].

The new PEPFAR, Global Fund, and UNAIDS strategies, as well as the 2021 Political Declaration of the United Nations General Assembly High-Level Meeting on HIV and AIDS, and WHO guidelines, call for HIV-NCD service integration across the continuum of care. Given growing enthusiasm around integrated care and its potential benefits for resource optimization and health outcomes, more evidence is needed to support implementation of HIV-NCD integrated care models, especially in resource-constrained environments. Government institutions, donors, and health authorities would benefit from additional perspectives on different service delivery models along the continuum of care, as well as more evidence on the costs and impact of integration.

1.3 Filling gaps in economic evidence of HIV-NCD integration

This report describes the results of a systematic literature review to identify HIV-NCD service delivery integration models across the continuum of care in low- and middle-income countries, and to assess the costs, impact, and cost-effectiveness of the identified models.

The review sought to answer four primary research questions.

1. Which models of care have been implemented across the care continuum for people living with HIV and one or more NCDs, and their associated risk factors?
2. Relative to single-disease models of care, what impact (short- and long-term, positive or negative) does integrating care have on people living with HIV and one or more NCDs, health systems, and other outcomes?
3. What are the costs of integrating HIV-NCD services compared to standalone services?
4. How cost-effective are integrated HIV-NCD programs?

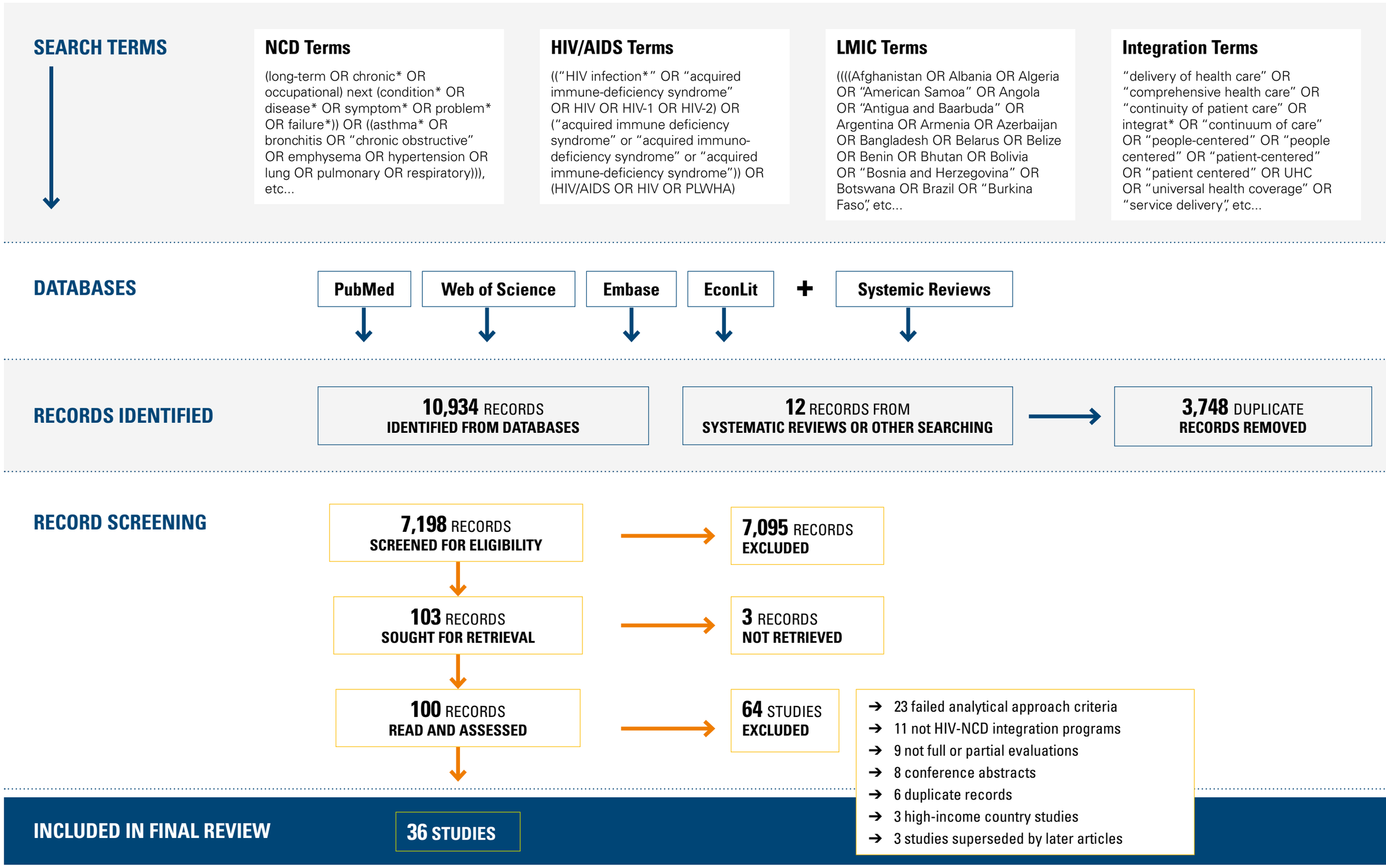
The methods of the systematic review and details on the eligibility criteria used to identify relevant programs are detailed in **Appendix 1**. Briefly, studies were eligible for review if they met several criteria.

First, the study was required to assess a HIV-NCD integration program. *Second*, the integrated program needed to have been implemented in a low- or middle-income country (LMIC) or countries. *Third*, the study was required to be at least a *partial* economic evaluation comparing two or more alternative interventions on either effectiveness or cost measures, or a *full* economic evaluation on both effectiveness and cost measures. *Finally*, the study needed to be a trial-based economic evaluation or program evaluation with an effective control (i.e. not a modeling study, but rather an economic evaluation of a real-world program). **Figure 1.1** summarizes the search strategy and studies identified during the search process.

This report proceeds as follows. **Section 2** details the design of HIV-NCD service-delivery programs identified in the review, including attributes such as the extent to which they deliver care across sites (e.g., home, community, facility, or remote care) and the activities performed at each site. It also describes evidence collected on the impact of integrated care programs (e.g., clinical and nonclinical outcomes), the incremental costs of integrating NCD services, and cost-effectiveness. Section 3 highlights select HIV-NCD programs identified in the review through detailed case studies. Section 4 summarizes results from the review and provides recommendations to national governments, donors, and the research community.

©Shutterstock

Figure 1.1 Search Strategy and Prisma diagram of studies identfied, screened, and included for full-text review



2. RESULTS

2.1 Descriptions of identified studies

The search strategy identified 35 articles describing 28 HIV-NCD integration programs that have been implemented in 16 countries in Africa, and Central, East and South Asia. Sixteen programs (57 percent) integrated some element of the NCD care continuum within existing HIV care continuums, while the remainder established new integrated care programs. No programs integrated HIV care into existing NCD programs.

Sixteen HIV-NCD integration programs were designed to prevent or treat mental health conditions (anxiety, depression, PTSD); nine to treat substance use disorders; five had a diabetes-related component (screening and/or pharmacological treatment); and four addressed hypertension (screening and/or pharmacological treatment). Two screened or treated cervical cancer, hyperlipidemia, and neurological conditions (epilepsy, peripheral neuropathy). Approximately two in ten programs integrated services for two or more NCDs or NCD risk factors.

Nearly all (27) of the 28 HIV-NCD integration initiatives operated as time-delimited programs or randomized controlled trials. Only one - the Integrated Chronic Disease Management model developed by the National Department of Health in South Africa - represented health system level change designed to structurally integrate chronic disease care for HIV, diabetes, respiratory conditions, and hypertension into primary healthcare clinics.

On average, the programs had median cohorts (intervention and control groups) of 440 people, ranging from 34 participants in a South African local group-based interpersonal therapy intervention to reduce depression, to over 111,000 people participating in the Sustainable East Africa Research in Community Health (SEARCH), a randomized controlled trial of a multi-disease testing and treatment program for people living with HIV and/or hypertension and diabetes in Uganda.

The United States National Institutes of Health (NIH) was the dominant funder of HIV-NCD programs, with a role in financing 14 of the 25 programs that provided funding information. Other US-based government institutions (i.e. Centers for Disease Control and Prevention, PEPFAR, and USAID) had a role in funding four programs. Institutions in low- and middle-income countries either fully funded or had a role in funding five programs.

Nineteen of the 28 programs generated studies that only examined the impact of HIV-NCD integration (e.g. clinical outcomes), with no information provided on costs. Five programs (18 percent) incorporated studies with evidence on both the costs and impact of the models — but only three out of the five studies formally compared them in a cost-effectiveness analysis. Four studies only contained cost information, which compared the costs of integration from patient, health system, or societal perspectives to the costs of non-integrated programs. The following figures describe and illustrate the characteristics of the programs in greater detail.

HIGHLIGHTS

28
HIV-NCD integration programs

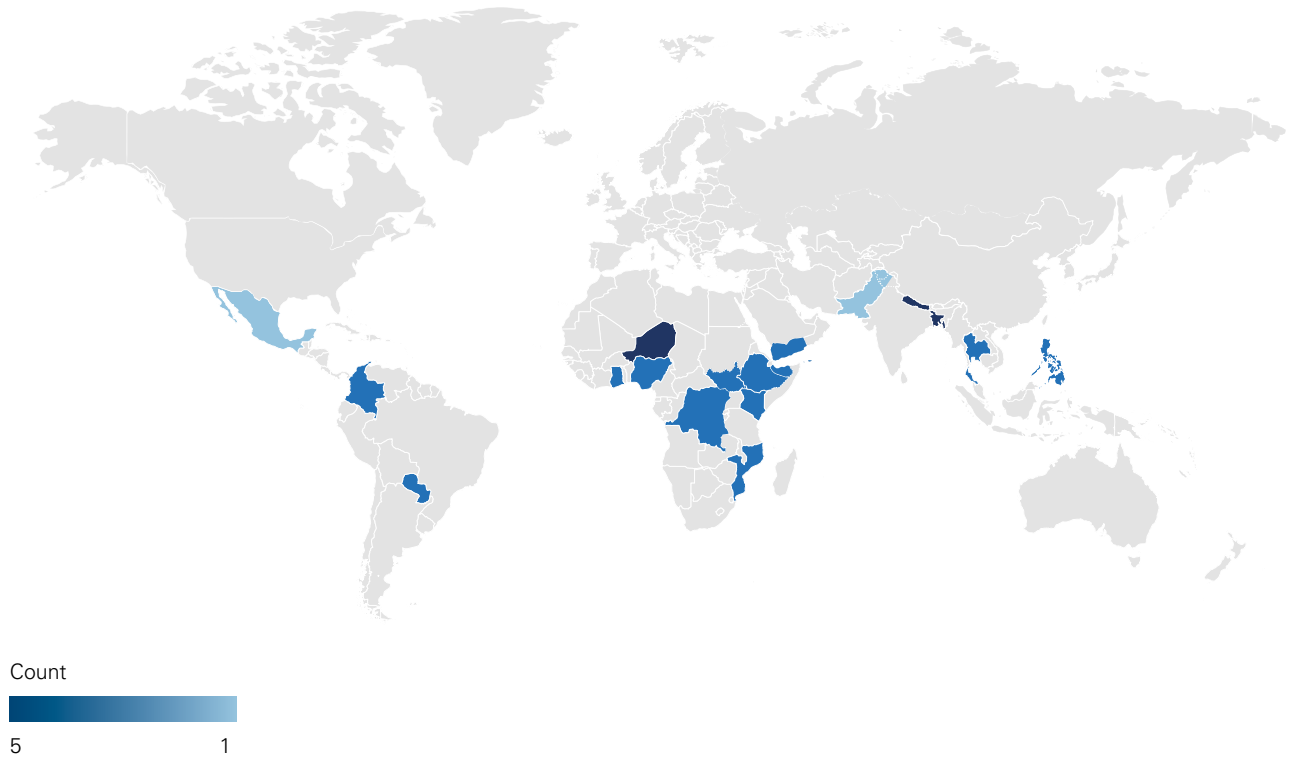
16 # of represented countries *(10 in sub-Saharan Africa)*

11 # of integrated NCDs or risk factors (most-commonly mental health conditions).

FUNDING
The US National Institutes of Health contributed funding to over half of the programs.

3 # of studies that looked into cost-effectiveness.

Figure 2.1 Number of articles by country



Represented countries include Kenya (5), South Africa (5), Uganda (5), Vietnam (4), Namibia (2), Rwanda (2), Tanzania (2), Cameroon (1), China (1), India (1), Indonesia (1), Malawi (1), Nepal (1), Ukraine (1), Zambia (1), and Zimbabwe (1)

Figure 2.2 Number of programs integrating HIV & specific conditions/risks

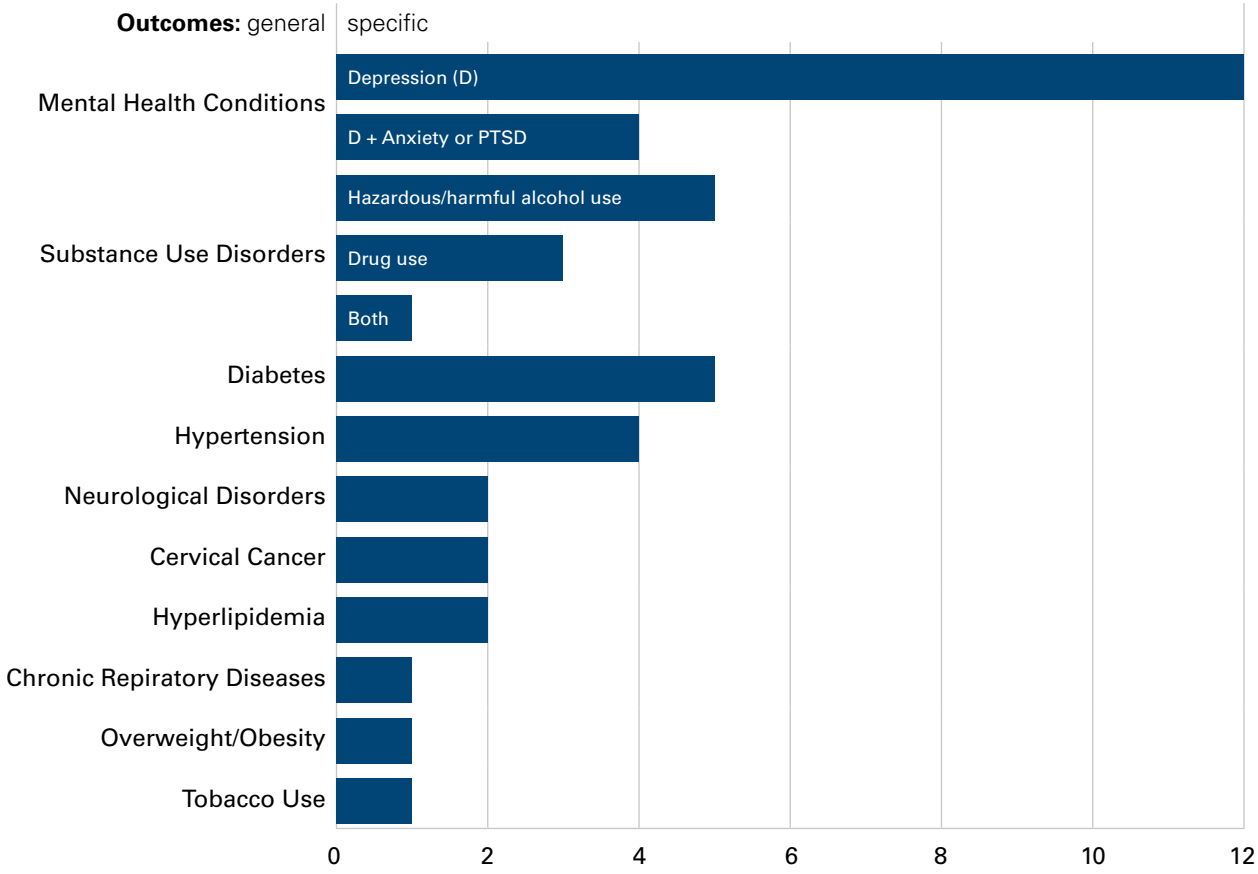
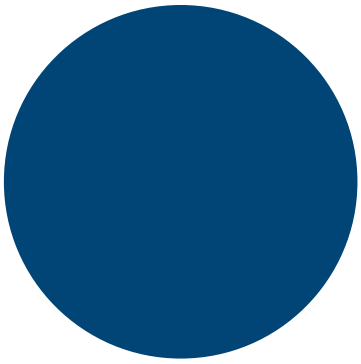


Figure 2.3 Funding organizations of HIV-NCD integration by sector

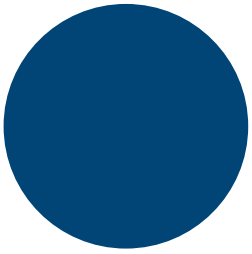
*indicates that funder is based in a low-income or middle-income country

Larger font indicates funding involvement on a greater number of the 28 HIV-NCD integration interventions, ranging from funding involvement in 1 program to funding involvement in 4 programs (National Institute for Mental Health)

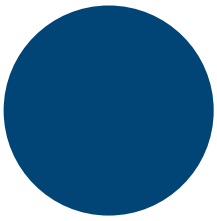
Figure 2.4 10 largest HIV-NCD integration studies by number of participants



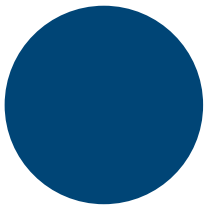
Country	**Kenya/Uganda**
Participants	**11.226**
Years	2012-2013
References	[16], [18-20]



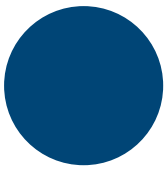
Country	**Namibia**
Participants	**5.374**
Years	2012-2013, 2015
References	[40]



Country	**Zambia**
Participants	**3.963**
Years	2013-2021
References	[33]



Country	**Kenya/Namibia/ Tanzania**
Participants	**3.538**
Years	2018-2019
References	[13]



Country	**Tanzania/Uganda**
Participants	**2.273**
Years	2016-2018
References	[31]

Country	**South Africa**
Participants	**1.340**
Years	2015-2016
References	[14]

Country	**Uganda**
Participants	**1.252**
Years	2016-2018
References	[12]

Country	**Uganda**
Participants	**1.140**
Years	2014
References	[28]

Country	**South Africa**
Participants	**878**
Years	2009
References	[37],[41]

Country	**Nepal**
Participants	**682**
Years	2015
References	[30]

Participant counts include both intervention and control groups. Numbers in brackets

Reference HIV-NCD integration studies according to their rows in the Coding Workbook

2.2 Service delivery platforms and types of care

Service delivery programs delivered unique combinations of care services across multiple settings (delivery platforms). **Table 1** catalogs and describes the types of services and delivery platforms uncovered in the literature search.

Table 1: Definitions of care services and delivery platforms

CARE SERVICES	
Education	Activities to promote health-related knowledge, awareness, and/or attitudes toward health or healthcare.
Screening/ diagnosis	Activities to screen or diagnose individuals for HIV/AIDs, mental health conditions or substance use disorders, and/or NCDs or NCD risk factors, or to continually monitor the status of these conditions.
Linkages and referrals	Any activity designed to facilitate initial entry into community-based care programs or health system facilities (for example, referral to primary care or specialist health clinics).
Treatment	Administration of direct forms of treatment — pharmacological or non-pharmacological (e.g., health promotion, psychosocial support) and rehabilitative or palliative care.
Medication access/delivery	Direct delivery of medications or other supplies, including activities to erase access or affordability barriers.
Follow-up	Engagement to increase patient follow-up at scheduled health appointments of any type (e.g., at health facilities, pharmacies, etc.).
Peer support	Direct peer support (i.e., from individuals living with the same diseases or disorders), one-on-one or in groups.
Clinical processes	A set of interrelated healthcare activities which are performed to facilitate service delivery [5]. Types of integration, coordination, and organization may include revisions to clinical/laboratory/pharmacy workflows, task shifting, creation of supervision structures, use of standardized treatment protocols, and development or incentivization of human resources.
Functional support	Within health system administrative and support functions and activities (financial, management, infrastructural, information systems) that are integrated to improve the process of service delivery [5].
Organizational support	Coordination of organizations through contracts, strategic alliances, knowledge networks or mergers to deliver comprehensive services to a defined population [5].
Financial risk protection	Activities meant to protect patients from financial hardship because of seeking care (e.g., provision of health insurance, subsidies, and benefits packages).
Other	Any activities or services that do not fall into the categories listed above.

DELIVERY PLATFORMS	
Home	Home visitation services by healthcare professionals (e.g., community health workers, nurses) or others, or self-care at home by patients.
Community	Services across the care continuum delivered at community sites (e.g., events or spaces, such as sporting events, community centers, or health fairs) or through community partnerships.
Health facility – direct	Direct service delivery to patients, usually care services across the continuum delivered in one-on-one interactions or in groups between healthcare providers (e.g., doctors, nurses) and patients.
Health facility – intermediate	Intermediate services are those provided by departments that support direct service delivery, most prominently laboratories or pharmacies.
Health facility – indirect	Indirect or "above service delivery" includes overheads that are crucial to care delivery within primary care clinics, but which are not direct patient care.
Remote	Services across the care continuum may be offered remotely (e.g., by phone, SMS, or videoconference).
Other	Any location or mode of service not included in the categories listed above. For these studies, other delivery platforms included health insurance and transportation reimbursements, for example.

The platform most often leveraged by programs for delivery of care services was health facilities (23 programs), followed by client homes (eight programs), remote service delivery (seven programs), and community settings (six programs), with a few programs (four) also offering other types of services not based in a particular setting. Nearly all (21/23) programs offering services in healthcare facilities leveraged primary care level facilities such as public health centers and HIV clinics. The remaining two were set in district or national hospitals. Half of all included programs provided care services at more than one location. The SEARCH service delivery model integrating HIV, hypertension, and diabetes care in Kenya and Uganda was the only model with services across all delivery platforms.

Figure 3.1 illustrates the flow of service delivery from delivery platforms to the type of care services provided. Direct forms of treatment (identified in 23 programs) were the most widely provided service across all delivery platforms, with most treatment centered in health facilities and to a lesser extent in client homes. Some programs provided treatment through multiple delivery platforms resulting in 28 instances of treatment (as shown in Figure 3) across 23 programs. Many programs (13) also supported clinical services processes, followed by education and screening/diagnosis (12 and ten programs, respectively). Treatment was mostly delivered in healthcare facilities, while most of the education, linkages and referrals, medication access, follow-up, and peer support occurred remotely or in home- or community-based settings. Identified intermediate services offered within health facilities related to provision of medications to health facilities. For example, recognizing that clinics often face shortages of drugs in Uganda and Tanzania, the Management of Chronic Conditions in Africa (MOCCA) program supplied a back-up supply of diabetes and hypertension medications to prevent shortages [31].

Figure 3.1 Number of identified care services offered in 28 programs, by platform and type

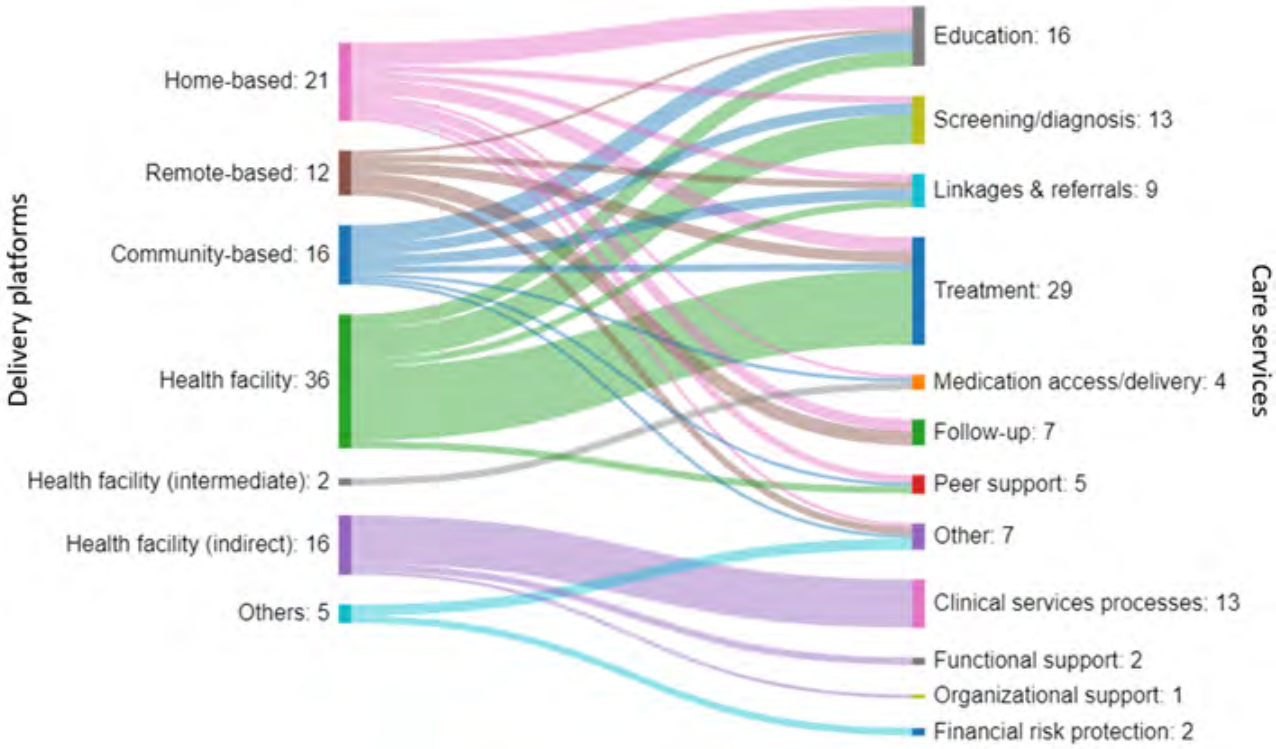


Table 2 summarizes the delivery platforms and type of services provided by each of the 28 programs, along with information on the years of implementation, number of participants, and the NCDs and/or NCD risk factors that were integrated with HIV services. Most programs (23) provided more than one service via one or more delivery platforms. Three programs provided just one type of health care service in one delivery platform (two provided only treatment in healthcare facilities and one provided solely home-based screening). Two additional service delivery models used only one service across multiple delivery platforms.

Table 2: Location and types of services provided

Program name	Years of operation	Size	Integrated NCDs and risk factors	Home-based	Community-based	Health facility-based	Remote	Other
IMPACTS ONLY								
Multi-component, clinic-based HIV prevention intervention, Kenya, Namibia, Tanzania [32]	2009 – 2011	3,538	SUD			L Tp C		
Project MIND, South Africa [33]	2017 – 2019	1,340	MC SUD			Tp		
HIV Prevention Trials Network 074 (HPTN 074), Indonesia, Ukraine, Vietnam [34], [35]	2015 – 2018	1,308	SUD	E F L MT			E F L MT	
INDEPTH (INtegration of DEPression Treatment in HIV care), Uganda [36]	2013 – 2014	1,252	MC			STp C		
Community Home-based Care Intervention on Mental Health Outcomes and Anti-retroviral Therapy Adherence in PLHIV, Nepal [37]	2015	682	MC SUD	E PT				O
Friendship Bench Therapy, Malawi [38]	2017 - 2019	501	MC			STp C		
Together for Empowerment Activities (TEA), China [39]	2009 - 2010 (pilot); 2011 - 2016	475 (families)	MC	E P O	E P O			
HADITHI - Helping AMPATH Disclose Information to Talk About HIV Infection, Kenya [40]	2013 - 2015	385 (child/ caregiver dyads)	MC			E PTp		
Psycho-education and interpersonal psychotherapy (IPT), Cameroon [41]	2019 - 2021	370	MC			TH C	F	
Interpersonal psychotherapy (IPT), Kenya [42]	2015 - 2016	256	MC			STp C		
CHW education in HIV and drug-use, Vietnam [43]	2018 - 2019	241	SUD		E L T	C		
MI-CBT: Motivational Interviewing blended with brief Cognitive Behavioural Therapy, Zimbabwe [44]	2016 - 2018	234	SUD			ETp C		Z
Mediational Intervention for Sensitizing Caregivers (MISC) and UCOBAC health and nutrition training, Uganda[45]	2012 - 2014	221 (child/ caregiver dyads)	MC	E	E	C		XY
Physiotherapy-led exercises (PTExs), Rwanda [46]	Not stated	120	NC			Tp	F	
Group support psychotherapy (GSP), Uganda [47]	2014	109	MC			E STp		
The Family Strengthening Intervention for HIV-affected families (FSI-HIV), Rwanda [48]	Not stated	82 (families)	MC SUD	E F				
Khanya, South Africa [49]	2018 - 2020	61	SUD	T		PTp C	O	
Integrated Yoga, India [50]	Not stated	44	MC			Tp		
Local group-based Interpersonal Therapy (IPT), South Africa [51]	2012 - 2013	34	MC			Tp C		
COSTS ONLY								
Bophelo! – Mobile voluntary counseling, Namibia [52]	2009	5,734	DM BMI HTN HL		S	S		
Management of Chronic Conditions in Africa (MOCCA), Tanzania, Uganda [30]	2018-2020	2,273	DM HTN			Tp M C U		
Linkages Study, South Africa [53]	2012-2013, 2015	570	DM MC HL BMI HTN T	S				
HIV/Cervical Cancer integration-Coptic Hope Center & Kenyatta National Hosp., Kenya [54], [55]	2014	148	C			TH S		
COSTS AND IMPACTS								
SEARCH, Kenya, Uganda [56]–[59]	2013 - 2021	111,266	DM HTN	E F L ST	E L ST	Tp M C	F O	Z
Integrated Chronic Disease Management (ICDM), South Africa [60], [61]	2011-Present	878	CRD DM MC NC HTN		E L M S	STp C R U		
COST-EFFECTIVENESS								
Cervical Cancer Referral Screening, Zambia [62]	2013 - 2014	3,963	C			LTp	LT	
Group support psychotherapy (GSP) – 1, Uganda [63]	2016 - 2018	1,140	MC SUD			E STp		
Reducing Hazardous Alcohol Use & HIV Viral Load (REDART), Vietnam [64]–[66]	2016-2018	440	SUD			Tp	T	

NCDs and risk factors

BMI = Obesity
C = Cancer
CRD = Chronic respiratory diseases
DM = Diabetes and kidney disease
HL = Hyperlipidemia
HTN = Hypertension
MC = Mental health conditions
NC = Neurological conditions
SUD = Substance use disorders
T = Tobacco use

Services

S = Screening/diagnosis
T = Treatment (Tp-primary care facility, Th- hospital setting)
C = Clinical service processes
E = Education
S = Screening/diagnosis
F = Follow-up
L = Linkages and referrals
P = Peer support
M = Medication access
X = Training
O = Other
R = Organizational support
U = Functional support
Y = Food nutritional support
Z = Financial risk protection

2.3 Clinical and nonclinical outcomes

The review compiled 24 programs that met qualifying criteria for rigorous evaluation of clinical and/or nonclinical outcomes resulting from implementation of integrated HIV-NCD programs. Clinical outcomes were defined as measurable changes in symptoms, overall health, the ability to function, quality of life, or survival rates [67]. Nonclinical outcomes broadly encompassed other assessed outcomes, including those related to health systems, behavioral factors influencing patient health, or other social or environmental factors. Cost outcomes are described separately in Section 2.4.

The identified programs assessed 14 different clinical outcomes. These included depression symptoms or remission, alcohol or drug use indicators (i.e., assessing the frequency or nature of alcohol or drug use), viral suppression (changes in the number of HIV patients with less than 200 copies of HIV per milliliter of blood), rates of antiretroviral therapy (ART) use (changes in uptake of —or adherence to— ART), changes in a patient's ability to function, anxiety symptoms or remission, CD4 counts (the number of CD4 T-cells), blood pressure and hypertension control rates (the number of patients with a systolic blood pressure less than 140 mmHg and a diastolic blood pressure less than 90 mmHg), changes in mortality rates, post-traumatic stress disorder (PTSD) symptoms, changes in HIV incidence rates, peripheral neuropathy symptoms (symptoms associated with conditions that affect nerves outside of patients' brains or spinal cords), perceptible vibration sense (ability of patients to perceive vibration), and quality of life (patients' perceived physical and mental health). Depression symptoms were the most widely reported HIV-NCD clinical outcome, followed by substance use, viral suppression, and ART adherence. Two service delivery models had evidence reporting on longer-term outcomes (e.g., mortality rates).

Nonclinical outcomes included changes in screening, diagnosis, and treatment rates, rates of linkages to care, rates of unprotected sex, barriers to seeking care, caregiver burden (the level of perceived strain on a caregiver resulting from taking care of a patient), rates of HIV testing in partners of people living with HIV, assessments of social support given to patients, and patient time spent at healthcare facilities. Screening, diagnosis, and treatment rates were the only nonclinical outcomes reported by more than one service delivery model. Favorable and significant outcomes were found in one program for linkages to care and another for rates of unprotected sex.

Table 3 summarizes the types of evaluated clinical outcomes reported by each program and describes whether outcomes were favorable and significantly different from the program's intervention comparators. Outcomes were assessed as "significantly different" if the studies reported a p-value <0.10. In general, integrated programs were successful in improving clinical outcomes; 21 of 24 programs (88 percent) generated at least one favorable and significantly different clinical outcome and 19 out of 24 (79 percent) programs reported favorable and significant outcomes on at least half of those that they measured. Among the three programs that did not report a significant favorable HIV or NCD clinical or nonclinical outcome, contributing factors included poor patient participation, difficulties recruiting participants, medication shortages, and overburdened staff [38], [43], [45]. None of the included service delivery models reported significant declines in either clinical or nonclinical outcomes.

Table 3: Clinical and nonclinical outcomes by program

PROGRAM NAME	Integrated NCDs and risk factors	Favorable and significant outcomes	Insignificant outcomes (i.e., no change)	% favorable and significant outcomes among all assessed outcomes
Multi-component, clinic-based HIV prevention intervention, Kenya, Namibia, Tanzania [32]	SUD	SDT US	AA PS SU	40.0%
Project MIND, South Africa [33]	MD SUD	DS SU	AA	66.7%
HIV Prevention Trials Network 074 (HPTN 074), Indonesia, Ukraine, Vietnam [34], [35]	SUD	AA M VS	HI	75.0%
INDEPTH (INtegration of DEPression Treatment in HIV care), Uganda [36]	MD	SDT (diagnosis)	SDT (screening & treatment)	50.0%
Community Home-based Care Intervention on Mental Health Outcomes and Anti-retroviral Therapy Adherence in PLHIV, Nepal [37]	MD SUD	AA AS DS SU	-	100.0%
Friendship Bench Therapy, Malawi [38]	MD	-	AA DS SDT VS	0.0%
Together for Empowerment Activities (TEA), China [39]	MD	DS	CB	50.0%
HADITHI - Helping AMPATH Disclose Information to Talk About HIV Infection, Kenya [40]	MD	DS	VS	50.0%
Psycho-education and interpersonal psychotherapy (IPT), Cameroon [41]	MD	AA DS	VS	66.7%
Interpersonal psychotherapy (IPT), Kenya [42]	MD	DS F PTSD	-	100.0%
CHW education in HIV and drug-use, Vietnam [43]	SUD	-	BC	0.0%
MI-CBT: Motivational Interviewing blended with brief Cognitive Behavioral Therapy, Zimbabwe [44]	SUD	SU	CD4 F QoL VS	20.0%
Mediational Intervention for Sensitizing Caregivers (MISC) and UCOBAC health and nutrition training, Uganda[45]	MD	-	AS DS F	0.0%
Physiotherapy-led exercises (PTExs), Rwanda [46]	ND	PNS	PVS	50.0%
Group support psychotherapy (GSP), Uganda [47]	MD	DS F PTSD	SU	75.0%
The Family Strengthening Intervention for HIV-affected families (FSI-HIV), Rwanda [48]	MD SUD	SU	DS	50.0%
Khanya, South Africa [49]	SUD	AA	SU	50.0%
Integrated Yoga, India [50]	MD	CD4 DS	AS	66.7%
Local group-based Interpersonal Therapy (IPT), South Africa [51]	MD	AS DS	SS	66.7%
SEARCH, Kenya, Uganda [56]–[59]	DM HTN	BP LC M VS	HI	80.0%
Integrated Chronic Disease Management (ICDM), South Africa [60], [61]	CRD DM MD ND HTN	BP CD4	-	100.0%
Reducing Hazardous Alcohol Use & HIV Viral Load (REDART), Vietnam [64]–[66]	SUD	SU	VS	50.0%
Cervical Cancer Referral Screening, Zambia [62]	C	SDT	-	100%
Group support psychotherapy (GSP) – 1, Uganda [63]	MD SUD	DS	F	50.0%

Note: Significant outcomes include all outcomes with a p-value <0.10; No unfavorable and significant outcomes were reported; Insignificant outcomes had a p-value > 0.10.

NCDs and risk factors

BMI = Obesity
C = Cancer
CRD = Chronic respiratory diseases
DM = Diabetes and kidney disease
HL = Hyperlipidemia
HTN = Hypertension
MD = Mental disorders
ND = Neurological disorders
SUD = Substance use disorders
T = Tobacco use

NCD/HIV clinical outcomes

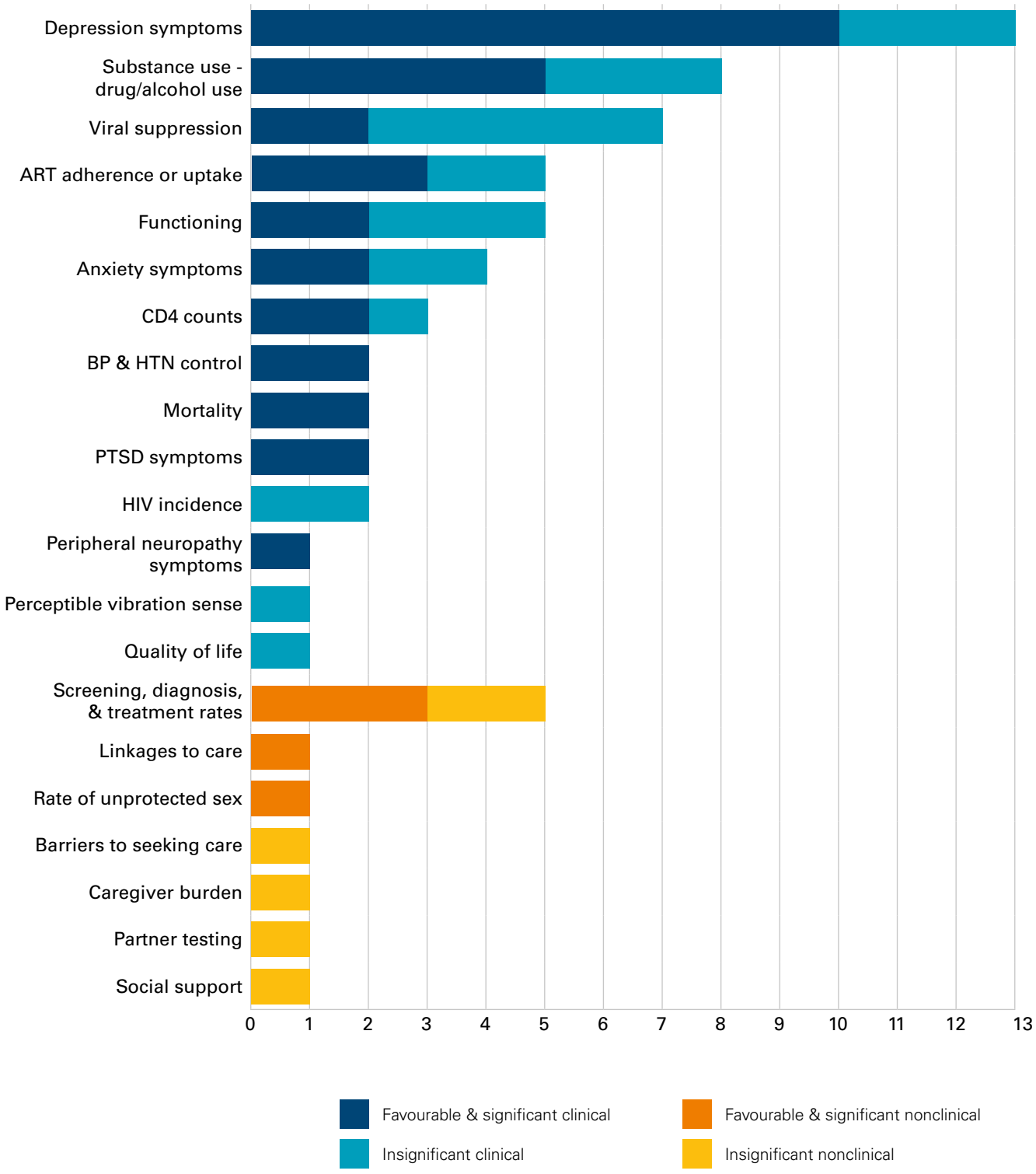
AA = ART adherence or uptake
AS = Anxiety symptoms
BP = BP control
CD4 = CD4 counts
DS = Depression symptoms
F = Functioning
HI = HIV incidence
M = Mortality
PNS = Peripheral neuropathy symptoms
PTSD = PTSD symptoms
PVS = Perceptible vibration sense
SU = Substance use – drug/alcohol use
VS = Viral suppression

Nonclinical outcomes

BC = Barriers to seeking care
CB = Caregiver burden
LC = Linkages to care
PS = Partner testing
QoL = Quality of life
SDT = Screening, diagnosis, and treatment rate
SS = Social support
US = Rate of unprotected sex

Figure 4.1 gives another perspective on outcomes, compiling them by category and significance. Ten out of 13 integrated programs designed to treat depression successfully reduced symptoms and/or achieved remission. Similarly, five in eight programs targeting substance use disorders reported significant positive changes in participants' use of drugs or alcohol. Two programs that assessed longer-term outcomes found that mortality decreased after integration [34], [56]. One of these programs, the HIV Prevention Trials Network, integrated drug use care with HIV care to increase HIV medication adherence and the other, the SEARCH trial, integrated HIV, diabetes, and hypertension care while aiming to both reduce patient-level barriers to care and optimize care efficiency.

Figure 4.1 The impact of integrated programs on HIV-NCD clinical and nonclinical outcomes



Clinical outcomes for people living with and at risk of HIV and NCDs

Thirteen of 24 service delivery models that rigorously assessed non-cost related program impacts had evidence on both HIV and NCD-related clinical or nonclinical outcomes [33], [34], [37], [38], [40], [41], [44], [49], [50], [56], [60], [62], [65]. Of the 13 programs, nine reported impacts on either CD4 counts or viral suppression and NCD clinical or nonclinical outcomes, eight on either HIV medication adherence or ART uptake and NCD clinical or nonclinical outcomes, and one on HIV incidence and NCD clinical or nonclinical outcomes. Four studies assessed multiple HIV-related outcomes. Eleven of the 13 programs that reported HIV and NCD clinical or nonclinical outcomes noted at least one favorable NCD outcome and improvements to —or maintenance of— HIV outcomes.

Out of the nine service delivery models with evidence on CD4 counts or viral suppression, eight recorded significant improvements in NCD outcomes (e.g., mortality rates, depression remission or symptoms, blood pressure control, and alcohol use) [34], [40], [41], [44], [50], [56], [60], [64]. Three of the nine found significant improvements in viral suppression or CD4 counts [34], [50], [60], while six produced no evidence of significant change in those measurements [34], [38], [40], [41], [44], [50], [56], [60], [64].

Similarly, among eight programs that evaluated impacts on either HIV medication adherence or ART uptake, six reported significant improvements in NCD outcomes (e.g., mortality, depression remission or symptoms, and harmful/hazardous alcohol use [33], [34], [37], [38], [41], [63]. Half of the programs found a significant impact on adherence or uptake [34], [37], [41], [49].

Nonclinical outcomes

A total of four programs included nonclinical outcomes related to the care cascade, including one that found a significant improvement in linkages between types of care [56], and three that evaluated screening, diagnosis, and treatment rates of patients [36], [38], [62]. For example, the Integration of Depression Treatment in HIV Care (INDEPTH) program screened participants for depression before linking those that exhibited symptoms of depression with different models of care. The diagnosis rate significantly increased among patients in the treatment arm by 8.3% absolute percentage points [36]. Evidence of the success of integration programs in improving the cascade of care was mixed among studies in our sample. Three out of four programs aiming to improve the cascade of care succeeded [36], [56], [62].

HIGHLIGHTS

79

Percent of programs reported favorable and significant outcomes on at least half of the outcomes that they measured.

LOWERING DEPRESSION

Programs targeting depression were highly successful, achieving favorable results in 10 out of 13 (77%) measured outcomes.

11 of 13

programs assessing both NCD and HIV-related outcomes reported improvements to —or maintenance of— HIV outcomes and positive NCD outcomes.

2.4 Costs and cost-effectiveness of integrated service delivery

The search strategy aimed to identify studies comparing the costs of integrated HIV-NCD service delivery models to non-integrated models. Ten identified studies [30], [53]–[56], [59], [61]–[63], [68] met this criterion.[4]

The studies described the costs of eight HIV-NCD integrated programs. Most (six out of eight) programs were costed from a health care system perspective, meaning that the studies investigated costs health providers would pay (e.g., labor of health providers; medicines, diagnostics, and supplies; facility overheads). The remaining two service delivery models were costed from a societal perspective that accounted both for costs to patients (e.g., out-of-pocket expenditures, transportation, child/elderly care) and to the health system. **Table 4** provides an overview of the cost category and outcome related to each program.

Studies conducted from a healthcare system perspective

Studies that reported costs from a healthcare system perspective (e.g., costs per person served or costs per health facility) tended to cost attachment of NCD care to existing HIV care (e.g., adding multi-disease testing to HIV screening programs), without assessing the extent to which integrated service delivery changed distributions of health service utilization from status quo practices. On average, these studies reported that the integrated HIV-NCD intervention increased costs by around 16 percent over non-integrated interventions. Increases ranged from a low of 2.1 percent (an additional US$6.29 per person served annually) to integrate hypertension care for people living with HIV within health facilities in Uganda [56] to a high of 42 percent (an additional US$3.95 per person served annually) to deliver multi-disease integrated home-based screenings in comparison to only HIV home-based screenings in South Africa [53].

Studies conducted from a societal perspective

Studies that conducted costing from a societal perspective identified HIV-NCD integration as cost saving when considering cost per person treated, in part because integration improved the efficiency of service delivery (e.g., delivered care for multiple diseases in fewer or synchronized visits compared to standalone care for each disease separately). For example, researchers in Kenya examined the impact of aligning pre-cervical cancer treatment with standard HIV-related care visits. Considering reductions in a) patient travel, travel-related meals eaten "out", childcare costs, as well as patient-averted productivity losses from lost work opportunities; and b) healthcare system costs such as labor (e.g., personnel time), diagnostic and other supplies, and overheads, the authors found that integrating care would be cost-effective. Costs would reduce by between 50 to 55 percent (US$ 24.73 to US$ 49.79) depending on whether colposcopies, LEEP, or cryotherapy procedures were performed. Using a similar premise and costing perspective, the same authors identified that aligning cervical cancer screening with existing HIV visits could reduce per person costs by 81 percent for screenings with VIA/VILI tests [54] compared to standalone cervical cancer screening visits.

Another study of the costs of providing integrated care for people living with HIV and diabetes and/or hypertension in Uganda [30] identified that aligning health facility visits to provide multi-disease care would reduce costs from a healthcare system perspective by 15 percent per person served (US$4.55) annually compared to providing standalone single disease care in separate visits. Savings derived from reductions in overhead costs (e.g., buildings, administration, equipment) from reduced numbers of client visits. Considering reduced medical expenditures, transportation, childcare, and other costs, individuals could save nearly US$25 annually.

Considering both the studies in Kenya and Uganda, reported savings from integrating HIV-NCD care overwhelmingly accrued to patients compared to health systems. In all studies, at least 85 percent of total societal savings applied to patients.

4 One additional study [69] did not compare integrated program costs to a non-integrated program, but it contained qualifying evidence on impacts. Costs of the program are described in Appendix 1, and in the program's case study in Section 3.3.

Studies that examined cost-effectiveness

While five integrated HIV-NCD service-delivery models containing evidence on both costs and impacts, only three [62], [63], [66] produced studies that directly assessed cost-effectiveness, in other words, the degree to which a program produces good health outcomes (e.g., lives saved or disability adjusted life years averted) in comparison to the costs that it takes to generate those outcomes. Specific thresholds of cost-effectiveness vary by context. For illustrative purposes, for the identified studies, we report cost-effectiveness in Appendix 2 using a 1x GDP per capita threshold to assess cost-effectiveness (i.e., dollars spent on a health intervention to gain one disability adjusted life year of health should not exceed 1x GDP per capita in the country of interest). In addition, we report whether interventions would be cost-effective considering more stringent country income level thresholds [70].[5] All cost-effectiveness studies identified that at least one integrated intervention studied was cost-effective considering 1x GDP per capita and more stringent country-specific cost-effectiveness thresholds.

5 Respectively in Uganda, Zambia, and Vietnam, country-specific income thresholds are 17, 32 and 57 percent of GDP per capita considering DALY 2 estimates from the Supplementary File 1 of Ochalek et al (2019). DALY 2 is the low end of Ochalek and colleagues' estimates, providing a stringent test for cost-effectiveness.

Table 4. Integrated HIV-NCD programs: Costing perspective, assessed cost categories, and cost outcomes

Program name/ targeted diseases and disorders*	HIV-NCD service delivery model and cost comparison	Costing perspective	Included costs	Cost outcome, USD (% Δ)
Enhanced counseling, and referral to add-on screening services, Zambia (cervical cancer)* [62]	Enhanced counseling after HIV-positive testing, & standardized CC referral services vs. standard testing/counseling with ad-hoc referral services	Healthcare system	Labor: health provider time; PoC: diagnostics and supplies; Overhead: admin, buildings, maintenance, utilities	↑ $9.15 (10%) to provide enhanced counseling & standardized CC referral compared to voluntary HIV counseling and testing only**
Group support psychotherapy, Uganda (depression)* [63]	Group Support Psychotherapy vs. Group HIV education only	Healthcare system	Program/implementation: Training, supervision, development of program materials, facilitation of community advisory boards; Labor: health provider time; hospitalization	↑ $7.68 (18%) per client served to deliver integrated care
Linkages study, South Africa (multiple NCDs, depression) [53]	Home-based HIV-NCD screening vs. Home-based HIV screening	Healthcare system	Program/implementation: Meetings/consultation, transportation, training, supplies; Labor: health provider time; Overhead: buildings, utilities; PoC: diagnostic equipment and supplies	↑ $3.95 (42%) per client served to deliver integrated screening
SEARCH, Uganda (diabetes, HTN)* [56]	Integrated hypertension care in PLHIV versus standalone HIV care	Healthcare system	Labor: personnel time; PoC: medications, diagnostics, supplies; Overhead: buildings, utilities	↑ $6.29 (2.1%) per client served to deliver integrated care
SEARCH, Uganda (diabetes, HTN)* [59]	Mobile screening (community & home) – Multi-disease vs HIV-only	Healthcare system	Labor: personnel time; Program/implementation (staff accommodation, transportation); PoC: diagnostic equipment and supplies; Overhead (buildings, vehicles, furniture)	↑ $1.16 (5.4%) per client to deliver integrated screening
Bophelo! – (multiple NCDs) [68]	Facility-based and mobile screening services – Multi-disease vs HIV screening only	Healthcare system	Labor: personnel time and per diems; PoC: diagnostic equipment and supplies; Program/implementation: staff accommodation, fuel	↑ $11.35 (18%) to deliver integrated multi-disease screening services
Integrated Chronic Disease Management, South Africa (multiple NCDs, mental disorders, epilepsy)* [61]	Integrated versus non-integrated community – (multi-disease education, health promotion, screening) facility-based (prevention/treatment) care.	Healthcare system	Program/implementation: reorient facilities/processes for people living with chronic disease; support from district level teams to supervise and train health providers; establish and operate community "adherence clubs"	↑ $24,102 per clinic (19.4%) in implementation costs to facilitate integrated facility-based care
HIV/Cervical Cancer integration – Kenya hospitals (cervical cancer) [54]	Multi-purpose HIV hospital visit (cervical cancer screening + HIV care) vs. Single-purpose hospital visit for cervical cancer screening	Societal	Patient – OoP expenditures for medical care, transportation, child/elderly care, productivity losses. Health system – Labor: health provider and lab technician time; Overhead: buildings, utilities); PoC: diagnostic equipment and supplies	VIA/VILI: Healthcare costs ↓ $0.34 (26%), Patient Costs ↓ $13.9 (85%) per client served to deliver screening during pre-existing HIV care facility visits**
HIV/Cervical Cancer integration – Kenya hospitals (cervical cancer) [55]	Cervical pre-cancer treatment/follow-up aligned with HIV care visits vs standalone pre-cancer treatment/follow-up	Societal	Patient – OoP expenditures for medical care, transportation, child/elderly care, productivity (lost labor) losses; Health system – Labor: health provider and lab technician time; Overhead (buildings, utilities); PoC: diagnostic equipment and supplies	Colposcopy, Cryotherapy, LEEP: Healthcare costs ↓ $2.60-5.54 (10-12%), Patient Costs ↓ 22.13 - 44.25 (100%) delivering cervical pre-cancer treatment during pre-existing HIV care visits.
Management of Chronic Conditions in Africa, Uganda (diabetes, HTN) [30]	Facility-based care – Multi-disease (integrated) versus single-disease	Societal	Patient – OoP expenditures for medical care, transportation, productivity (lost labor) losses, food; Health system - labor (health provider and lab technician time), PoC: medications, diagnostics equipment and supplies, Overhead: administration, buildings, equipment, furniture.	↓ $4.55 (15%) per client served in health system costs and ↓ $25 (27%) in patient costs per person to deliver "one-stop-shop" multi-disease care compared to separate care visits

Abbreviations: CBT – Cognitive Behavioral Therapy; CC – Cervical cancer; HC2 Hybrid Capture 2; HPV – human papillomavirus; HTN – hypertension; MET – Motivational enhancement therapy; OoP – out-of-pocket; PoC – point of care; VIA – Visual Inspection with Acetic Acid; VILI – Visual Inspection with Lugol's Iodine * Designates a program with studies that captured both costs and consequences ** Calculated using details from author papers – See Appendix 1. *** Cost studies were required to compare the costs of integrated service delivery models to non-integrated models. Exceptions were made for studies that reported cost information and contained qualifying evidence on consequences. REDART in Vietnam compared the consequences of the program to non-integrated standards of care, but costs were only compared between the two intervention arms.

3
CASE STUDIES

This section presents case studies of three of the 28 identified HIV-NCD programs meeting the inclusion criteria for this review, offering a closer look at the structure, costs, and impact of HIV-NCD integration programs. Case studies were selected to represent a diversity of service delivery models, geographic locations, sizes, integrated NCDs and NCD risk factors, and evidence on costs and outcomes. Lessons from these programs may inform stakeholder approaches to integration.

The Integrated Chronic Disease Management (ICDM) program in South Africa was the only identified example of a service delivery model structurally embedded within the health system. As such, the model provides learning for stakeholders interested in establishing integrated chronic care delivery models at primary care level. Designed to deliver services across the care continuum for multiple chronic diseases —HIV, chronic respiratory diseases, hypertension, and mental and neurological conditions— the program achieved noteworthy clinical outcomes, but also faced implementation barriers that give insight into the challenge of restructuring health systems in an era in which NCDs are the predominant contributor to the health burden.

Two programs operated as randomized controlled trials: Sustainable East Africa Research in Community Health (SEARCH) in Uganda and Kenya, and Reducing Hazardous Alcohol Use among ART Clients (REDART) in Vietnam. SEARCH, a large-scale trial involving over 100,000 participants, deployed a patient-centered care model for people living with HIV, hypertension, and/or diabetes. The model aimed to reduce barriers to care, including by improving patient interactions with clinics, and to increase knowledge of both patients and providers on managing chronic conditions. As the only identified program providing services within homes, in communities, at health facilities, and remotely, it provides a unique example of how to deliver patient-centered care. Over 80 peer-reviewed publications [58] provide a robust evidence base from which to draw conclusions on costs, outcomes, and lessons learned from program implementation.

REDART (440 participants) was designed to reduce alcohol use in specific subpopulations of people living with HIV in Vietnam, including those who inject drugs. As one of only a few multi-arm interventions identified in the literature review, it investigates the costs, outcomes, and cost-effectiveness of more versus less intensive approaches to intervention —including by offering counseling services remotely rather than onsite. Achieving positive HIV- and NCD-related outcomes, the program is an example of win-wins that can be achieved by integrating services.

3.1 Integrated Chronic Disease Management (ICDM)

Initiated by the South Africa National Department of Health in 2011 and ongoing to present day, ICDM aims to improve chronic disease health outcomes among patients at primary healthcare facilities.

ICDM
International Community of Diaconic Management

Location	42 primary health care (PHC) facilities in three districts, South Africa
Years	2011 – present
Integration	HIV, tuberculosis, chronic respiratory diseases, diabetes, hypertension, epilepsy, and mental health conditions
Funding	Fogarty International Centre of the National Institutes of Health and the African Doctoral Dissertation Research Fellowship (ADDRF) program.

MAIN FINDINGS

Increased
CD4 count

Increased
BP control

↑ $24,102
(19.4%) PER CLINIC

Program description

The ICDM program was designed to improve health outcomes among people living with chronic disease, reduce fragmentation of PHC services and ensure PHC facilities met national minimum standards [60], [71]. The program's main characteristics include improving operational efficiency and quality of care by *reorganizing facilities* to provide efficient care for people living with chronic diseases, strengthening training, supervision, and *support of clinical staff*, assisting patients to self-manage care through community-based support (outreach teams and community health workers), and building collaborations between non-health and health institutions to facilitate delivery of care [72].

Service delivery models

Community-based. Health education and promotion campaigns and screening campaigns were conducted in communities by outreach teams. School health teams also conducted education and awareness campaigns and provided screening services in schools. Individuals identified as high risk were referred to health facilities, and community health workers followed up regularly to emphasize adherence, provide education, and identify developing complications to ensure prompt referral. Patients controlling their chronic conditions were offered options to collect medication at community outlets.

Health facility. Multi-disease care following standardized protocols based on national guidelines was offered across the care continuum [73]. Interventions to improve clinical service processes included training nurses to manage chronic conditions, new supervision structures to undertake audits of provided services, and facility reorganization (e.g., new equipment, care pathway layouts) to manage patient flow [72]. Functional service support included development of new systems to track appointments and facilitate record keeping on record management of patients with chronic diseases [73]. Organizational integration included new collaborations between health clinics and schools and community organizations to support and extend service delivery [61], [72].

Outcomes

Clinical. An interrupted time series analysis that examined patient outcomes before and after ICDM implementation found that facilities deploying ICDM had a 6% higher likelihood of controlling patients' CD4 counts and a 1% greater likelihood of controlling blood pressure [60]. Both improvements were statistically significant ($p < 0.10$).

Costs

Healthcare system perspective. Considering implementation costs alone, integrating chronic disease care required a 19% increase in spending per clinic (USD $24,102 per clinic). No assessment was made of the costs of clinical service delivery (e.g., of medications).

Challenges

A sustainability self-assessment tool administered to managers, supervisors, and a designated ICDM nurse in 37 facilities found nurse and clinician resistance to change were major impediments to implementation [73]. Poor infrastructure, and material and medication shortages were also barriers. Several patients reported having to wait in long lines to receive care.

Lessons

1. **Involving key stakeholders in the implementation of integrated care programs is important to achieve wide acceptability.** Clinical staff resistance to program implementation was a major challenge. Nurses previously working in HIV-only care units were wary of increases in workload due to multi-disease care, and the ICDM mandate of "nurse-led" care drove clinicians to disengage from participating in implementation [73]. Moreover, supervisors and local managers, who might have provided mentorship and leadership to help overcome such barriers, were overstretched by competing demands that did not allow them to assist at facility level. National health authorities must follow key change management principles to create buy-in for transformational changes [74]. Health system staff should be consulted and included in the design phase of integrated programs and coalitions.
2. **Health system level integration of chronic disease care can lead to improved health outcomes.** Although the ICDM program in South Africa faced many challenges in its implementation, it improved clinical outcomes for patients. When integrating care in LMICs, health system capacity and readiness needs should be considered and included in model implementation. Activities such as reorganizing facilities, training staff on integrated care, improving medication supply chains, and enhancing management processes are just a few activities that can improve health-system-level integration of chronic disease care.

Relevance for stakeholders

National governments. ICDM is an example of a health-system-level integrated model of service delivery, with proven health benefits. Along with SEARCH, ICDM demonstrates that task-shifting (e.g., nurse-led care) can efficiently use resources while improving health outcomes. The case study also is a lesson on the challenges of creating sustainable change and steps that can be taken to improve the chances of success.

Donors. Health system level change may ultimately be more sustainable than standalone programs. Increase development assistance for health that can be used by national governments to restructure or enhance existing health systems.

Researchers. Besides ICDM, health-system-level integration in LMICs has not been rigorously evaluated. The case study highlights the need for researchers to deploy creative study designs to assess real-world examples of integration at health system level.

3.2 Sustainable East Africa Research in Community Health (SEARCH)

SEARCH was a cluster-randomized controlled trial (RCT) involving over 100,000 participants in Kenya and Uganda. This case study focuses on two phases of the SEARCH program: I (2013-2017) and II (2017-2020). A third phase, SEARCH Sapphire, is ongoing [75].

SEARCH
SUSTAINABLE EAST AFRICA RESEARCH IN COMMUNITY HEALTH

Location	32 rural communities in Kenya and Uganda
Years	2013 – 2021
HIV-NCD Integration	HIV, diabetes, and hypertension
Sponsors and collaborators	Bill and Melinda Gates Foundation; Gilead Sciences; Infectious Diseases Research Collaboration, Uganda; Kenya Medical Research Institute; Makerere University; National Institute of Allergy and Infectious Diseases (NIAID); United States President's Emergency Plan for AIDS Relief (PEPFAR); and the World Bank.

INTEGRATED COSTS

MULTI-DISEASE SCREENING
↑ $1.16
(5.4%) PER PATIENT SCREENED

+ HTN CARE
↑ $6.29
(2.1%) PER PERSON LIVING WITH HIV TREATED FOR HYPERTENSION

Program description

At baseline, universal home- and community-based screening programs launched to diagnose HIV, hypertension, diabetes, and other diseases or conditions. Randomized comparator communities received one-time screening services and individuals with positive diagnoses were referred to standard of care. Screening for intervention communities continued annually. Patients with positive diagnoses in intervention communities were referred and linked to "one-stop-shop" integrated HIV-NCD care centers.

Service delivery

Home-based. 1) Residents who did not engage in community-based testing were identified and approached for testing in homes or places of their choosing. All people testing positive for HIV received post-test counseling, education on living with HIV and preventing transmission, and information on linking to care. 2) Participants in the intervention arm who missed appointments and could not be reached by phone were visited at home.

Community-based. Two-week multi-disease mobile community health campaigns screened for HIV, with selected communities receiving non-HIV service screenings. All people who tested positive for HIV received the post-test services described above.

Health facility. Patient-centered multi-disease care visits: Nurse-led, with physicians addressing complex cases; longer ART refill periods; cost-covered medication with availability guarantees; training for providers on treatment protocols. The program used a triage system (led by nurses) to reduce patient waiting times and adopted flexible clinic hours to meet patient needs.

Remote. Patients were reminded by phone of upcoming appointments, followed up by phone if appointments were missed, and given access to a clinic "hotline" to ask questions.

Other. Transport vouchers were provided to reimburse patients who linked with care services; those who missed care appointments were offered facilitated transport to return to clinics.

Outcomes

Clinical. After three years, compared to patients in comparator communities, the prevalence of viral suppression in the intervention group was 15% higher, hypertension control was 26% higher, tuberculosis incidence was 21% lower, and overall mortality rates declined by one absolute percentage point. No significant impact was identified on HIV incidence [56].

Nonclinical. More participants in the intervention group were linked to care than those in the control group; 20% more people in the intervention group attended at least one clinic visit in each of the three program years.

Costs

Healthcare system perspective. SEARCH assessed the difference in costs per patient between (1) screening for HIV versus screening for several diseases including HIV, diabetes, and hypertension; and (2) providing HIV care alone versus providing both HTN and HIV care. Attaching multi-disease screening to mobile community health campaigns cost an additional US$1.16 (5.4%) per person screened [56]. Delivering hypertension care to people living with HIV cost an additional $6.29 (2.1%) per person served versus standalone HIV care [59].

Challenges

Despite an innovative service delivery platform that covered several settings, equity concerns persisted with youth failing to achieve gains in viral suppression [76]. Barriers to uptake of care included HIV-related stigma, patients' lack of social support, interference of care with patient work obligations, prior negative experiences with health services, drug side effects, and treatment fatigue [79].

Lessons

1. **Patient-centered approaches were key to improving linkages to care and achieving health outcomes.** Community engagement, multi-disease service delivery, and patient-centered care were key drivers of SEARCH's success in meeting and exceeding 90-90-90 targets for HIV, while also improving the care continuum for people living with hypertension. Importantly, the program removed many of the access and affordability barriers to treatment, offering cost-covered medications and in some cases, covering transportation costs to clinics.

2. **Integrated service delivery can generate a wide range of health outcomes with relatively marginal costs to add multi-disease care.** The SEARCH program led to improvements in patient outcomes including improvements in viral suppression, decreases in probability of mortality, improvements in tuberculosis symptoms, increases in hypertension control, and improvements in linkages to care. For around US$ 1 more per person screened and $6 per patient treated, SEARCH generated 21 percent relative reductions in all-cause mortality among people treated for hypertension [57].

Relevance for stakeholders

National governments. SEARCH 's achievements were partially attributable to its effort to dismantle patient barriers to care by focusing on the Five A's of Access —affordability, availability, accessibility, accommodation, and acceptability [77]— providing a model for national health authorities to follow.

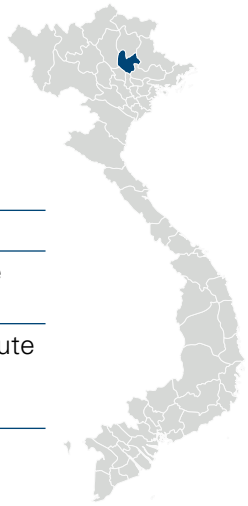
Donors. Supporting large-scale integrated care models that evaluate longer-term outcomes such as mortality can help build evidence for the true impact of these types of programs.

Researchers. The breadth of research around SEARCH (80+ published peer reviewed articles) provides evidence to inspire future integration programs that build from its success. Still, more can be done, including conducting cost-effectiveness analyses that describe the return on investment of integration.

3.3 Reducing Hazardous Alcohol Use & HIV Viral Load (REDART)

REDART, a RCT in Thai Nguyen, Vietnam compared the effectiveness of integrating motivational enhancement therapy (MET) and cognitive behavioral therapy (CBT) to the standard of care at ART outpatient clinics in reducing hazardous alcohol use. This case study reports on the costs, outcomes, and cost-effectiveness of more versus less intensive approaches to intervention after 12 months.

Location	7 antiretroviral therapy clinics in Thai Nguyen, Vietnam
Years	2016 – 2018
Integration	HIV & alcohol use interventions
Funding	US National Institute on Drug Abuse (NIDA)



Program description

This RCT trial assigned selected existing patients in ART clinics to three arms. Patients in the comparator arm were administered a baseline assessment for hazardous or harmful alcohol use (HHAU) and access to standard of care services in the ART clinic (i.e., harm reduction, ART at any CD4 count, referrals to local substance use centers, and referrals for diagnosis of other infectious diseases). The two intervention arms represented interventions of different intensity. Patients in the "brief intervention" arm participated in four MET and CBT counseling sessions, two delivered one-to-one in-person with trained counselors, and two delivered one-to-one telephone sessions. Patients in the "combined intervention" participated in six one-to-one in-person sessions with trained providers and had the option of attending three in-person group counseling sessions.

Service delivery models

Health facility. In counseling sessions, trained counselors administered motivational enhancement therapy to boost alcohol control motivation and cognitive behavioral therapy to help build skills to refuse alcohol and manage both cravings and high-risk temptation situations. Education on the harmful impacts of alcohol use was also given during the in-person sessions. In the group sessions, participants reinforced skills already learned, while being provided with a space to reflect on personal alcohol experiences.

Remote treatment. Telephone counseling sessions were given to select intervention participants in addition to the in-person sessions. Content of the sessions included review of drinking patterns, information on the harmful effects of alcohol use, and behavior change strategies.

COST-EFFECTIVENESS

BRIEF INTERVENTION

$525

PER QALY GAINED[a,b]

MET-CBT

$1,475

PER QALY GAINED[a]

Cost-effective considering a:

a. 1x GDP per capita threshold

b. Country-specific 0.57x GDP per capita threshold

Outcomes

Clinical. The program produced several statistically significant (p <0.10) outcomes. The brief intervention and combined intervention arms both achieved 237 days (65% of the year) of abstinence compared to 182 days (50% of the year) in the comparator group. The mean number of drinks per drinking day also decreased by more in the brief intervention and combined arms (4.2 and 3.4 respectively) compared to the comparator group (2.9). Viral suppression was significantly higher in the brief intervention but not in the combined intervention compared to standard of care.

Costs and cost-effectiveness

A study of costs of the program identified that the overall cost required to deliver the brief intervention was US$35 per participant and the costs required to deliver the more complex intervention was US$95 per participant [69]. Consisting of fewer counseling sessions, some of which were conducted remotely, the brief intervention had significantly lower costs from a patient perspective due to reduced travel and time to participate in sessions. Costs from a health system perspective were also lower because less human resource time was required to deliver the intervention. Both the brief intervention arm ($525 per quality adjusted life year (QALY) gained) and the combined intervention ($1,474 per QALY gained) were cost-effective considering the 1x GDP per capita threshold, but only the brief intervention was cost-effective considering the more stringent country-specific threshold (see Appendix 2).

Challenges

The process to adapt service delivery models that were developed in high-resource settings to lower-resource settings was intensive, requiring 2.5 years to complete [78]. As one example, while in high-resource settings alcohol consumption is standardized —with mass-produced beer, wine, and liquor required to list alcohol by volume (ABV)— in Vietnam, high consumption of home-brewed rice wines meant that there was no easy way to assess levels of alcohol use. Thus, high levels of formative research —including collecting and testing random samples of rice wines from homes and bars/street cafes— was required to initiate the program [78].

Further, while lay counselors successfully delivered the interventions, significant upfront investments were required to assist them in developing the required skill set (in some cases as many as 176 training hours) [78].

Lessons

1. **A multi-arm study design provided insight into the cost-efficiency of more versus less intensive forms of treatment.** The brief intervention was as effective as the combined intervention in reducing HHAU, more effective in increasing rates of viral suppression, and substantially less costly to implement. Designs that allow researchers to focus on the effectiveness of program components can provide insights into cost-effective ways to deliver care.

2. **Integrating behavioral health interventions into HIV clinic settings can cost-effectively increase HIV medication adherence among people living with HIV.** REDART targeted alcohol use behaviors and achieved improvements in HIV outcomes as a result. Other programs should include activities that reduce barriers to HIV care to effectively treat people living with HIV and increase HIV medication adherence.

Relevance for stakeholders

National governments. An example of win-win opportunities to achieve NCD-related health outcomes while improving HIV-related outcomes.

Donors. Integrating brief interventions for alcohol use improved HIV and alcohol use outcomes in Vietnam. Further study is needed to assess whether the same results can be achieved in other settings [64].

Researchers. Multi-arm study designs can show how different components of a delivery model contribute to outcomes and costs, providing insights into how to efficiently build programs.

4. CONCLUSIONS

This systematic literature review identified studies describing 28 HIV-NCD programs in 16 countries in Africa and Asia. It found evidence on the types of service delivery models deployed to integrate service delivery, the impact of HIV-NCD programs on a range of clinical and nonclinical outcomes, and the costs of implementation from patient and/or healthcare system perspectives. The main conclusions in these three areas are provided below.

4.1 Service delivery models

Nearly all programs identified in the review focused on clinical service delivery integration (i.e., providing care for two or more diseases in the same location or along the same care continuum), with most programs focused on integration of care for HIV and mental health conditions or substance use disorders.

Over half of the identified programs provided services in more than one setting (client homes, in the community, at health facilities, or remotely). These are real-world examples of the 2019 UN General Assembly's call to invest in new, innovative delivery models and collaborations to expand service coverage while also increasing the quality of care. Patient-centered approaches in several programs sought to overcome availability, accessibility, and affordability barriers by delivering care at patient homes or in the community — generating significant gains in engagement and retention. For example, SEARCH's two-week health campaigns and mobile HIV-NCD screening clinics acted as the vanguard in communities, generating awareness and high initial screening rates that covered 71 percent of the adult population in 32 communities in Uganda. The program then leveraged censuses and records to identify and connect with community members who did not present, conducting a second-wave home-based screening campaign for those individuals that jumped the community screening rate to 89 percent. Efforts to link patients to —and keep them in— care (e.g., by using transportation vouchers; extended clinical hours; follow up for missed appointment by phone and in person if necessary) led the program to exceed 90-90-90 goals HIV care and achieve 91-42-46 for hypertension (significantly better than national standards) [76], [79].

The diversity of delivery settings and services deployed within programs suggests that multifaceted interventions may be helpful to deliver comprehensive integrated NCD-HIV care. However, little is known about the ways that the component parts of service delivery models may interact. Future research could explore the comparative effectiveness and cost-effectiveness of different configurations of models of care, and the effect they may have on improving patient access to services.

4.2 The impact of HIV-NCD integration programs

Evidence is strong that integrated services can deliver health impact. Out of 24 programs with qualifying evidence on impact, 19 (79 percent) reported favorable and significant results in at least half of the outcomes that they measured. Most reported NCD outcomes related to improvements in depression or substance use disorders. Ten out of 13 integrated programs designed to treat depression were successful in lowering symptoms and/or achieving remission. Similarly, five in eight programs targeting substance use disorders reported significant reductions in patient use of drugs or alcohol. While some programs were designed to provide care for HIV and hypertension, cervical cancer, diabetes, and/or chronic respiratory diseases, no studies were identified that rigorously evaluate clinical outcomes of HIV-diabetes or chronic respiratory disease programs and only a handful existed for hypertension or cervical cancer. More research is needed to determine the feasibility and impact of models of service delivery for HIV and NCDs.

Among programs with evidence on both HIV and NCD clinical outcomes, 11 out of 13 identified that 1) HIV outcomes either improved or did not change (i.e., HIV outcomes did not suffer or decline due to integrated service delivery); and 2) NCD outcomes significantly improved. Taken together, this suggests that the claim that integration programs can widen health benefits for people living with HIV bears out in real-world programs.

4.3 Costs and cost-effectiveness of HIV-NCD integration programs

The costing evidence for eight HIV-NCD programs provided a glimpse into the potential of HIV-NCD integration programs to produce efficiencies that return to patients and health systems. Studies of two programs that conducted costing from a societal perspective (i.e., considered both patient and health system costs) identified that integrated programs can be cost-effective compared to non-integrated programs. Around 85 percent of the savings related to patients —in large part because synchronized care visits or care offered in locations closer to patient homes led to lower transportation, childcare, time, healthcare, and other costs. Integrated service delivery models may lower affordability barriers for patients, leading to potential gains in access and adherence to care. In these studies, a smaller share of savings also related to health systems, mostly because sharing resources across multiple diseases led to more efficient use of capital investments (e.g., facilities, equipment). The remaining studies costed six integrated programs from a healthcare perspective. On average, they reported that integrated HIV-NCD interventions increased costs by an average of 16 percent compared to non-integrated interventions. From a health system perspective, the additional cost to integrate programs may be relatively marginal compared to the health outcomes that the programs generate.

While the sample of costing studies is small, the difference in cost outcomes depending on the cost perspective of the study signals the need for researchers to be as inclusive as possible regarding the types of costs that are considered. They should also seek to document and track the multi-directional impact of integration on health service utilization. For example, integrated health promotion and screening programs may motivate more individuals to seek services downstream in the care continuum (i.e., treatment), drawing more patients into health systems and increasing service utilization (and costs). At the same time, integrated clinical service delivery models may theoretically decrease health service utilization (and costs) of patients already identified as living with one or more comorbidities, since these models of care often co-locate care or provide care for multiple conditions under one roof. Broadly, few of the identified costing studies tracked how a program changes the total number of patients accessing at least one component of the care continuum nor quantified resulting effects on resource use or costs (see Appendix 1). Most studies also did not contain sufficient information to assess whether the costs of providing care separately for conditions was lower than the cost of providing care together (ibid).

Only three of the five programmes providing evidence on both costs and impacts of implementing programs led to cost-effectiveness studies. All three found at least one intervention that was cost-effective considering both 1x GDP per capita and country-specific cost-effectiveness thresholds, demonstrating that integration can deliver on its promise of cost-effectiveness. Still, more evidence is needed. Filling this evidence gap would propel more substantive conclusions on the cost-effectiveness of HIV-NCD integration programs, and better address one of the primary research questions of this review. Donors, governments, and researchers should align to support the inclusion of costing and cost-effectiveness sub-studies within program evaluations and trials as a standard.

5. KEY RECOMMENDATIONS

Based on literature review findings, this report concludes with key recommendations to stakeholders with an interest in HIV-NCD integrated service delivery, namely national governments, donors, and researchers.

5.1 Recommendations for national governments

1. **Explore opportunities to integrate service delivery for HIV and NCDs**, including mental health conditions and substance use disorders. Integrated HIV-NCD programs can improve NCD outcomes while sustaining or improving HIV outcomes. In addition, integration is key to achieving UHC, with integrated care being more cost-effective than vertical programs.
2. **Dismantle access barriers to HIV and NCD care continuums**. Innovative models for integrated care —delivering a wide range of services in homes and communities, remotely, and at health facilities— can improve the acceptability, affordability, and availability of services.
3. **Consult health care professionals in the design and implementation of integrated programs**. Engagement of these professionals improves the success and sustainability of programs and reduces resistance to change. Establishing key change management principles can support transformational change.

5.2 Recommendations for donors

1. **Increase development assistance for health** allocated to fund the implementation and upscaling of HIV-NCD integration programs. Building on lessons learnt can ensure impact, cost-effectiveness and sustainability.
2. **Support funding programs and studies** that fill geographical and disease-based evidence gaps in HIV-NCD integration. Most integration research in LMICs has been conducted in sub-Saharan Africa, with major gaps in the Americas, the Eastern Mediterranean Region, and the Western Pacific Region. The evidence pool on integrating cancers, cardiovascular diseases, chronic respiratory diseases, and diabetes within HIV service delivery is sparse in comparison to that on mental health conditions and substance use disorders.
3. **Fund cost-effectiveness studies as part of program evaluation.** Filling the economic evidence gap on HIV-NCD integration programs is crucial to determine the resources required, facilitating investment and supporting the optimization of resource allocation.

5.3 Recommendations for researchers

1. **Deploy study designs that capture costing evidence** from a societal perspective, considering both patient and health system costs. Such studies reported integration as cost saving, with most of the savings accrued by patients.
2. **Compare different service delivery models.** Multi-faceted interventions may be helpful to deliver comprehensive integrated NCD-HIV care and improve patient access to services. Further research would inform about scaling interventions at the health-system level.
3. **Report on both positive and negative externalities** of integrating HIV-NCD care. Despite the positive clinical and nonclinical impact of integration, burdens on the health system, health care providers, patients, and caregivers should be studied to better prepare health systems. This comprehensive evidence is needed to create health system change.

6. REFERENCES

[1] World Health Organization & UNAIDS, "Integration of mental health and HIV interventions: key considerations," *WHO Publications*, Apr. 28, 2022. https://www.who.int/publications-detail-redirect/9789240043176 (accessed Jun. 15, 2023).

[2] The United States President's Emergency Plan for AIDS Relief, "PEPFAR Five-year Strategy 2022," *United States Department of State,* Dec. 01, 2022. https://www.state.gov/pepfar-five-year-strategy-2022/ (accessed Jun. 15, 2023).

[3] The Global Fund, "Board Decision Document: Approval of the Global Fund Strategy Narrative," *The Global Fund*, Nov. 08, 2021. https://www.theglobalfund.org/en/board/meetings/46/ (accessed Jun. 15, 2023).

[4] United Nations, "Universal Health Coverage | General Assembly of the United Nations," *UN.org*, Sep. 23, 2019. https://www.un.org/pga/73/event/universal-health-coverage/ (accessed Jun. 15, 2023).

[5] World Health Organization, "Integrating the prevention and control of noncommunicable diseases in HIV/AIDS, tuberculosis, and sexual and reproductive health programmes: implementation guidance," *WHO Publications*, Apr. 03, 2023. https://www.who.int/publications-detail-redirect/9789240061682 (accessed Jun. 15, 2023).

[6] NCD Risk Factor Collaboration (NCD-RisC), "Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: a pooled analysis of 1201 population-representative studies with 104 million participants," *Lancet Lond. Engl.*, vol. 398, no. 10304, pp. 957–980, Sep. 2021, doi: 10.1016/S0140-6736(21)01330-1.

[7] UNAIDS, "Fact sheet - Latest global and regional statistics on the status of the AIDS epidemic." UNAIDS, Jul. 27, 2022. Accessed: Jun. 15, 2023. [Online]. Available: https://www.unaids.org/en/resources/documents/2022/UNAIDS_FactSheet

[8] D. Flood *et al.*, "The state of diabetes treatment coverage in 55 low-income and middle-income countries: a cross-sectional study of nationally representative, individual-level data in 680 102 adults," *Lancet Healthy Longev.,* vol. 2, no. 6, pp. e340–e351, May 2021, doi: 10.1016/s2666-7568(21)00089-1.

[9] J. Manne-Goehler et al., "Health system performance for people with diabetes in 28 low- and middle-income countries: A cross-sectional study of nationally representative surveys," *PLoS Med.*, vol. 16, no. 3, p. e1002751, Mar. 2019, doi: 10.1371/journal.pmed.1002751.

[10] Maja E. Marcus, Cara Ebert, Pascal Geldsetzer, Michaela Thielmann, Brice Wilfried Bicaba, and Glennis Andall-Brereton, "Unmet need for hypercholesterolemia care in 35 low- and middle-income countries: A cross-sectional study of nationally representative surveys | PLOS Medicine," *PLOS Med.*, vol. 18, no. 10, Oct. 2021, doi: https://doi.org/10.1371/journal.pmed.1003841.

[11] A. Fekadu et al., "Under detection of depression in primary care settings in low and middle-income countries: a systematic review and meta-analysis," *Syst. Rev.*, vol. 11, no. 1, p. 21, Feb. 2022, doi: 10.1186/s13643-022-01893-9.

[12] Global Burden of Disease Collaborative Network, "Global Burden of Disease Study 2019 (GBD 2019) Results," Institute for Health Metrics and Evaluation, Seattle, United States, 2021. Accessed: Apr. 17, 2020. [Online]. Available: http://ghdx.healthdata.org/gbd-results-tool

[13] T. Doan, W. Shin, and N. Mehta, "To what extent were life expectancy gains in South Africa attributable to declines in HIV/AIDS mortality from 2006 to 2017? A life table analysis of age-specific mortality," Demogr. Res., vol. 46, no. 18, pp. 547–564, Mar. 2022, doi: 10.4054/DemRes.2022.46.18.

[14] S. Teeraananchai, S. Kerr, J. Amin, K. Ruxrungtham, and M. Law, "Life expectancy of HIV-positive people after starting combination antiretroviral therapy: a meta-analysis," *HIV Med.*, vol. 18, no. 4, pp. 256–266, Aug. 2016, doi: 10.1111/hiv.12421.

[15] S. Nsanzimana et al., "Life expectancy among HIV-positive patients in Rwanda: a retrospective observational cohort study," *Lancet Glob. Health*, vol. 3, no. 3, pp. e169–e177, Mar. 2015, doi: 10.1016/S2214-109X(14)70364-X.

[16] P. Patel *et al.*, "Noncommunicable diseases among HIV-infected persons in low-income and middle-income countries: a systematic review and meta-analysis," *Aids*, vol. 32 Suppl 1, no. Suppl 1, pp. S5-s20, Jul. 2018, doi: 10.1097/qad.0000000000001888.

[17] D. Stelzle et al., "Estimates of the global burden of cervical cancer associated with HIV," *Lancet Glob. Health*, vol. 9, no. 2, pp. e161–e169, Feb. 2021, doi: 10.1016/S2214-109X(20)30459-9.

[18] J. J. Bigna, A. M. Kenne, S. L. Asangbeh, and A. T. Sibetcheu, "Prevalence of chronic obstructive pulmonary disease in the global population with HIV: a systematic review and meta-analysis," *Lancet Glob. Health*, vol. 6, no. 2, pp. e193–e202, Feb. 2018, doi: 10.1016/S2214-109X(17)30451-5.

[19] R. U. Hernández-Ramírez, M. S. Shiels, R. Dubrow, and E. A. Engels, "Spectrum of cancer risk among HIV-infected people in the United States during the modern antiretroviral therapy era: a population-based registry linkage study," *Lancet HIV,* vol. 4, no. 11, pp. e495–e504, Nov. 2017, doi: 10.1016/S2352-3018(17)30125-X.

[20] M. J. Feinstein et al., "Characteristics, Prevention, and Management of Cardiovascular Disease in People Living With HIV: A Scientific Statement from the American Heart Association," *Circulation*, vol. 140, no. 2, pp. e98–e124, Jul. 2019, doi: 10.1161/CIR.0000000000000695.

[21] J. A. Ciesla and J. E. Roberts, "Meta-analysis of the relationship between HIV infection and risk for depressive disorders," *Am. J. Psychiatry*, vol. 158, no. 5, pp. 725–730, May 2001, doi: 10.1176/appi.ajp.158.5.725.

[22] P. Ehrenkranz, A. Grimsrud, C. B. Holmes, P. Preko, and M. Rabkin, "Expanding the Vision for Differentiated Service Delivery: A Call for More Inclusive and Truly Patient-Centered Care for People Living With HIV," *J. Acquir. Immune Defic. Syndr.* 1999, vol. 86, no. 2, pp. 147–152, Feb. 2021, doi: 10.1097/QAI.0000000000002549.

[23] World Health Organization and Lucinda Cash-Gibson, "Integrating health services: brief," *World Health Organization*, Oct. 2018. https://apps.who.int/iris/handle/10665/326459 (accessed Jun. 15, 2023).

[24] A. Kintu *et al.*, "Integrating care for non-communicable diseases into routine HIV services: key considerations for policy design in sub-Saharan Africa," *J. Int. AIDS Soc.*, vol. 23, no. S1, p. e25508, 2020, doi: 10.1002/jia2.25508.

[25] R. NUGENT *et al.*, "Costs and Cost-effectiveness of HIV/NCD Integration in Africa: From Theory to Practice," *AIDS Lond. Engl.*, vol. 32, no. Suppl 1, pp. S83–S92, Jul. 2018, doi: 10.1097/QAD.0000000000001884.

[26] Institute for Health Metrics and Evaluation, "Financing Global Health 2019 Tracking Health Spending in a Time of Crisis," *Seattle, Washington*, 2019. [Online]. Available: http://www.healthdata.org/policy-report/financing-global-health-2019-tracking-health-spending-time-crisis

[27] "From Double Shock to Double Recovery: Health Financing in a Time of Global Shocks," *World Bank.* https://www.worldbank.org/en/topic/health/publication/from-double-shock-to-double-recovery-health-financing-in-the-time-of-covid-19 (accessed Jul. 07, 2023).

[28] "The Future of Global Health Spending Amidst Multiple Crises," *Center for Global Development | Ideas to Action*. https://www.cgdev.org/publication/future-global-health-spending-amidst-multiple-crises (accessed Jul. 07, 2023).

[29] M. Duffy, B. Ojikutu, S. Andrian, E. Sohng, T. Minior, and L. R. Hirschhorn, "Non-communicable diseases and HIV care and treatment: models of integrated service delivery," *Trop. Med. Int. Health TM IH*, vol. 22, no. 8, pp. 926–937, Aug. 2017, doi: 10.1111/tmi.12901.

[30] T. Shiri *et al.*, "Patient and health provider costs of integrated HIV, diabetes and hypertension ambulatory health services in low-income settings — an empirical socio-economic cohort study in Tanzania and Uganda," *BMC Med.*, vol. 19, no. 1, p. 230, Sep. 2021, doi: 10.1186/s12916-021-02094-2.

[31] J. Birungi *et al.*, "Integrating health services for HIV infection, diabetes and hypertension in sub-Saharan Africa: a cohort study," BMJ Open, vol. 11, no. 11, p. e053412, Nov. 2021, doi: 10.1136/bmjopen-2021-053412.

[32] P. Bachanas *et al.*, "Delivering Prevention Interventions to People Living with HIV in Clinical Care Settings: Results of a Cluster Randomized Trial in Kenya, Namibia, and Tanzania," *AIDS Behav.*, vol. 20, no. 9, pp. 2110–2118, Sep. 2016, doi: 10.1007/s10461-016-1349-2.

[33] Myers B *et al.*, "Comparing dedicated and designated approaches to integrating task-shared psychological interventions into chronic disease care in South Africa: a three-arm, cluster randomised, multicentre, open-label trial.," *Lancet*, vol. 400, no. 10360, pp. 1321–1333, 2022, doi: 10.1016/S0140-6736(22)01641-5.

[34] W. C. Miller *et al.*, "A Scalable, Integrated Intervention to Engage People Who Inject Drugs in HIV Care and Medication-Assisted Treatment: A Randomized, Controlled Vanguard Trial (HPTN 074)," *Lancet Lond. Engl.*, vol. 392, no. 10149, pp. 747–759, Sep. 2018, doi: 10.1016/S0140-6736(18)31487-9.

[35] K. E. Lancaster *et al.*, "Engaging People Who Inject Drugs Living with HIV in Antiretroviral Treatment and Medication for Opioid Use Disorder: Extended Follow-up of HIV Prevention Trials Network (HPTN) 074," *Open Forum Infect. Dis.*, vol. 8, no. 8, 2021, doi: 10.1093/ofid/ofab281.

[36] G. J. Wagner, V. Ngo, P. Goutam, P. Glick, S. Musisi, and D. Akena, "A Structured Protocol Model of Depression Care versus Clinical Acumen: A Cluster Randomized Trial of the Effects on Depression Screening, Diagnostic Evaluation, and Treatment Uptake in Ugandan HIV Clinics," *PLoS ONE*, vol. 11, no. 5, p. e0153132, May 2016, doi: 10.1371/journal.pone.0153132.

[37] K. N. Pokhrel *et al.*, "Investigating the impact of a community home-based care on mental health and anti-retroviral therapy adherence in people living with HIV in Nepal: a community intervention study," *BMC Infect. Dis.*, vol. 18, no. 1, p. 263, Jun. 2018, doi: 10.1186/s12879-018-3170-1.

[38] Stockton MA *et al.*, "The impact of an integrated depression and HIV treatment program on mental health and HIV care outcomes among people newly initiating antiretroviral therapy in Malawi.," *PLoS One*, vol. 15, no. 5, p. e0231872, 2020, doi: 10.1371/journal.pone.0231872.

[39] L. Li *et al.*, "Efficacy of a Multilevel Intervention on the Mental Health of People Living with HIV and their Family Members in Rural China," *Health Psychol. Off. J. Div. Health Psychol. Am. Psychol. Assoc.*, vol. 36, no. 9, pp. 863–871, Sep. 2017, doi: 10.1037/hea0000503.

[40] R. Vreeman *et al.*, "A randomized, controlled trial of a patient-centered disclosure counseling intervention for Kenyan children living with HIV," J. Int. AIDS Soc., vol. 21, no. (Vreeman R.; McAteer C.) Indiana University, School of Medicine, Department of Pediatrics, Indianapolis, United States(Vreeman R.; Nyandiko W.; Marete I.; Ayaya S.) *College of Health Science, Moi University, Department of Child Health and Paediatrics*, Eld, 2018, doi: 10.1002/jia2.25148.

[41] J. J. N. Ndenkeh, A. M. Nji, H. A. Yumo, C. Rothe, and A. Kroidl, "Depression management and antiretroviral treatment outcome among people living with HIV in Northwest and East regions of Cameroon," *BMC Infect. Dis.*, vol. 22, no. 1, p. 732, Sep. 2022, doi: 10.1186/s12879-022-07711-w.

[42] S. Meffert *et al.*, "Interpersonal psychotherapy delivered by nonspecialists for depression and posttraumatic stress disorder among Kenyan HIV-positive women affected by gender-based violence: Randomized controlled trial," *PLOS Med.*, vol. 18, no. 1, 2021, doi: 10.1371/journal.pmed.1003468.

[43] Li L *et al.*, "A community approach to promote healthcare services for people living with HIV who use drugs in Vietnam.," *Int J STD AIDS,* vol. 33, no. 2, pp. 164–172, 2022, doi: 10.1177/09564624211053430.

[44] Madhombiro M *et al.*, "Effectiveness of a psychological intervention delivered by general nurses for alcohol use disorders in people living with HIV in Zimbabwe: a cluster randomized controlled trial.," *J Int AIDS Soc*, vol. 23, no. 12, p. e25641, 2020, doi: 10.1002/jia2.25641.

[45] M. J. Boivin *et al.*, "Effect of Caregiver Training on the Neurodevelopment of HIV-Exposed Uninfected Children and Caregiver Mental Health: A Ugandan Cluster-Randomized Controlled Trial," *J. Dev. Behav. Pediatr.*, vol. 38, no. 9, pp. 753–764, Nov. 2017, doi: 10.1097/dbp.0000000000000510.

[46] D. K. Tumusiime, A. Stewart, and F. W. Venter, "Effect of physiotherapeutic exercises on peripheral neuropathy, functional limitations of lower extremity and quality of life in people with HIV," Physiother. U. K., vol. 101, no. (Tumusiime D.K.) University of Rwanda, Physiotherapy, Kigali, Rwanda(Stewart A.) University of the Witwatersrand, Physiotherapy, Johannesburg, South Africa(Venter F.W.) *University of the Witwatersrand, Medicine, Johannesburg, South Africa*, pp. eS1547–eS1548, 2015, doi: 10.1016/j.physio.2015.03.1542.

[47] Nakimuli-Mpungu E *et al.*, "Group support psychotherapy for depression treatment in people with HIV/AIDS in northern Uganda: a single-centre randomised controlled trial.," *Lancet HIV*, vol. 2, no. 5, pp. e190-9, 2015, doi: 10.1016/S2352-3018(15)00041-7.

[48] S. Chaudhury *et al.*, "Exploring the potential of a family-based prevention intervention to reduce alcohol use and violence within HIV-affected families in Rwanda," *AIDS Care*, vol. 28 Suppl 2, no. sup2, pp. 118–129, Mar. 2016, doi: 10.1080/09540121.2016.1176686.

[49] J. F. Magidson *et al.*, "Project Khanya: results from a pilot randomized type 1 hybrid effectiveness-implementation trial of a peer-delivered behavioural intervention for ART adherence and substance use in HIV care in South Africa," *J. Int. AIDS Soc.*, vol. 24, no. S2, 2021, doi: 10.1002/jia2.25720.

[50] R. Naoroibam, K. G. Metri, H. Bhargav, R. Nagaratna, and H. Nagendra, "Effect of Integrated Yoga (IY) on psychological states and CD4 counts of HIV-1 infected patients: A randomized controlled pilot study," *Int. J. Yoga*, vol. 9, no. 1, pp. 57–61, 2016, doi: 10.4103/0973-6131.171723.

[51] I. Petersen, J. Hanass Hancock, A. Bhana, and K. Govender, "A group-based counselling intervention for depression comorbid with HIV/AIDS using a task shifting approach in South Africa: A randomized controlled pilot study," *J. Affect. Disord.*, vol. 158, pp. 78–84, Apr. 2014, doi: 10.1016/j.jad.2014.02.013.

[52] I. D. Beer, K. Chani, F. Feeley, T. F. R. de Wit, E. Sweeney-Bindels, and P. Mulongeni, "Assessing the costs of mobile voluntary counseling and testing at the workplace versus facility based voluntary counseling and testing in Namibia," Nov. 13, 2015. https://www.rrh.org.au/journal/article/3357/ (accessed Jun. 16, 2023).

[53] I. Golovaty *et al.*, "Cost of Integrating Noncommunicable Disease Screening into Home-Based HIV Testing and Counseling in South Africa," *J. Acquir. Immune Defic. Syndr.* 1999, vol. 78, no. 5, pp. 522–526, Aug. 2018, doi: 10.1097/QAI.0000000000001713.

[54] Vodicka EL *et al.*, "Costs of integrating cervical cancer screening at an HIV clinic in Kenya.," *Int J Gynaecol Obstet*, vol. 136, no. 2, pp. 220–228, 2017, doi: 10.1002/ijgo.12025.

[55] Vodicka EL *et al.*, "Estimating the costs of HIV clinic integrated versus non-integrated treatment of pre-cancerous cervical lesions and costs of cervical cancer treatment in Kenya.," *PLoS One,* vol. 14, no. 6, p. e0217331, 2019, doi: 10.1371/journal.pone.0217331.

[56] S. B. Shade *et al.*, "Costs of integrating hypertension care into HIV care in rural East African clinics," *AIDS Lond. Engl.*, vol. 35, no. 6, pp. 911–919, May 2021, doi: 10.1097/QAD.0000000000002834.

[57] M. D. Hickey *et al.*, "Effect of a patient-centered hypertension delivery strategy on all-cause mortality: Secondary analysis of SEARCH, a community-randomized trial in rural Kenya and Uganda," *PLOS Med.*, vol. 18, no. 9, p. e1003803, Sep. 2021, doi: 10.1371/journal.pmed.1003803.

[58] Havlir DV *et al.*, "HIV Testing and Treatment with the Use of a Community Health Approach in Rural Africa.," N Engl J Med, vol. 381, no. 3, pp. 219–229, 2019, doi: 10.1056/NEJMoa1809866.

[59] W. Chang *et al.*, "Cost and efficiency of a hybrid mobile multi-disease testing approach with high HIV testing coverage in East Africa," *J. Acquir. Immune Defic. Syndr.* 1999, vol. 73, no. 3, pp. e39–e45, Nov. 2016, doi: 10.1097/QAI.0000000000001141.

[60] S. Ameh, K. Klipstein-Grobusch, E. Musenge, K. Kahn, S. Tollman, and F. X. Gómez-Olivé, "Effectiveness of an Integrated Approach to HIV and Hypertension Care in Rural South Africa: Controlled Interrupted Time-Series Analysis," *J. Acquir. Immune Defic. Syndr.* 1999, vol. 75, no. 4, pp. 472–479, Aug. 2017, doi: 10.1097/QAI.0000000000001437.

[61] L. Lebina, M. Kawonga, T. Oni, H.-Y. Kim, and O. A. Alaba, "The cost and cost implications of implementing the integrated chronic disease management model in South Africa," *PLoS ONE*, vol. 15, no. 6, p. e0235429, Jun. 2020, doi: 10.1371/journal.pone.0235429.

[62] P. C. Hewett *et al.*, "Randomized evaluation and cost-effectiveness of HIV and sexual and reproductive health service referral and linkage models in Zambia," BMC Public Health, vol. 16, p. 785, Aug. 2016, doi: 10.1186/s12889-016-3450-x.

[63] Nakimuli-Mpungu E *et al.*, "Effectiveness and cost-effectiveness of group support psychotherapy delivered by trained lay health workers for depression treatment among people with HIV in Uganda: a cluster-randomised trial.," *Lancet Glob Health*, vol. 8, no. 3, pp. e387–e398, 2020, doi: 10.1016/S2214-109X(19)30548-0.

[64] Go VF *et al.*, "Effect of 2 Integrated Interventions on Alcohol Abstinence and Viral Suppression Among Vietnamese Adults with Hazardous Alcohol Use and HIV: A Randomized Clinical Trial.," *JAMA Netw Open*, vol. 3, no. 9, p. e2017115, 2020, doi: 10.1001/jamanetworkopen.2020.17115.

[65] Blackburn NA *et al.*, "Implementation of two alcohol reduction interventions among persons with hazardous alcohol use who are living with HIV in Thai Nguyen, Vietnam: a micro-costing analysis.," *Glob Health Action*, vol. 13, no. 1, p. 1814035, 2020, doi: 10.1080/16549716.2020.1814035.

[66] N. Blackburn *et al.*, "The cost-effectiveness of adapting and implementing a brief intervention to target frequent alcohol use among persons with HIV in Vietnam," *AIDS Behav.*, vol. 25, no. 7, pp. 2108–2119, Jul. 2021, doi: 10.1007/s10461-020-03139-y.

[67] "Clinical outcome." https://toolkit.ncats.nih.gov/glossary/clinical-outcome (accessed Jul. 07, 2023).

[68] "RRH: Rural and Remote Health article: 3357 - Assessing the costs of mobile voluntary counseling and testing at the workplace versus facility based voluntary counseling and testing in Namibia." https://www.rrh.org.au/journal/article/3357 (accessed Jun. 16, 2023).

[69] N. A. Blackburn *et al.*, "Implementation of two alcohol reduction interventions among persons with hazardous alcohol use who are living with HIV in Thai Nguyen, Vietnam: a micro-costing analysis," *Glob. Health Action*, vol. 13, no. 1, p. 1814035, Dec. 2020, doi: 10.1080/16549716.2020.1814035.

[70] J. Ochalek, J. Lomas, and K. Claxton, "Estimating health opportunity costs in low-income and middle-income countries: a novel approach and evidence from cross-country data," *BMJ Glob. Health*, vol. 3, no. 6, p. e000964, 2018, doi: 10.1136/bmjgh-2018-000964.

[71] L. Lebina, O. Alaba, M. Kawonga, and T. Oni, "Process evaluation of fidelity and costs of implementing the Integrated Chronic Disease Management model in South Africa: mixed methods study protocol," *BMJ Open*, vol. 9, no. 6, p. e029277, Jun. 2019, doi: 10.1136/bmjopen-2019-029277.

[72] "Integrated Chronic Disease Management Manual | Department of Health Knowledge Hub." https://knowledgehub.health.gov.za/elibrary/integrated-chronic-disease-management-manual (accessed Jul. 07, 2023).

[73] O. H. Mahomed, S. Asmall, and A. Voce, "Sustainability of the integrated chronic disease management model at primary care clinics in South Africa," *Afr. J. Prim. Health Care Fam. Med.*, vol. 8, no. 1, p. 1248, Nov. 2016, doi: 10.4102/phcfm.v8i1.1248.

[74] J. Kotter, "Leading Change: Why Transformation Efforts Fail," *Harvard Business Review*, 1995.

[75] "Sustainable East Africa Research in Community Health | Search | United States," *SEARCH*. https://www.searchendaids.com (accessed Jul. 07, 2023).

[76] G. Chamie, M. R. Kamya, M. L. Petersen, and D. V. Havlir, "Reaching 90–90–90 in rural communities in East Africa: lessons from the Sustainable East Africa Research in Community Health Trial," Curr. Opin. *HIV AIDS*, vol. 14, no. 6, pp. 449–454, Nov. 2019, doi: 10.1097/COH.0000000000000585.

[77] R. Spak, "The 5 A's of access for employer-sponsored healthcare," Aug. 01, 2017. https://www.mercer.com/en-us/insights/us-health-news/the-5-as-of-access-for-employer-sponsored-healthcare/

[78] H. E. Hutton *et al.*, "Cultural Adaptation of 2 Evidence-Based Alcohol Interventions for Antiretroviral Treatment Clinic Patients in Vietnam," J. Int. Assoc. Provid. *AIDS Care*, vol. 18, p. 2325958219854368, Jun. 2019, doi: 10.1177/2325958219854368.

[79] D. Heller *et al.*, "Hypertension testing and treatment in Uganda and Kenya through the SEARCH study: An implementation fidelity and outcome evaluation," *PLOS ONE*, vol. 15, no. 1, 2020, doi: 10.1371/journal.pone.0222801.

[80] F. W. Thielen *et al.*, "How to prepare a systematic review of economic evaluations for clinical practice guidelines: database selection and search strategy development (part 2/3)," Expert Rev. Pharmacoecon. *Outcomes Res.*, vol. 16, no. 6, pp. 705–721, Nov. 2016, doi: 10.1080/14737167.2016.1246962.

[81] G. McCombe *et al.*, "Integrating Care for Diabetes and Hypertension with HIV Care in Sub-Saharan Africa: A Scoping Review," vol. 22, no. 1, Art. no. 1, Jan. 2022, doi: 10.5334/ijic.5839.

[82] A. Rohwer, J. Uwimana Nicol, I. Toews, T. Young, C. M. Bavuma, and J. Meerpohl, "Effects of integrated models of care for diabetes and hypertension in low-income and middle-income countries: a systematic review and meta-analysis," *BMJ Open*, vol. 11, no. 7, p. e043705, Jul. 2021, doi: 10.1136/bmjopen-2020-043705.

[83] B. Wijnen, G. Van Mastrigt, W. K. Redekop, H. Majoie, R. De Kinderen, and S. Evers, "How to prepare a systematic review of economic evaluations for informing evidence-based healthcare decisions: data extraction, risk of bias, and transferability (part 3/3)," Expert Rev. Pharmacoecon. *Outcomes Res.*, vol. 16, no. 6, pp. 723–732, Oct. 2021, doi: 10.1080/14737167.2016.1246961.

[84] G. A. P. G. van Mastrigt *et al.*, "How to prepare a systematic review of economic evaluations for informing evidence-based healthcare decisions: a five-step approach (part 1/3)," Expert Rev. Pharmacoecon. *Outcomes Res.*, vol. 16, no. 6, pp. 689–704, Nov. 2016, doi: 10.1080/14737167.2016.1246960.

[85] S. Sweeney, C. D. Obure, C. B. Maier, R. Greener, K. Dehne, and A. Vassall, "Costs and efficiency of integrating HIV/AIDS services with other health services: a systematic review of evidence and experience," *Sex. Transm. Infect.*, vol. 88, no. 2, pp. 85–99, Dec. 2011, doi: 10.1136/sextrans-2011-050199.

[86] V. Haldane *et al.*, "Integrating HIV and substance use services: a systematic review," *J. Int. AIDS Soc.*, vol. 20, no. 1, p. 21585, May 2017, doi: 10.7448/IAS.20.1.21585.

[87] T. Jiang *et al.*, "Immunological and Psychological Efficacy of Meditation/Yoga Intervention Among People Living with HIV (PLWH): A Systematic Review and Meta-analyses of 19 Randomized Controlled Trials," Ann. Behav. Med. Publ. Soc. Behav. Med., vol. 55, no. 6, pp. 505–519, Jun. 2021, doi: 10.1093/abm/kaaa084.

[88] C. G. Kemp *et al.*, "Implementation science for integration of HIV and non-communicable disease services in sub-Saharan Africa: a systematic review," *AIDS Lond. Engl.*, vol. 32 Suppl 1, pp. S93–S105, Jul. 2018, doi: 10.1097/QAD.0000000000001897.

[89] S. Rocks *et al.*, "Cost and effects of integrated care: a systematic literature review and meta-analysis," Eur. J. Health Econ. *HEPAC Health Econ. Prev. Care*, vol. 21, no. 8, pp. 1211–1221, Jul. 2020, doi: 10.1007/s10198-020-01217-5.

[90] B. Njuguna *et al.*, "Models of integration of HIV and noncommunicable disease care in sub-Saharan Africa: lessons learned and evidence gaps," *AIDS Lond. Engl.*, vol. 32 Suppl 1, no. Suppl 1, pp. S33–S42, Jul. 2018, doi: 10.1097/QAD.0000000000001887.

[91] A. J. Adler *et al.*, "Understanding integrated service delivery: a scoping review of models for noncommunicable disease and mental health interventions in low-and-middle income countries," *BMC Health Serv. Res.*, vol. 23, no. 1, p. 99, Jan. 2023, doi: 10.1186/s12913-023-09072-9.

7. APPENDIX

Appendix 1. Methods

Studies were eligible for review if they met several criteria. First, the study was required to assess an HIV-NCD integration program. Integration was defined broadly as achieving clinical-service, functional, or organizational integration.[6] NCD was defined as encompassing NCDs, behavioral or metabolic NCD risk factors, or mental, neurological, or substance use disorders.[7] Second, the integrated program needed to have been implemented in a low- or middle-income country (LMIC) or countries, where LMIC was defined as any country that was classified by the World Bank as such during the period from 2009 to present.[8] Third, the study was required to be at least a partial economic evaluation comparing two or more alternative interventions on either effectiveness or cost measures, or a full economic evaluation on both effectiveness and cost measures.[9] Effectiveness measures could consider clinical outcomes (e.g., viral suppression) or nonclinical outcomes (e.g., time patients spend waiting at health facilities). The study could consider costs from patient, health system or societal perspectives. Finally, the study needed to be a trial-based economic evaluation or program evaluation with an effective control[10] (i.e., not a modeling study, but rather an economic evaluation of an existing program).[11] Search parameters were not constrained by time.[12]

The search strategy was developed following reference guidelines for systematic reviews of economic evaluations for informing evidence-based healthcare decisions [80], [83], [84]. Search terms, in English only, were selected to identify studies overlapping four search term categories: NCDs, HIV/AIDS, LMIC, integrated service delivery. The review searched four databases: PubMed, Embase, Web of Science, and EconLit, and reference lists of related systematic reviews [25], [82], [85]–[89]. In addition, the final set of included articles were mined to identify additional studies.

Figure 1.1 illustrates the search process, and the number of articles identified, screened, and ultimately included in the review. At least two of three total reviewers screened each article independently, first by abstract and title and then by full text to determine eligibility for inclusion. Differences in opinion were resolved through discussion with all three reviewers present and consensus was required for an article to advance to the next stage of review. In total, 35 studies describing the costs and/or effectiveness of 28 HIV-NCD integrated programs were included in the review.

Informed by the review of literature on integrated service delivery models [90], [91] and reference guidelines on data extraction from economic evaluations [83], an Excel-based framework was developed to organize and code data extracted from the studies. The framework cataloged descriptive characteristics of the

6 The World Health Organization highlights three types of integrated care: 1) Functional Integration, which includes administrative and support functions and activities (financial, medicines, management and information systems) that are structured and integrated for the primary purpose of service delivery; 2) Service Integration, which includes integration, coordination and organization of (mainly) clinical health services; and 3) Organizational Integration, which includes the coordination of organizations in and outside of the health system through contracts, strategic alliances, knowledge networks or mergers to deliver comprehensive services to a defined population [5].

7 The program of interest could integrate a component of the NCD care continuum with existing care for PLHIV, or vice-versa. Or it could establish a new program of integrated care. Studies that aim to prevent contraction of HIV are not considered; only those examining care for people already living with HIV.

8 Scope was limited to low- and middle-income countries to align this report as a follow-on from previous NCD Alliance reports. 2009 is chosen as the cutoff date because it is the year in which the World Health Assembly's resolution WHA62 recommended that Member States "encourage the development, integration and implementation of vertical programmes…in the context of integrated primary health care" [25]. Previous reviews identify this pivot point as around the year in which integrated literature takes off [80], [81].

9 Comparison of two or more interventions was chosen (as opposed to merely reporting program outcomes) to ensure that a reference point existed to evaluate the extent to which integration costs or consequences differed from a baseline or alternative intervention. The interventions and comparator could either a) compare an unintegrated control arm to integrated intervention arm(s); b) compare multiple integrated interventions of different strengths; or c) do both. Partial economic evaluations were included to incorporate a wider range of evidence that highlights additional models of HIV-NCD integration and its outcomes.

10 This criterion was set to increase confidence in the results of studies. To ensure studies had a rigorous design to evaluate consequences of integrated service delivery models, following a similar review by Rohwer et al., (2021) [82] only "randomized controlled trials (RCTs), including cluster RCTs, controlled (non- randomized) clinical trials or cluster non- randomized trials, interrupted time series (ITS) studies with at least three data points before and after the intervention, and controlled before- and- after (CBA) studies" were eligible for inclusion. For costing studies, reported costs needed to be compared to non-integrated services in some manner.

11 The objective of the literature review is to learn the scope of real-world models of integrated care for people living with HIV or NCDs. Moreover, the Grading of Recommendations Assessment, Development, and Evaluation (GRADE method) "recommends excluding model-based economic evaluations as they are often based on trials which could lead to double counting of results".

12 Reference guidelines for literature reviews of economic evaluations of health programs and policies recommend not restricting search parameters based on time of publication [80].

included integrated programs; the care delivery site (home; community; primary, secondary, or tertiary level health facilities; and/or remote) and the type of care activities performed at each site (education, follow-up, linkage and referrals, medication delivery, peer support, screening/diagnosis, treatment, and other activities); the study design of economic evaluations; costs of NCD/HIV integrated programs by cost sub-categories (e.g., labor, medications, overheads); and the consequences of integrated programs (i.e. clinical and other outcomes). Data was coded by a single reviewer and checked by a second reviewer.

Appendix 2. Cost-effectiveness studies

Group support psychotherapy for people living with HIV and depression in Uganda [63]

A randomized controlled trial in 30 primary healthcare centers in rural northern Uganda compared the costs, consequences, and cost-effectiveness of two interventions for people living with HIV and depression. Participants in the first intervention arm were assigned to lay health workers who conducted an eight-session group HIV education (GHE) program focusing on HIV progression, transmission, prevention, and basic facts about antiretroviral therapy. Participants in the second intervention arm were assigned to lay health workers who conducted an eight-session group support psychotherapy (GSP) program focusing on triggers, symptoms, and treatment options for depression; the relationship between depression and HIV; and coping and problem-solving skills for dealing with stigma. Dedicated sessions also gave participants opportunities to share personal problems and focused on income-generation skill-building.

One-year post-implementation, participants in the GSP group demonstrated significantly lower rates of mild, moderate, and severe forms of depression and had higher rates of functioning compared to the GHE group. In addition, they had lower suicide risk, PTSD symptoms, and hazardous alcohol use. Owing especially to reductions in the weight of living with depression, the GSP intervention averted 396 more disability adjusted life years (DALYs) than the GHE intervention.[13] Considering that the GSP intervention cost US$ 5,138 more to implement, the incremental cost-effectiveness ratio (ICER) of the GSP intervention was US$13 per DALY gained. Thus, the intervention was cost-effective considering a 1x GDP per capita threshold and the more stringent country-specific threshold of 17 percent of GDP per capita [70].

Enhanced counseling post HIV testing, and referral to add-on screening services, Zambia [62]

A randomized controlled trial in Zambia investigated the impact of linking HIV testing and counseling (HTC) to cervical cancer screening. Participants in the first intervention arm experienced standard care, consisting of HTC with informal cervical cancer referrals that placed the responsibility on patients to navigate within health systems. Participants in the second intervention arm were provided with enhanced, client-centered counseling and then time with health providers to discuss cervical cancer services and referrals. Motivational interviewing techniques were used to address barriers to uptake. Participants in a third intervention arm received the same intervention, plus a personal escort to the cervical cancer screening.

The study found that participants in intervention arms two and three were more than three times as likely to be screened for cervical cancer in the six months following HIV testing and counseling than participants in arm 1. In a modeling exercise to assess the impact of screening on prevention of future cervical cancer, the study found that the cost per DALY averted of arm 2 was US$ 607 and US$ 106. Both arms were cost-effective considering the 1x GDP per capita threshold; only arm 2 was cost effective using more stringent country specific thresholds but not income-level specific thresholds [70].

13 DALYs measure lost healthy life years by accounting for 1) years of life lost due to a given disease, disorder, or injury, and 2) years of life lived in a state of disability attributable to ill-health. Illustratively, consider an individual who experiences a stroke due to cardiovascular disease. The person survives the initial stroke event, but for two years lives in a state of disability that places severe activity limitations on their day-to-day existence. If measured on a 0 to 1 scale —where 0 = death and 1 = full health— these activity limitations place the person in a state of health that is equivalent to 0.4 times that of "full health". In this state, though the person lives two years, they lose 1.2 healthy life years ((1-0.4) x 2.0 years). Then, the individual dies from complications related to their initial stroke. Had the stroke never occurred in the first place, they would have been expected to live an additional five years. In this case, cardiovascular disease resulted in 6.2 (5 years + ((1-0.4) x 2.0 years)) DALYs.

Provision of a brief intervention to reduce alcohol use in people living with HIV in Vietnam (REDART trial) [66]

REDART assessed the cost-effectiveness of integrating two interventions to reduce alcohol use into HIV outpatient clinics among people living with HIV compared to the standard of care (referral by health providers to local substance use centers that were not co-located with HIV outpatient clinics). Participants in the standard of care arm had a baseline assessment for hazardous or harmful alcohol use and were given access to standard of care services in the ART clinic (i.e., harm reduction, ART at any CD4 count, referrals to local substance use centers). Participants in a brief intervention arm received standard of care plus participated in four MET and CBT counseling sessions —two were delivered one-on-one with trained counselors in person and two were delivered one-one-one in telephone sessions. Participants in the combined intervention arm received standard-of-care and took part in six one-to-one in-person sessions with trained providers and were given the option of attending three in-person group counseling sessions.

Cost and effectiveness data from the RCT trial was uploaded into a model assessing projected costs and outcomes over one year for a hypothetical cohort of 1,000 people [66]. The brief intervention cost an additional US$ 39,000 to deliver compared to standard of care, while more intensive human resource requirements for the combined intervention led to an additional US$ 54,000 in costs. Despite costing less, the brief intervention generated higher gains in viral suppression and improved health from reductions in frequent or semi-frequent drinking. Both the brief intervention arm ($ 525 per quality adjusted life year (QALY)[14] gained) and the combined intervention ($ 1,474 per QALY gained) were cost-effective considering the 1x GDP per capita threshold, but only the brief intervention was cost-effective considering the more stringent country-specific threshold [70]

14 QALYs are like DALYs, except that instead of measuring healthy life years lost they measure years lived in a state of good health.

#NCDs @ncdalliance