Gausi B, Otiku P, Jacob N, Oni T. Patient outcomes in integrated HIV and non-communicable disease models of care: a scoping review. *Journal of Global Health Reports*. 2021;5:e2021084. doi:10.29392/001c.27094

Research Articles

Patient outcomes in integrated HIV and non-communicable disease models of care: a scoping review

Blessings Gausi[1], Paul Otiku[2], Nisha Jacob[1], Tolu Oni[3]

[1] School of Public Health and Family Medicine, University of Cape Town, South Africa, [2] School of Public Health and Family Medicine, University of Cape Town, South Africa; Department of Public Health, Lira University, Uganda, [3] School of Public Health and Family Medicine, University of Cape Town, South Africa; MRC Epidemiology Unit, University of Cambridge, United Kingdom

Keywords: integrated models of care, non-communicable diseases, multimorbidity, syndemics, hiv

https://doi.org/10.29392/001c.27094

Journal of Global Health Reports

Vol. 5, 2021

Background

High rates of non-communicable diseases (NCD) among people living with human immunodeficiency virus (HIV) have been reported in high HIV burden, low-resource settings. The growing dual burden of HIV and NCD epidemics has necessitated introduction of integrated models of HIV and NCD care in order to leverage existing HIV care infrastructure for NCDs. There is a paucity of evidence on the effects of integrated care on long-term patient outcomes. We sought to review literature that described effects of integration on long-term patient outcomes.

Methods

We reviewed literature published between 01 Jan 2000 to 25 September 2019, that described long-term patient outcomes in HIV and NCD integrated models of care in order to understand the effects of integration on long-term patient outcomes. Relevant literature was searched in PubMed, Scopus, EBSCOhost and Web of Science. A manual search of abstracts in the International AIDS Society and the Journal of Acquired Immunodeficiency Syndrome was also conducted.

Results

One thousand six hundred and sixty articles were identified, 31 of which were read in full, with 11 meeting eligibility criteria. Patient outcomes in four models of integrated care were identified: (i) integration of NCD screening and treatment services into established HIV centres; (ii) integration of HIV screening and treatment services into established NCD centres; (iii) simultaneous integration of HIV and NCD services at health facilities; and (iv) integrated HIV and NCD care specifically for multi-morbid patients. Studies reported high rates of control of HIV and NCD across the various models of integrated care. However, majority of studies lacked comparator groups required to ascertain non-inferiority of integrated care over non-integrated care.

Conclusions

There is limited evidence on the effect of integrated HIV and NCD models of care on long-term patient outcomes especially in low-resource, high-burden settings. Randomized clinical trials with clearly defined comparator groups and standardized measures of HIV and NCD outcomes are needed to demonstrate non-inferiority of integrated against non-integrated care.

Human Immunodeficiency virus (HIV) is a threat to global public health with almost 40 million people living with the virus worldwide.[1] With the advent and scale up of anti-retroviral therapy (ART), HIV has become a manageable chronic condition with life expectancies of people living with HIV (PLWH) comparable to those living with other chronic conditions.[2] This increasing longevity among PLWH, and the premature aging effect of HIV is increasing the prevalence of non-communicable disease (NCD) comorbidities such as Diabetes Mellitus Type 2 (DM) and hypertension (HTN).[3,4] High rates of NCDs among PLWH have been reported in high HIV-burden, and low-resource settings[5–7] placing strain on the health systems in these settings which are ill-equipped to cope with the inherent complexity of multi-morbid patients.[8]

The growing dual burden of HIV and NCD syndemics (epidemics occurring in the same population at the same time) has necessitated exploration of integration of HIV and

NCD care in primary health care to leverage existing HIV care infrastructure for NCD care in high HIV-burden settings.[9,10] Integrated care has been defined as the coordination, co-location, or simultaneous delivery of HIV and NCD services to patients who need it, when they need it.[11] Three models of integrating HIV and NCD care in primary health care have been previously described[12] as follows: **model 1**: Integration of NCD screening and treatment services into established HIV centres; **model 2**: Integration of HIV screening and treatment services into established NCD centres; and **model 3**: simultaneous integration of HIV and NCD services at integrated health centres. As these models do not pre-suppose multi-morbidity, a fourth model proposed by Njuguna et al[9] includes integrated HIV and NCD care for PLWH with comorbid DM or HTN or both, which may be delivered at group (using medical adherence clubs-MACs) or individual levels.

Despite increasing evidence to suggest feasibility of integrating HIV and NCD care, little is known about the effect of such integration on long-term patient outcomes.[9,12,13] These long-term outcomes include, but are not limited to, medication adherence, retention in care, loss to follow up, HIV viral load suppression / improvement in CD4 counts and markers of NCD control. It is not known if integration of HIV and NCD care in primary health care improves or at least maintains these outcomes among PLWH with multimorbidity receiving integrated HIV and NCD care. Such evidence is needed to inform program managers and health policy makers in order to adopt, implement and scale up integrated HIV and NCD care for multi-morbid patients.

This review aims to identify literature that describes the effect of integrating HIV and NCD care on long-term patient outcomes.

METHODS

We conducted a scoping review[14,15] of literature that described the effect of integrating HIV and NCD care on long-term patient outcomes. This typology of literature review has been noted to be appropriate where there is a need to identify and map the amount of literature and studies available on a given topic, or where evidence is emerging but remains unclear.[16] Nonetheless, a rigorous and transparent methodology is required. This review followed the Arksey and O'Malley methodological framework for conducting scoping reviews comprising five stages: identifying the research question, identifying relevant studies, study selection, charting the data and collating, summarizing and reporting results.[17,18] The reporting of the review findings follows the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist (*Figure S1* in **online supplementary document**).[19]

RESEARCH QUESTION

This review was guided by the question 'What are the effects of integrating HIV and NCD care on long-term patient outcomes?'

Table 1. Search strategy applied to PUBMED and adapted for use in other databases

Query	Fields	Search term
#1	All	Effects OR outcomes OR effectiveness OR Successes OR impact
#2	All	(Integrated OR combined) AND (care OR management OR health service delivery model)
#3	All	Chronic disease OR Non-communicable disease
#4	All	HIV OR Human Immunodeficiency Virus
#5	#1 AND #2 AND #3 AND #4	

SEARCH STRATEGY

We conducted a preliminary search of the terms 'outcomes, effects, successes, effectiveness, impact, integrated HIV, non-communicable disease, chronic disease care' in PubMed. We then analysed key studies for potential broader search terms and refined the search strategy (**Table 1**).

INFORMATION SOURCES

We performed a literature search, using the final search strategy in PubMed, Scopus, EBSCOhost and Web of Science. We also conducted a manual search of abstracts in the International AIDS Society and the Journal of Acquired Immunodeficiency Syndrome. Grey literature was sourced from Mednar and Open Grey. Bibliographies of relevant papers were also carefully searched to source journal articles unidentified through database searches.

INCLUSION CRITERIA

We included articles that reported the following patient outcomes after receiving integrated care for at least 6 months: adherence to medication, retention in care, loss to follow up, viral load measurements, CD4 counts and markers of NCD treatment outcomes including blood pressure (BP) for HTN, and glycosylated haemoglobin (HbA1c) for DM.

Studies were considered for this review if and only if they had enrolled patients older than 18 years of age into integrated care, with a diagnosis of either HIV alone, HIV and HTN or HIV and DM or both. Longitudinal studies, case-control and cross-sectional studies published between 01 January 2000 to 25 September 2019 were included for review. This time frame was selected as there was minimal roll-out of ART programs in low- and middle-income countries, where the burden of HIV is highest, prior to 2000.

EXCLUSION CRITERIA

Literature not published in English, and that did not report patient outcomes of interest were excluded. Literature reviews were also excluded however, their reference lists were

carefully hand -searched for eligible studies that might have been missed in previous steps.

STUDY SELECTION

Articles retrieved using the search strategy were exported into EndNote version 9 for removal of duplicates. Thereafter, two authors (BG and PO) independently screened articles by title or title and abstract to determine if articles met the eligibility criteria. A full-text screening was then carried out. Ambiguous abstracts were also evaluated via a full text review for eligibility. Disagreements between the two reviewers were resolved through discussion to reach consensus.

ETHICAL CONSIDERATIONS

As reviewed literature were published and available in the public domain, ethical approval was not sought for the purposes of conducting this review.

DATA COLLECTION AND SYNTHESIS

The following outcomes were collected and charted from selected articles using a standardized form: Author, place, setting of intervention/study, model of integration utilized, intervention (services integrated), duration of intervention, study population, and outcomes (Table 2). A narrative synthesis of the results was also performed on included studies.

RESULTS

A total of 11 studies were included in the review. Results of our search strategy and process are shown in a PRISMA flow diagram in Figure 1.

CHARACTERISTICS OF INCLUDED STUDIES

Of the 11 studies included, one was an abstract article[20] whereas ten were full text articles.[21–30] Eight studies (72.7%) were published later than 2010, the majority of which (n=7) were cohort studies (**Table 2**). There were no randomized clinical trials identified. Six of the 11 studies were conducted in high-income countries (United States of America and United Kingdom) with five conducted in low- and middle-income high HIV-burden countries (Cambodia, Uganda, Kenya and South Africa) (**Table 2**).

MODELS OF HIV/NCD INTEGRATION

Applying the four model categories of integration described by Duffy and Njuguna,[9,12] we found that three of the studies that were identified described NCD services integrated into established HIV care centres (model 1), no study reported integration of HIV services into established NCD programs (model 2), five studies described simultaneous integration of HIV and NCD services (model 3), and three studies reported integration of HIV and NCD services among PLWH with multimorbidity (model 4) (**Table 2**).

PATIENT OUTCOMES

All studies reported HTN outcomes, 60% reported DM outcomes and 50% reported HIV outcomes. Only one study (Janssens et al[24]) reported patient outcomes for all three diseases (Table 2). Eight of the 11 studies (72.7%) reported integrated care based in primary care facilities (Table 2).

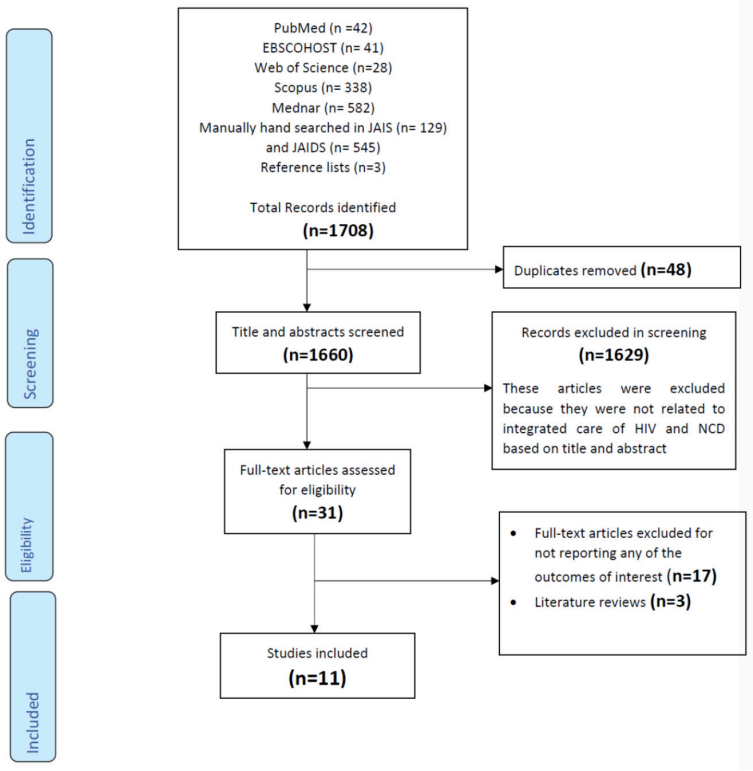

Figure 1. Flow diagram for selection of studies

Table 2. Descriptive characteristics of selected articles

Study	Setting	Intervention	Model*	Duration (months)	Study population	Study design	Outcomes
C, Chu (2011)	Primary care centre in the Bronx, New York, USA	Screening and treatment for HTN and DM offered to PLWH	1	N/A	PLWH, N=854 Of these, n=223 had comorbid HTN and n=108 had DM	Cross-sectional	• Prevalence of HTN and DM was 26% and 13% respectively • 90% of PLWH and hypertension met ADA† target for BP • 59% of PLWH and DM met ADA target for HbA1c • Adherence to medication and viral suppression were not reported
Muddu, M (2019)	Primary health centre in Eastern Uganda	Screening and treatment of HTN among PLWH	1	12	PLWH N=1649 Of these,465 were screened for HTN, n=218 had comorbid HTN	Respective cohort	• Among those screened, 47.8% had HTN • Among 1649, 98.5% were initiated on ART, 70.7% were retained into care, and 90.3% were suppressed • Of the 1431 patients with HIV alone, 1408 (98.4%) were initiated on ART, 1005 (71.4%) were retained in care, 100% of these were monitored and 906 (90.2%) were controlled • Among PLWH with HTN, 99.5% were initiated on ART, 65.9% were retained, 91.6% were suppressed and 24.3% had controlled BP‡. HIV outcomes were similar among PLWH with HTN and without HTN
Myerson, M (2014)	Tertiary centre, The Spencer Cox Center for Health Care, New York, USA	Screening and treatment of HTN among PLWH	1	N/A	4278 PLWH, of which 1840 had HTN	Cross-sectional	• 88% on ART; 67% with suppressed VL (viral load less than 200 copies/mL) • Among 3906 with documented recent CD4, mean CD4 was 468 cells /µL • Prevalence of HTN was 43% • Of the PLWH with HTN, 75% were being treated; and 57% had controlled BP • No data reported on retention in care and adherence due to cross-sectional nature of the study
Janssens, B (2007)	Provincial referral hospital, Cambodia	ART treatment and care, DM treatment and care	3	24	HIV+, n=4793 DM only =2638 HTN only=1419 No HIV+DM or HIV+HTN	Prospective cohort	• 87.7% of HIV-infected were retained, 9.3% died and 3% lost to follow up • Median CD4 count rose from 53 to 316 cells/µL • 29 % lost to follow up • Median HbA1c fell from 11.5% to 8.6%, 57% had HbA1c ≤ 9%

Study	Setting	Intervention	Model*	Duration (months)	Study population	Study design	Outcomes
							• 68% of HTN had BP ≤160/90 after 6 months of regular treatment • Adherence and viral suppression rates were not reported
Khabala, K (2015)	Primary care center, in urban informal settlement Kiberia, Kenya	Integrated ART and chronic disease care offered to people with DM, HTN and PLWH through MACs	3	12	Total of 1432 were enrolled in MACs PLWH n= 1020, People with HTN n = 352, People with DM = 60, 12 were PLWH and HTN	Retrospective cohort study	• Loss to follow up was 3.5% overall • High compliance to medical check-ups (99%) • Markers of control of HIV and HTN or DM after follow-up were not reported
Kwarisiima, D (2019)	Primary care centre in rural Uganda	Screening and treatment for HIV, HTN and DM	3	36	34704 were screened: 2071 were PLWH 199 had HTN and only 89 were linked to care at base line. 32,633 were HIV negative, of these 4355 had HTN and 1949 were linked to care at base line	Prospective cohort	• 48% of visits had controlled BP among PLWH in the entire follow up period • 46% of visits had controlled BP among people not living with HIV • HIV-infected patients were more likely than uninfected patients to have controlled blood pressure at follow-up visits (aOR 1.28; 95% CI 1.00–1.77) • NCD care was interrupted with significant hypertension drug stock outs • HIV related outcomes were not reported
Ameh, S (2017)	Primary care centres in rural South Africa	Integrated management of DM, HIV and HTN	3	30	435 in intervention facilities, HTN-210, PLWH -141 and 443 in control facilities HTN-91, PLWH-282	Controlled interrupted time series design	• Patients at intervention facilities had 6% greater likelihood of CD4 >350 cells/μL than comparison facilities (coefficient = 0.057; 95% CI: 0.056 to 0.058; P < 0.001) • Patients at pilot facilities had 1.0% greater likelihood of controlled BP (coefficient = 0.010; 95% CI: 0.003 to 0.016; P = 0.002) • Viral suppression, retention to care and loss to follow up were not reported
Edwards, J (2015)	Primary care center, in urban informal settlement Kiberia, Kenya	ART treatment, NCD screening, treatment and care	3	30	HIV with HTN n=200 HIV with DM n=10 HTN only n=1697 DM only n=299	Prospective cohort	• For PLWH and HTN, median systolic blood pressure (SBP) and interquartile range (IQR) reduced from 151 (136-164) mmHg to 143 (129-159) mmHg while diastolic blood pressure (DBP) and IQR, reduced from 97 (86-105) mmHg to 85 (74-95) mmHg. • For PLWH and DM, mean HbA1c at last visit was 8.2% whereas among those with DM

Study	Setting	Intervention	Model*	Duration (months)	Study population	Study design	Outcomes
							only mean HbA1c was 8.8% • For those with HTN only, median SBP(IQR) reduced from 160 (144–177) mmHg to 141 (129–158) mmHg while DP(IQR) reduced from 100 (90–110) mmHg to 87 (75–95) mmHg. • HIV outcomes were not reported
Bury, E (2007)	Tertiary center, HIV specialist clinic USA-Oklahoma	ART, Diabetes treatment in both arms, Adherence counselling in one arm	4	24	PLWH with DM n=40	Retrospective cohort	• Less than 50% attained ADA guidelines for HbA1c • Glycemic control was similar to findings in HIV-uninfected population • HIV outcomes were not reported
Noble, G (2012)	Secondary centre, HTN clinic, Birmingham,UK	Treatment for HTN offered to PLWH and HTN	4	N/A	PLWH plus hypertension, n=36	Cross-sectional	• 85% new or known hypertensive • 63% had controlled BP • Average decrease in 10-year cardiovascular risk was 39% (range 8% to 74%). • All patients rated the clinic as good or great on all aspects and were happy with the care received. • HIV related outcomes were not reported
Oluwatoyin, A (2009)	Primary care center in urban USA-Chicago	ART and Diabetes treatment and care to PLWH	4	12	PLWH and DM N=216	Respective cohort	• Baseline CD4 count was 516 cells/μL+/-314 cells/μL • 72% had baseline viral load < 75 cells /mL • No HIV outcomes reported at the end of follow up • Mean HbA1c at baseline = 7.3% +/- 1.9 % • 54% had HbA1c < 7%, and 72% had HbA1c < 8% at end of follow up • Rates of glycemic control were similar to results among HIV-uninfected population (30%-44%) • Mean SBP at baseline was 131 +/-17 mmHg, • Mean DBP at baseline was 79 +/-10 mmHg • 56% met ADA blood pressure goals at end of follow up

*Model 1: Integration of NCD screening and treatment services into established HIV centres.
Model 2: Integration of HIV screening and treatment services into established NCD centres.
Model 3: Simultaneous integration of HIV and NCD services at integrated health centres.

Model 4: Integration of NCD and HIV care for patients with multi-morbidity. This could be offered at an individual level or group level in form of medical adherence clubs for stable patients.
†ADA – American Diabetes Association, targets BP<140/90 and HbA1c < 7%.
‡ Controlled BP means blood prerssure <140/90. 95% CI means 95 percent confidence interval.
ART – antiretroviral therapy; DM – diabetes mellitus; HIV – human immunodeficiency virus; HTN – hypertension; PLWH – people living with HIV.

PATIENT OUTCOMES BY MODEL OF INTEGRATION

MODEL 1: INTEGRATION OF NCD SERVICES INTO ESTABLISHED HIV CARE CENTRES

The three studies that reported patient outcomes in the context of integration Model 1 offered NCD screening and treatment services to PLWH in established HIV treatment centres. Prevalence of comorbid HTN among PLWH studied was 26% (USA), 47.8% (Uganda) and 43% (USA) respectively.[21–23] Chu et al[21] conducted a descriptive cross-sectional study among PLWH with comorbid DM or comorbid HTN. They found that 90% (N= 223) of PLWH with comorbid HTN had controlled BP (BP ⩽140/90) and 59% (N= 103) of PLWH and DM had HbA1c < 7%. However, HIV related outcomes (HIV viral suppression or CD4 counts) were not reported. Muddu et al[22] compared HIV control rates among PLWH with no comorbidity to PLWH with comorbid HTN. They found that after 1 year of follow up and integrated management, 24.3% of those with comorbid HTN (N= 218) had controlled BP. HIV-related outcomes and retention rates did not differ between PLWH without (viral load (VL) suppressed in 90.2%; retention 71.4% (N=906)) or with comorbid HTN (VL suppressed in 91.6%; retention 65.9% (N=218)) respectively. Myerson et al[23] conducted a cross-sectional study in the USA examining control of HIV and HTN among PLWH. They found that among PLWH with comorbid HTN, 57% (N=1840) had controlled BP. In terms of HIV control, 88% of the overall cohort (N= 4278) were on ART and 67% of these had suppressed VL (mean CD4 count 468 cells /mm3).

While these studies reported high rates of control of HIV and comorbid NCDs among patients who received Model 1 of integrated care, they were not designed to show benefit of integrated care compared to non-integrated care. Instead, they merely reported patient outcomes upon integrating NCD screening and treatment services in established HIV programs. Comparison was not made to patient outcomes either before integration or to patient outcomes in non-integrated care.

MODEL 3: SIMULTANEOUS INTEGRATION OF NCD AND HIV SERVICES

Five studies reported patient outcomes upon simultaneous integration of HIV and NCD care.[24–28] Full details on study design, integrated services and results are shown in Table 2. Janssens et al[24] reported treatment outcomes from 8850 participants receiving integrated care for 24 months. Of the 8850, 1419 were HIV-uninfected and received care for HTN only, 2638 were HIV-uninfected and received care for DM only and 4793 were PLWH without comorbidities. Among PLWH followed up, 87.7% (N=4793) were retained in care, 9.3% had died and 3% were lost to follow up. Median CD4 counts after attending integrated care for 24 months had risen from 53 to 316 cells/mm3. However, viral suppression rates were not reported. Among people with HTN, 68% (N=1419) had controlled BP. Among people with DM, median HbA1c fell from 11.5% to 8.6% and 57% had HbA1c ⩽ 9%. Khabala et al[25] conducted a descriptive retrospective cohort study of 1432 HIV-infected and uninfected participants. Of the 1432, 1020 were PLWH, 352 had HTN only and 60 had DM only. Participants were clinically stable for at least 12 months and recruited into MACs of 25-30 patients each. They reported an overall loss to follow up of 3.5% and high rate of compliance to clinical procedures, however, patient outcomes related to control of HIV or NCD were not reported. Kwarisiima et al[26] conducted a descriptive cohort study which examined BP control among people with HTN without HIV and PLWH with comorbid HTN in a rural Ugandan community. After screening 34,704 individuals for HIV and HTN, 2071 were found to have HIV. Of the 4355 patients found to have HTN without HIV, 1949 were linked to care at baseline. Of the 2071 PLWH, 199 had comorbid HTN and only 89 were linked to care at baseline. Control of BP among PLWH with HTN (48%) and people with HTN only (46%) did not differ. In this study, the authors noted that NCD care was interrupted with significant hypertension drug stock outs during the study which may have influenced their results. Of note, investigators observed that HIV-infected patients were more likely than uninfected patients to have controlled BP at follow-up visits (adjusted odds ratio, aOR=1.28; 95% confidence interval, CI=1.00–1.77).

Ameh et al[27] conducted a controlled interrupted time series study in rural South Africa that compared the likelihood of control of HIV and HTN before and after a pilot implementation of an integrated chronic disease management (ICDM) model by the National Health Department in selected primary health care facilities. A sample of 435 participants were enrolled in intervention facilities using proportionate sampling of which 210 had HTN and 141 were PLWH. Similarly, a sample of 443 participants were enrolled in control facilities, of which 91 had HTN and 282 were PLWH. Results showed that after 30 months of follow up, patients at intervention facilities had a 6% greater likelihood of having CD4 counts >350 compared to control facilities (coefficient=0.057; 95% CI=0.056-0.058; *P*<0.001). In addition, patients at pilot facilities had a 1.0 % greater likelihood of having patients with controlled BP (coefficient=0.010; 95% CI=0.003-0.016; *P*=0.002). However viral suppression, retention in care and loss to follow up were not reported.

The fifth, model 3 study was conducted by Edwards et al[28] at a primary care centre in an urban informal settlement in Kenya. This was a retrospective descriptive study of 2206 participants that compared BP and diabetes outcomes among PLWH with comorbid HTN (N=200) or DM (N=10), with people with HTN (N=1697) or DM (N=299) only. At 30 months of follow-up, the median systolic blood pressure (SBP) reduced from 151 (Interquartile range, IQR=136-164) mmHg at baseline to 143 (IQR=129-159) mmHg, while diastolic blood pressure (DBP) reduced from 97 (IQR=86-105) mmHg to 85 (IQR=74-95) mmHg for PLWH and comorbid HTN. For people with HTN only, median SBP reduced from 160 (IQR=144–177) mmHg at baseline to 141 (IQR=129–158) mmHg while DBP reduced from 100 (IQR=90–110) mmHg to 87 (IQR=75–95) mmHg. For PLWH and DM, mean HbA1c at last visit was 8.2% (95% CI=7-11%) while among people with DM only HbA1c at last visit was 8.8% (95% CI=7-11%). Neither HbA1c at baseline nor HIV outcomes were reported. In summary, control of HIV and

comorbidities was achieved in this model of care despite logistical challenges experienced by some. Majority of studies describing this model of care did not report key HIV-related outcomes such as viral suppression. Only one study (Ameh et al[27]) compared outcomes among patients who attended integrated care with those who attended non-integrated care. The study showed some evidence that patients who attended IC were more likely to have controlled HIV or NCD compared to non-integrated care patients, suggesting superiority of IC over non-integrated care for control of comorbidities.

MODEL 4: INTEGRATED CARE FOR PATIENTS WITH MULTIMORBIDITY

Three studies reported patient outcomes among PLWH with comorbid HTN or DM or both (Model 4)[20,29,30] (Table 1). Two of these studies (Bury et al[29] and Oluwatoyin et al[30]) undertook descriptive retrospective cohort studies among PLWH with comorbid DM who attended integrated care at HIV specialist clinics in the USA. At the end of follow up, Bury et al[29] and Oluwatoyin et al[30] reported that 50% and 54% of participants respectively, had achieved ADA(American Diabetes Association) targets for BP and HbA1c at last visit.[31] These outcomes were found to be similar to those in studies with HIV-uninfected populations in the same setting. Noble et al[20] conducted a cross-sectional review of PLWH with comorbid HTN in a secondary healthcare settings in Birmingham, United Kingdom. Findings showed that 63% (N=36) had controlled BP.

In summary, patients attending model 4 of integrated care were reported to demonstrate high rates of NCD control similar to HIV-uninfected populations in comparable settings. However, neither key HIV outcomes, outcomes before integration, nor comparison with patients in non-integrated care, were reported in all three studies.

DISCUSSION

Studies included in our review sought to evaluate long-term patient outcomes in various models of integrated HIV and NCD care. Eleven studies were identified and of these, three reported outcomes under Model 1 (integration of NCD screening and treatment services into established HIV),[21–23] five reported outcomes using model 3 (simultaneous integration of HIV and NCD services at integrated health centre)[24–28] and three studies applied model 4 of integrated care (integration of NCD and HIV care for patients with multi-morbidity).[20,29,30] Notably, no study was found that reported outcomes using model 2 of integrated care (integration of HIV screening and treatment services into established NCD centre). Results from the three Model 1 studies showed that after receiving integrated care, patients achieved high rates of control of their comorbidities.[21–23] Furthermore, HIV-related outcomes in these studies were found to be similar among comorbid and non-comorbid PLWH.[22] This suggests that when managed appropriately, comorbid PLWH can attain equally high levels of HIV control comparable to PLWH with no comorbidities. However, even though these studies reported high rates of HIV and NCD control after integration, a noteworthy finding was that none of these studies included a comparator group e.g., co-morbid PLWH attending non-integrated care. As such, it is not known if the reported treatment outcomes in this model of care are higher than treatment outcomes in a non-integrated setting.

Simultaneous integration of NCD and HIV services (model 3) also appeared to confer clinical benefits to PLWH.[24–28] Ameh et al showed that participants who attended integrated primary care facilities were found to have higher likelihood of control of their immune status as well as their NCD compared to participants who never utilized integrated care.[27] This was the only study identified that demonstrated that integration may have a positive effect on patient outcomes using a well-defined comparator group. However, while NCD outcomes were reported, the absence of key HIV outcomes such as viral load suppression means the effect of this model on HIV control remains unknown.

Studies in our review also reported outcomes after integrating care of PLWH with comorbid DM or HTN (model 4).[20,29,30] It is encouraging to note that patients with multimorbidity who attended this form of integrated care achieved good clinical control of their comorbidities at rates comparable to those of HIV-uninfected people in similar settings.[32–35] However, similar to studies that reported patient outcomes in model 3, key HIV-related outcomes were not reported in these studies. Consequently, it also remains unknown if this model of care is more effective for control of HIV among patients with multimorbidity. Furthermore, these studies also did not include control groups to which patient outcomes after integration could be compared against. Comparison could take the form of before/after integration studies including the same PLWH with multimorbidity or comparison to multimorbid PLWH who received non-integrated care.

Patient outcomes in PLWH without NCD comorbidities receiving ART care through adherence clubs (MACs) have been described in literature.[36–38] However, our review confirms a lack of evidence on the effectiveness of integrated MACs (that offer combined HIV and NCD care) for PLWH with multimorbidity who have more complex healthcare needs. Our review further highlights paucity of evidence from sub-Saharan Africa, where the burden of the HIV/NCD syndemic is greatest, with only five studies identified.[22,25–28] Given that more than two-thirds of PLWH live in sub-Saharan Africa,[39] studies evaluating the effectiveness of integrated HIV and NCD care are urgently needed in this setting to guide health care policy.

Our study has some limitations. Notably, due to heterogeneity of measures of disease outcomes used and diversity of the case mix and sampling strategies of included studies, we could not make meaningful comparisons both within and across the identified integrated models of care. For example, the diverse and non-uniform age range of adults in the included studies meant that it was not possible to compare integrated care outcomes of different adult age groups. In addition, as the inclusion criteria for the review focused on patients over 18 years old, the review was unable to explore age-dependent models of integrated care.

To evaluate non-inferiority of integrated care models, there is a need for randomised controlled trials that compare clinical outcomes for HIV and NCD in patients receiv-

ing integrated versus non-integrated models of care among PLHW with multimorbidity. Given the evidence of multimorbidity emerging at increasingly younger ages in sub-Saharan African PLWH,[6] further research will also need to include adolescents in order to ensure integrated models of care are tailored to different age-groups. Lastly, our findings of highly heterogenous studies demonstrate the need for future studies to capture both HIV and NCD outcomes using comparable indicators in order to facilitate comparisons in future evidence synthesis research. To our knowledge, this is the first review to assess evidence on long-term patient outcomes in the context of various integrated HIV and NCD models of care; and we highlight the potential to leverage resources from HIV service platforms to provide effective integrated chronic disease care.[10,13,40]

CONCLUSIONS

The potential to leverage existing HIV infrastructure to provide NCD care to multimorbid patients without jeopardizing quality of care is a key consideration for health service delivery, particularly in high HIV-burden settings undergoing rapid epidemiological transition with a rise in NCD comorbidity. Our review has identified evidence on integration of HIV/NCD care across diverse models of care, and the potential for integration to contribute to desired long-term patient outcomes. However, we highlight the need for the use of comparable indicators to assess both HIV and NCD outcomes in future studies. Furthermore, randomized controlled trials are urgently needed to compare clinical outcomes for HIV and NCD control in patients receiving integrated versus non-integrated models of care in order to evaluate non -inferiority of integrated care among PLHW with multimorbidity.

ACKNOWLEDGMENTS

The authors would like to thank Prof Gill Morgan, a renowned reference librarian at the University of Cape Town Health Sciences Library for her immense assistance towards development of the search strategy for this review.

FUNDING

None.

AUTHORSHIP CONTRIBUTIONS

BG: Conception and design of the study, literature search, article screening, data extraction and collation, synthesis and interpretation of data, manuscript drafting and revision, final approval and agreement to be accountable for all aspects of the work.

PO: Literature search, article screening, data extraction and collation, synthesis and interpretation of data, manuscript drafting and revision.

NJ: Conception and design of the study, interpretation of data, manuscript drafting, revision and final approval.

TO: Conception and design of the study, interpretation of data, manuscript drafting, revision and final approval.

COMPETING INTERESTS

The authors completed the Unified Competing Interest form at http://www.icmje.org/disclosure-of-interest/ (available upon request from the corresponding author) and declare no conflicts of interest.

CORRESPONDENCE TO:

Blessings Gausi MD MPH
School of Public Health and Family Medicine,
Faculty of Health sciences,
University of Cape Town,
South Africa.
gsxble001@myuct.ac.za

Submitted: March 14, 2021 GMT, Accepted: June 23, 2021 GMT

REFERENCES

1. WHO. WHO HIV Data and Statistics 2017 Report. World Health Organization. Published 2018. Accessed July 15, 2019. https://www.who.int/hiv/data/en/

2. Marcus JL, Chao CR, Leyden WA, et al. Narrowing the Gap in Life Expectancy Between HIV-Infected and HIV-Uninfected Individuals With Access to Care. *JAIDS J Acquir Immune Defic Syndr*. 2016;73(1):39-46. doi:10.1097/QAI.0000000000001014

3. Dillon DG, Gurdasani D, Riha J, et al. Association of HIV and ART with cardiometabolic traits in sub-Saharan Africa: a systematic review and meta-analysis. *Int J Epidemiol*. 2013;42(6):1754-1771. doi:10.1093/ije/dyt198

4. Guaraldi G, Orlando G, Zona S, et al. Premature Age-Related Comorbidities Among HIV-Infected Persons Compared With the General Population. *Clin Infect Dis*. 2011;53(11):1120-1126. doi:10.1093/cid/cir627

5. Lalkhen H, Mash R. Multimorbidity in non-communicable diseases in South African primary healthcare. *South African Med J*. 2015;105(2):134. doi:10.7196/SAMJ.8696

6. Oni T, Youngblood E, Boulle A, McGrath N, Wilkinson RJ, Levitt NS. Patterns of HIV, TB, and non-communicable disease multi-morbidity in peri-urban South Africa- a cross sectional study. *BMC Infect Dis*. 2015;15(1):20. doi:10.1186/s12879-015-0750-1

7. Achwoka D, Waruru A, Chen TH, et al. Noncommunicable disease burden among HIV patients in care: a national retrospective longitudinal analysis of HIV-treatment outcomes in Kenya, 2003-2013. *BMC Public Health*. 2019;19(1):372. doi:10.1186/s12889-019-6716-2

8. Levitt NS, Steyn K, Dave J, Bradshaw D. Chronic noncommunicable diseases and HIV-AIDS on a collision course: relevance for health care delivery, particularly in low-resource settings—insights from South Africa. *Am J Clin Nutr*. 2011;94(6):1690S-1696S. doi:10.3945/ajcn.111.019075

9. Njuguna B, Vorkoper S, Patel P, et al. Models of integration of HIV and noncommunicable disease care in sub-Saharan Africa. *AIDS*. 2018;32:S33-S42. doi:10.1097/QAD.0000000000001887

10. Vorkoper S, Kupfer LE, Anand N, et al. Building on the HIV chronic care platform to address noncommunicable diseases in sub-Saharan Africa: a research agenda. *AIDS*. 2018;32(Suppl 1):S107-S113. doi:10.1097/QAD.0000000000001898

11. Waddington C. WORLD HEALTH ORGANIZATION: INTEGRATED HEALTH SERVICES - WHAT AND WHY? Published 2008. https://www.who.int/healthsystems/technical_brief_final.pdf

12. Duffy M, Ojikutu B, Andrian S, Sohng E, Minior T, Hirschhorn LR. Non-communicable diseases and HIV care and treatment: models of integrated service delivery. *Trop Med Int Heal*. 2017;22(8):926-937. doi:10.1111/tmi.12901

13. Haldane V, Legido-Quigley H, Chuah FLH, et al. Integrating cardiovascular diseases, hypertension, and diabetes with HIV services: a systematic review. *AIDS Care*. 2018;30(1):103-115. doi:10.1080/09540121.2017.1344350

14. Daudt HM, van Mossel C, Scott SJ. Enhancing the scoping study methodology: a large, inter-professional team's experience with Arksey and O'Malley's framework. *BMC Med Res Methodol*. 2013;13(1):48. doi:10.1186/1471-2288-13-48

15. Peters MDJ, Godfrey CM, Khalil H, McInerney P, Parker D, Soares CB. Guidance for conducting systematic scoping reviews. *Int J Evid Based Healthc*. 2015;13(3):141-146. doi:10.1097/XEB.0000000000000050

16. Munn Z, Peters MDJ, Stern C, Tufanaru C, McArthur A, Aromataris E. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Med Res Methodol*. 2018;18(1):1-7. doi:10.1186/s12874-018-0611-x

17. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol*. 2005;8(1):19-32. doi:10.1080/1364557032000119616

18. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. *Implement Sci*. 2010;5(1):69. doi:10.1186/1748-5908-5-69

19. Tricco AC, Lillie E, Zarin W, et al. PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Ann Intern Med*. 2018;169(7):467-473. doi:10.7326/M18-0850

20. Noble G, Reeves I, Jackson R, Abrahams L. An integrated approach to blood pressure control in HIV. In: *Abstracts of the 18th Annual Conference of the British HIV Association (BHIVA)*. ; 2012:134. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=7&cad=rja&uact=8&ved=2ahUKEwjY2Mmmz-TkAhWgR0EAHTVXAv4QFjAGegQIBhAC&url=https%3A%2F%2Fwww.bhiva.org%2Ffile%2FgHJDLWFATpytr%2FAbstracts2012.pdf&usg=AOvVaw1poA5xqA5UTCKMAPBJ5PAt

21. Chu C, Umanski G, Blank A, Meissner P, Grossberg R, Selwyn PA. Comorbidity-related treatment outcomes among HIV-infected adults in the Bronx, NY. *J Urban Health*. 2011;88(3):507-516. doi:10.1007/s11524-010-9540-7

22. Muddu M, Tusubira AK, Sharma SK, Akiteng AR, Ssinabulya I, Schwartz JI. Integrated Hypertension and HIV Care Cascades in an HIV Treatment Program in Eastern Uganda. *JAIDS J Acquir Immune Defic Syndr*. 2019;81(5):552-561. doi:10.1097/QAI.0000000000002067

23. Myerson M, Poltavskiy E, Armstrong EJ, Kim S, Sharp V, Bang H. Prevalence, Treatment, and Control of Dyslipidemia and Hypertension in 4278 HIV Outpatients. *JAIDS J Acquir Immune Defic Syndr*. 2014;66(4):370-377. doi:10.1097/QAI.0000000000000168

24. Janssens B, Van Damme W, Raleigh B, et al. Offering integrated care for HIV/AIDS, diabetes and hypertension within chronic disease clinics in Cambodia. *Bull World Health Organ*. 2007;85(11):880-885. doi:10.2471/blt.06.036574

25. Khabala KB, Edwards JK, Baruani B, et al. Medication Adherence Clubs: a potential solution to managing large numbers of stable patients with multiple chronic diseases in informal settlements. *Trop Med Int Heal*. 2015;20(10):1265-1270. doi:10.1111/tmi.12539

26. Kwarisiima D, Atukunda M, Owaraganise A, et al. Hypertension control in integrated HIV and chronic disease clinics in Uganda in the SEARCH study. *BMC Public Health*. 2019;19(1):511. doi:10.1186/s12889-019-6838-6

27. Ameh S, Klipstein-Grobusch K, Musenge E, Kahn K, Tollman S, Gómez-Olivé FX. Effectiveness of an Integrated Approach to HIV and Hypertension Care in Rural South Africa: Controlled Interrupted Time-Series Analysis. *J Acquir Immune Defic Syndr*. 2017;75(4):472-479. doi:10.1097/QAI.0000000000001437

28. Edwards JK, Bygrave H, Van den Bergh R, et al. HIV with non-communicable diseases in primary care in Kibera, Nairobi, Kenya: characteristics and outcomes 2010-2013. *Trans R Soc Trop Med Hyg*. 2015;109(7):440-446. doi:10.1093/trstmh/trv038

29. Bury JE, Stroup JS, Stephens JR, Baker DL. Achieving American Diabetes Association goals in HIV-seropositive patients with diabetes mellitus. *Proc (Bayl Univ Med Cent)*. 2007;20(2):118-123. doi:10.1080/08998280.2007.11928265

30. Adeyemi O, Vibhakar S, Max B. Are We Meeting the American Diabetes Association Goals for HIV - Infected Patients with Diabetes Mellitus? *Clin Infect Dis*. 2009;49(5):799-802. doi:10.1086/605286

31. American Diabetes Association. Standards of medical care in diabetes--2006. *Diabetes Care*. 2006;29 Suppl 1:S4-42. Accessed September 17, 2019. http://www.ncbi.nlm.nih.gov/pubmed/16373931

32. Putzer G, Roetzheim R, Ramirez AM, Sneed K, Brownlee HJ, Campbell RJ. Compliance with recommendations for lipid management among patients with type 2 diabetes in an academic family practice. *J Am Board Fam Pract*. 2004;17(2):101-107. doi:10.3122/JABFM.17.2.101

33. Benoit SR, Fleming R, Philis-Tsimikas A, Ji M. Predictors of glycemic control among patients with Type 2 diabetes: A longitudinal study. *BMC Public Health*. 2005;5(1):36. doi:10.1186/1471-2458-5-36

34. Gæde P, Vedel P, Larsen N, Jensen GVH, Parving HH, Pedersen O. Multifactorial Intervention and Cardiovascular Disease in Patients with Type 2 Diabetes. *N Engl J Med*. 2003;348(5):383-393. doi:10.1056/NEJMoa021778

35. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). UK Prospective Diabetes Study (UKPDS) Group. *Lancet (London, England)*. 1998;352(9131):837-853. Accessed September 17, 2019. http://www.ncbi.nlm.nih.gov/pubmed/9742976

36. Tsondai PR, Wilkinson LS, Grimsrud A, Mdlalo PT, Ullauri A, Boulle A. High rates of retention and viral suppression in the scale-up of antiretroviral therapy adherence clubs in Cape Town, South Africa. *J Int AIDS Soc*. 2017;20:21649. doi:10.7448/IAS.20.5.21649

37. Mukumbang FC, Orth Z, Van Wyk B. What do the implementation outcome variables tell us about the scaling-up of the antiretroviral treatment adherence clubs in South Africa? A document review. *Heal Res Policy Syst*. 2019;17(1). doi:10.1186/s12961-019-0428-z

38. De Jager GA, Crowley T, Esterhuizen TM. Patient satisfaction and treatment adherence of stable human immunodeficiency virus-positive patients in antiretroviral adherence clubs and clinics. 2018;10(1):1-8. doi:10.4102/phcfm.v10i1.1759

39. WHO. HIV/AIDS Fact Sheet. WHO. Published 2017. Accessed July 21, 2017. http://www.who.int/mediacentre/factsheets/fs360/en/

40. Rabkin M, Melaku Z, Bruce K, et al. Strengthening Health Systems for Chronic Care: Leveraging HIV Programs to Support Diabetes Services in Ethiopia and Swaziland. *J Trop Med*. 2012;2012:1-6. doi:10.1155/2012/137460

SUPPLEMENTARY MATERIALS

Online Supplementary Document

Download: https://www.joghr.org/article/27094-patient-outcomes-in-integrated-hiv-and-non-communicable-disease-models-of-care-a-scoping-review/attachment/67499.pdf