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Interventions to Support People With HIV Following Hospital Discharge: A Systematic Review

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Background. Individuals hospitalized with HIV-related complications face high post-discharge mortality and morbidity, particularly in resource-limited settings. This systematic review evaluated the impact of interventions to reduce post-hospital mortality, lower readmissions, and improve linkage to care.

Methods. We searched the PubMed, Embase, and Cochrane databases up to 1 October 2024 for studies reporting outcomes of post-discharge interventions. Two independent reviewers performed study selection, extracted data, and assessed risk of bias. We pooled data using random effects meta-analysis.

Results. We included 4 randomized controlled trials (conducted in Spain, South Africa, Tanzania, and the United States) and 6 observational studies (Canada, Thailand, Zambia, and the United States). Interventions included pre-discharge counseling, medication review, referral to care, and goal setting, as well as post-discharge follow-up via home visits, telephone calls, and support from social workers or community health workers. Pooled data from randomized controlled trials showed no difference between post-discharge interventions and usual care in mortality, but the estimate was imprecise (relative risk [RR], 0.98; 95% CI, .59–1.63). However, interventions may reduce readmissions (RR, 0.82; 95% CI, .52–1.30) and may slightly improve linkage/retention in care (RR, 1.10; 95% CI, .95–1.27). Observational studies reported similar results, with no mortality effect but potential reductions in readmissions (RR, 0.77; 95% CI, .48–1.25) and improved linkage/retention (RR, 1.42; 95% CI, 1.11–1.81). Interventions were largely feasible, acceptable, and low cost.

Conclusions. Interventions that include pre-discharge care planning and post-discharge follow-up, such as telephone contact and home visits, may improve linkage to care and reduce readmissions. However, interventions were not associated with reduced post-discharge mortality.

Keywords. discharge; HIV; hospitalization; mortality; readmission.

Despite improved access to antiretroviral therapy, hospitalizations from complications relating to HIV infection, including coinfections associated with advanced HIV disease, remain substantial [1–3]. People who are hospitalized with HIV-related illness are at high risk of death [4–7], and this risk persists after discharge from inpatient care. A systematic review published in 2022 found that 19% of people with HIV were subsequently readmitted to hospital after discharge and 14% had died [2]. In a prospective cohort study from Tanzania published in 2016, almost a third of deaths occurred within 3 months after hospital discharge [8].

Several studies have identified factors associated with poor post-discharge outcomes, such as readmission, failed linkage to care, and death among people with HIV. These risk factors include low CD4 cell count [9], not taking antiretroviral therapy at admission or discharge [10], and discharge against medical advice [11]. Poor functional status (ie, inability to perform normal daily activities) is also an important predictor of mortality [1].

Individuals with HIV who are admitted to a hospital should be considered at high risk for death in the following 12 months [12], and there is a need to identify effective ways to reduce post-

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hospital mortality. We conducted this systematic review to summarize the available evidence on interventions to improve clinical outcomes after hospitalization among people with HIV.

METHODS

This systematic review and meta-analysis adhered to the PRISMA statement (Preferred Reporting Items for Systematic Reviews and Meta-analyses). The study protocol is available in the supplementary appendix.

Using a highly sensitive search strategy developed by an information specialist, we searched PubMed, Embase, and the Cochrane library from inception to 1 October 2024 for studies assessing interventions to improve outcomes following hospital discharge. Abstracts from IAS and CROI were screened from 2022 to 2024 to identify studies not yet published in full, as were the bibliographies of included articles. Randomized trials and comparative observational studies were included if they reported on the impact of an intervention on the following outcomes among people with HIV: post-discharge mortality, readmission, or linkage/retention after hospital care; linkage and retention were combined, as both terms refer to follow-up care in outpatient services in the early post-discharge period. There were no restrictions based on follow-up time. Information on cost and acceptability was extracted if reported. Study selection and data extraction were conducted by at least 2 reviewers working independently and in pairs (N. F., A. K., A. R.), with any disagreements resolved by consensus. Summary extraction tables were shared with study investigators for verification.

We extracted data on population, details of the intervention and comparator, and outcomes (including the number of patients who died, were readmitted to care, and were successfully linked to community health care services). We assessed risk of bias using the Cochrane tool for randomized trials and an adapted Newcastle Ottawa scale for observational studies, and this assessment was used to inform a GRADE assessment of evidence certainty [13]. We calculated relative risks (RRs) and corresponding 95% CIs for each outcome and pooled the data using random effects meta-analysis because of anticipated heterogeneity. Outcomes were pooled separately for randomized trials and observational studies. For observational studies, we used raw (unadjusted) data, with studies weighted by within- and between-study variance to account for heterogeneity across studies. A post hoc decision was taken to pool outcomes across study designs as a supplemental analysis, given the limited data and considering the similarities between follow-up of studies with and without baseline randomization for these interventions [14]. All analyses were carried out in Stata version 15 (StataCorp).

RESULTS

From an initial screen of 2305 abstracts, 10 studies consisting of 3202 participants were included in the analysis (Figure 1). Four studies were randomized trials conducted in Spain [15], South Africa [12], Tanzania [16], and the United States [17]. Six studies were observational designs: a prospective single-arm study from Canada [18], pre- and post-analysis studies from Thailand and the United States [19, 20], an interrupted time series from the United States [21], a retrospective study from the United States [22], and a quasi-experimental study from Zambia [23] (Table 1). Where cause of admission was reported, HIV-related causes were common [12, 22]; at admission, the proportion of patients with advanced HIV disease (defined as CD4 <200 cells/mm^3) ranged from 31% to 66% [12, 15–18, 20, 21]. All studies were conducted among adults, including patients with severe [12, 15–19, 21] to moderate [20, 22] immunosuppression. Four studies were in select populations at higher risk of poor outcomes (eg, people not in antiretroviral therapy care) [15–18], and 6 recruited a general group of hospitalized people with HIV.

All interventions evaluated had pre- and post-discharge components. Pre-discharge interventions refer to those offered during hospital admission, and post-discharge interventions refer to those offered at a variable period following discharge from hospital (immediately to several months after discharge). Pre-discharge interventions included counseling (3 studies [16, 17, 22]), care referral (3 studies [12, 19, 21]), medication review (2 studies [20, 22]), goal setting (1 study [18]), and follow-up instructions (2 studies [19, 23]). Post-discharge interventions consisted of home visits (4 studies) conducted by nurses [12] or social support/community health workers [12, 16, 22, 23] and telephone follow-up, including SMS/text (7 studies [12, 15–20]). Support was provided by social workers [16, 22], peer volunteers [18], or patient care navigators [22]; 2 studies employed pharmacists to support medication follow-up (Table 1, Supplementary Appendix) [15, 20]. Mortality within 30 days was cited by 1 study [19]; the rest reported mortality at 6 to 12 months [12, 16, 17, 23]. Four studies assessed readmission within 30 days [19, 20, 22]—a common metric for assessing quality care—while the rest reported readmission 6 to 12 months after discharge. The follow-up time for assessing linkage/retention in care varied from 30 days [17, 19, 22] to 12 months [16]. Six studies provided less intensive discharge support to participants in the control group [12, 15, 16, 19, 22, 23].

Across the randomized trials, there was no clear evidence of a difference in mortality comparing those who did and did not receive an intervention (RR, 0.98; 95% CI, .59–1.63); I^2 = 46.0%): this estimate is imprecise and there were few deaths, with pooled risk differences across the trials ranging from 7 fewer to 6 more per 100 patients.

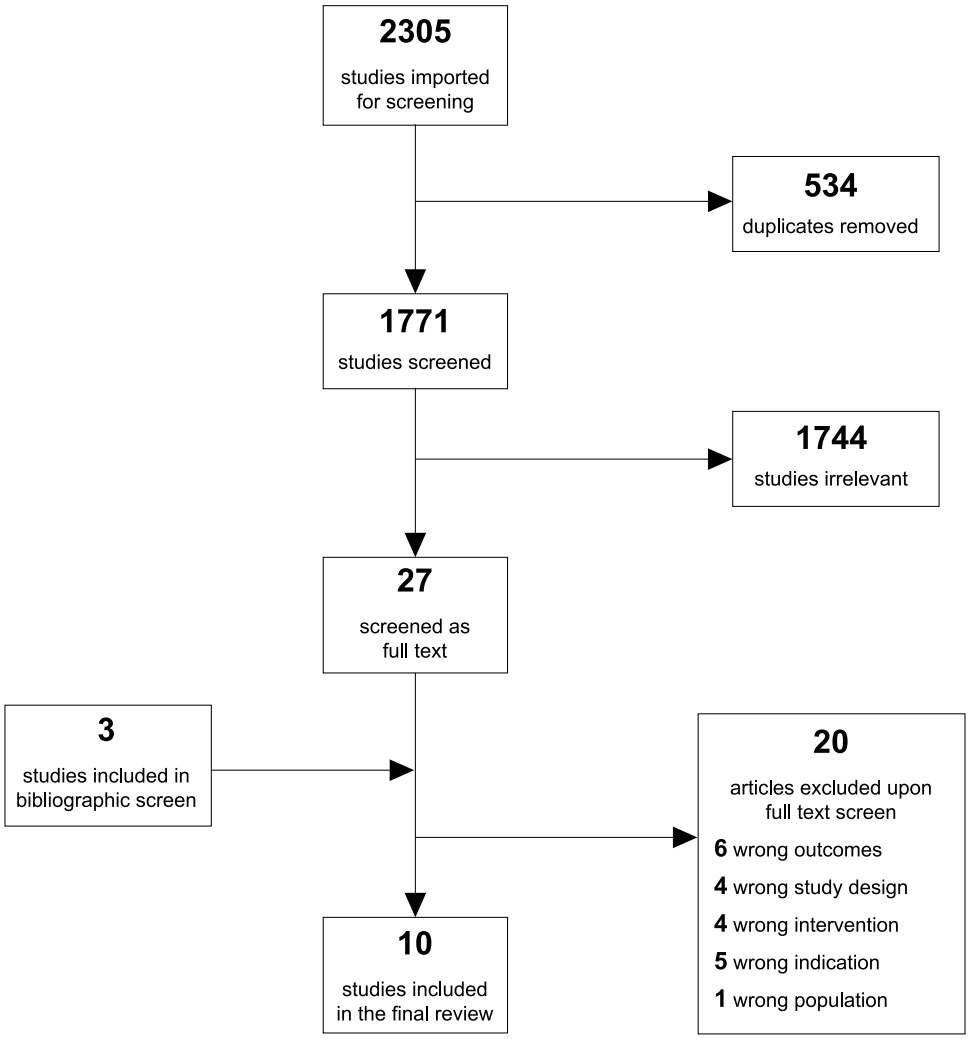

Figure 1. Study selection process.

The interventions might be associated with reduced likelihood of readmissions (RR, 0.82; 95% CI, .52–1.30; $I^2 = 53.7\%$) and a slight increase in the likelihood of linkage/retention (RR, 1.10; 95% CI, .95–1.27; $I^2 = 41\%$), although the confidence interval is wide, including no effect (Figure 2).

Outcomes were similar across the observational studies, which reported no difference in mortality (RR, 1.0; 95% CI, .63–1.59; $I^2 = 0.0\%$), possibly decreased likelihood of readmissions (RR, 0.77; 95% CI, .48–1.25; $I^2 = 49.0\%$), and increased likelihood of linkage/retention in care (RR, 1.42; 95% CI, 1.11–1.81; $I^2 = 79.0\%$).

Pooling all data across study designs gave similar results: no difference in mortality (RR, 1.02; 95% CI, .79–1.32; $I^2 = 0\%$) and a possible reduction in readmissions (RR, 0.87; 95% CI, .69–1.09; $I^2 = 44.5\%$). There was an increase in linkage/retention in care (RR, 1.24; 95% CI, 1.07–1.44: $I^2 = 74.0\%$), which translated into 18 more patients out of every 100 (6–30 patients) being linked/retained. The certainty of the evidence was low, with downgrading mainly due to risk of bias and imprecision (supplementary appendix).

Four studies that assessed post-discharge follow-up by telephone or home visit reported that the interventions were feasible [12, 18, 23] and acceptable [15, 23]. One study that assessed social worker hospital and home care in Tanzania cited the cost of delivering the intervention at US $22 per patient [16]. A study from Thailand stated that the intervention (enhanced inpatient rounds and telephone follow-up) was cost neutral [19]; a study from the United States found that the intervention (telephone follow-up) was cost saving through reduced readmissions [20].

DISCUSSION

This systematic review summarizes the available evidence on interventions to improve outcomes of patients with HIV following hospital discharge. The review found a limited number

Table 1. Study Characteristics

Study	Country and Year	Design	Cause of Admission	CD4	Sample Size (Intervention), Age, and Inclusion Criteria	Intervention		Control
						Pre-discharge	Post-discharge	
Giordano [17]	USA, 2010–2013	Randomized controlled trial	Any	66% <200	417 (225); >50% >40 y; people newly diagnosed with HIV or out of care	2 in-person sessions from a peer supporter	Peer support: 5 postdischarge telephone calls; brochures	Counseling on avoiding HIV transmission
Guzman Ramos [15]	Spain, 2017–2018	Randomized controlled trial	Any	45% <200	39 (20); mean age 54.5 y; PWH determined to be at high risk of readmission	Risk stratification for readmission	2 pharmacotherapeutic follow-up visits, motivational interviewing, information leaflets on adherence, and SMS/text	Standard care, including pharmacotherapeutic follow-up
Hoffmann [12]	South Africa, 2020–2021	Randomized controlled trial	Medical ward (nonsurgical, obstetric, or psychiatric); TB (28%) was the leading diagnosis	49% <200	111 (63); median, 41 y; most hospitalized PWH admitted >2 d eligible	Care referrals	Telephone or home visit package with up to 6 home visits with nurse and counsellor. Macronutrient supplement for participants meeting food insecurity criteria	Instructions from discharge counselors given pre-discharge (no study-delivered postdischarge follow-up)
Peck [16]	Tanzania, 2019–2022	Randomized controlled trial	Any; 62% for infectious causes	48% <200	500 (250); mean 37 y; adults newly diagnosed with HIV or not taking ART	Intervention: first counseling session	Intervention: up to 5 sessions conducted by a social worker at hospital, home, and HIV clinic over a 3-mo period.	30-min counseling session and nurses escort to HIV clinic for appointment schedule
Brizzi [20]	USA, 2017–2018	Pre- and post-analysis	Any	31% <200	128 (68); median 47 y; adults who were being followed up at outpatient clinic in same hospital	Review of medications	Pharmacist-driven ART stewardship; transitions of care service; telephone follow-up within 7 d for high-risk patients	Standard care
Claassen [23]	Zambia, 2023	Quasi-experimental study	Any	…	224 (100); median 41 y; all adult hospitalized PWH	Discharge card: diagnoses, laboratory tests, medications, follow-up instructions	Community health worker visit within 7 d of discharge to check vital signs, adherence, counseling, and referral as needed. Additional visits up to 3 mo	Standard care with telephone follow-up
Eaton [18]	Canada, 2017–2018	Prospective observational study	ART (re)initiation; substance use	36% <200	17 (17); mean 49 y; adults admitted to a specialist hospital for subacute and respite HIV care; drug use common among participants	Goal setting with nurse; meeting with peer volunteer	9 phone calls with peer volunteer over 7 wk	None
Hill [22]	USA, 2020–2021	Retrospective observational study[b]	Any; 40% had AIDS-defining illness at admission	Mediam CD4 223	114 (77); median 51 y; all hospitalized adults who were scheduled for a discharge clinic visit	Medication counseling	Patient care navigators provide appointment reminders and assist with transport to	Standard care, including medication counseling

Table 1. Continued

Study	Country and Year	Design	Cause of Admission	CD4	Sample Size (Intervention), Age, and Inclusion Criteria	Intervention		Control
						Pre-discharge	Post-discharge	
							discharge clinic; doctor, social workers, and counselors address psychosocial needs; and pharmacists assist with medication reconciliation at discharge clinic.	
Khawcharoenporn[a] [19]	Thailand, 2014–2015	Pre- and postanalysis	Any	Mediam CD4 158	240 (120); median 37 y; all hospitalized adult PWH	Enhanced inpatient rounds, including a social worker and peer supporter and instructions about how to make a follow-up appointment	Appointment reminders, patient education, and telephone calls. Written materials	Standard care, including instructions on how to make a follow-up appointment
Nijhawan [21]	USA, 2012–2016	Interrupted time series	Any	33% <200	1412 (1103); median 43 y; all hospitalized adult PWH	Review barriers to care, complete patient education, and develop an individualized transitional care plan; multidisciplinary transition team	Medical HIV consultation ± transitional care nurse intervention	Standard care (no case management)

Abbreviations: ART, antiretroviral therapy; PWH, people with HIV; TB, tuberculosis.

[a]Intervention participants (where disaggregated).

[b]Studied people who did and did not attend a discharge clinic (all people invited to clinic).

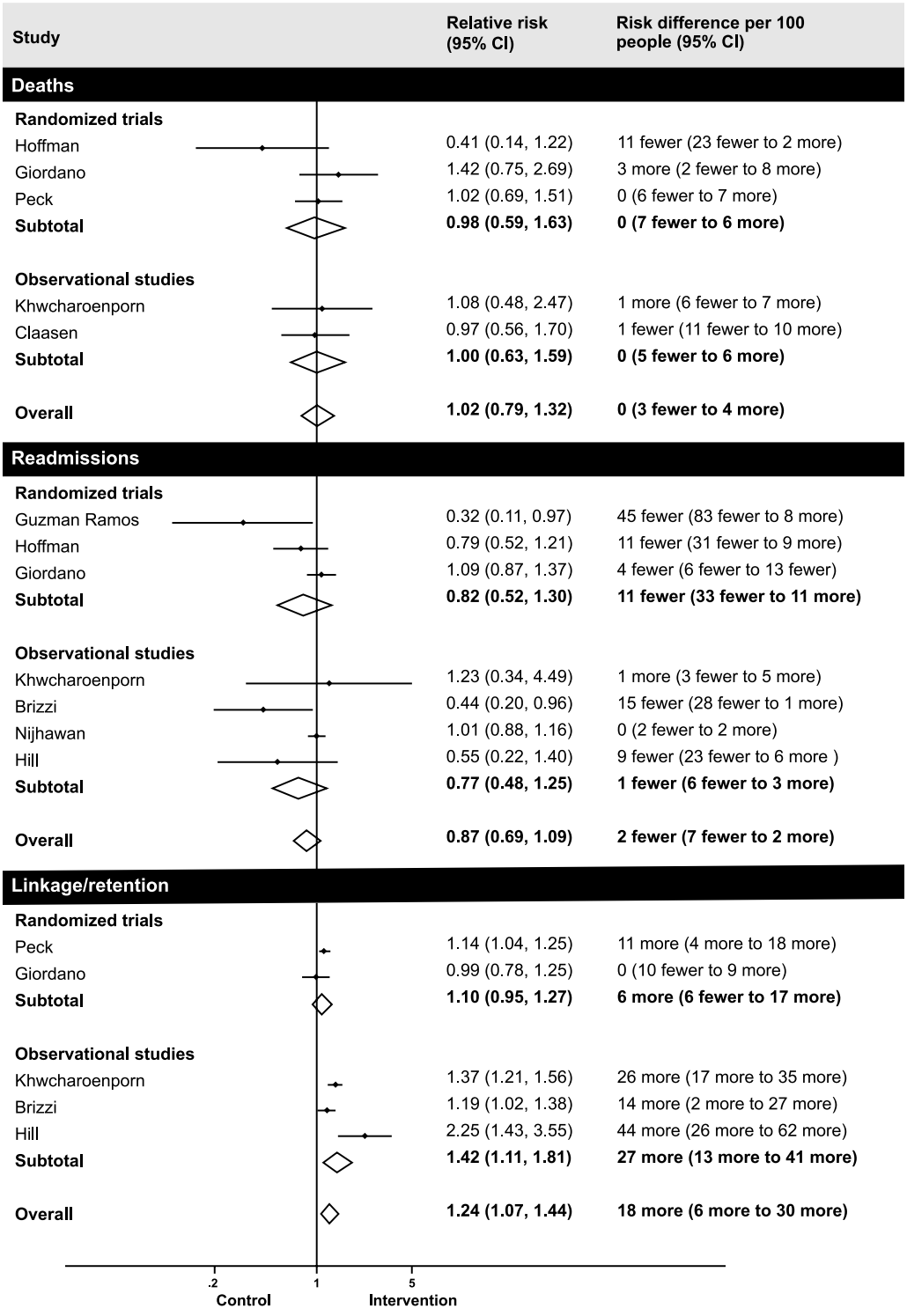

Figure 2. Forest plot of Intervention effects.

of studies, mostly with small numbers of participants. Studies tested a number of interventions that were provided prior to and following discharge. The studies in this review provide further evidence of poor outcomes following hospital discharge, in particular post-discharge mortality, as well as some direction for interventions that can reduce readmission and improve linkage to ongoing post-discharge care. Approaches that supported improved outcomes included the provision of information and referral for follow-up care prior to discharge and follow-up through telephone communication or home visits

in the weeks following discharge. Where reported, interventions were considered feasible, acceptable, and affordable.

However, there was a consistent lack of an effect on mortality, which was similarly high across intervention and control arms, ranging from 7% to 18%. Studies have mainly focused on providing psychosocial and pharmacy support, and more research is needed to assess interventions designed to improve post-discharge survival. In particular, studies are needed to identify biomedical interventions prior to and following discharge to manage opportunistic infections that were not diagnosed or fully treated during admission and to prevent, diagnose, and treat emergent infections and treatment-related toxicities. Several studies in this review reported that a substantial number of patients died in hospital prior to receiving the intervention [12, 18, 23], highlighting the need to more effectively respond to predischarge mortality [24].

Preventing unnecessary readmissions can enhance care quality and lower costs. Thirty-day readmissions are frequently used as a key indicator of health care quality, as they may indicate poor inpatient care and have a significant impact on patients' quality of life [25]. However, this outcome requires careful interpretation because readmissions may be necessary for some patients. One of the studies in this review deployed community health workers to visit the homes of patients after discharge [23], and this study reported higher readmissions in the intervention group because the intervention identified people who were not recovering well (based on vital signs). Readmissions from this study were therefore not included in the pooled estimates for this review; if this study is included in the analysis, results remain nonsignficiant (RR, 0.92; 95% CI, .65–1.30).

While most of the studies (6 studies, 66% of all participants) were conducted in high-income settings, the majority of the randomized evidence (2 trials, 57% of randomized participants) came from southern or eastern Africa. The interventions that were evaluated could be implemented in low-income settings, and where information on resources was provided, the cost of delivering the interventions was modest. The claim of cost saving through reduced readmissions reported by 1 study would apply to any intervention that reduced avoidable readmissions [20]. However, some studies engaged a number of specialized clinic staff in discharge preparation and follow-up, and that type of intervention may not be feasible in low-income hospital settings.

The certainty of the available evidence was low due to concerns regarding the randomization process and outcome measures, the confounding in the observational studies, and the small sample sizes and event rates leading to imprecise estimates. The available evidence base overall was small, comprising 4 trials and 6 observational studies, preventing the conduct of meaningful stratified analyses to explore important differences among studies that may influence outcomes such as setting, study quality, and differences in intervention components. While interventions varied, most studies provided some preparatory support in hospital and post-discharge follow-up. Outcomes across all studies lacked precision, with most individual study and pooled estimates crossing the null, including benefit and no benefit. This is largely explained by the fact that the total sample size is not large and the number of events is small, with only subsets of studies contributing data for each outcome. This is reflected in the GRADE assessment, which rated the certainty of the evidence as low, with serious risk of imprecision [26]. This highlights the need for larger studies, ideally randomized in design, with adequately powered sample sizes and sufficient follow-up.

Another limitation of the available evidence is the lack of studies conducted among children, which is an important gap given the known high mortality, particularly in resource-limited settings [27]. There is a need for adequately powered randomized studies across all age groups. There was also limited information on feasibility, acceptability, quality of life and other patient-reported outcomes, and cost, which are important considerations for the adoption of interventions into policy and practice. Finally, we cannot exclude publication bias. While there were too few studies reporting the same outcomes to be able to assess this statistically, the strength of the available evidence does not suggest that available results differ systematically from results that may not have been published [28].

Systematic reviews of discharge interventions for patients hospitalized with heart failure [29], those with chronic obstructive pulmonary disease [30], and older patients who were chronically ill [31] have reported that transitional care interventions that bridge the care gap from hospital to home have reduced hospital readmissions, with some benefit on other health outcomes including mortality. Such indirect evidence from comparable health conditions should be considered when seeking to improve the outcomes of people with HIV following discharge from hospital.

In conclusion, the studies summarized by this review provide evidence around the effectiveness of feasible and low-cost interventions to improve linkage to care and potentially reduce readmissions but did not ultimately identify any interventions that reduce mortality.

Supplementary Data

Supplementary materials are available at *Open Forum Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

Notes

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Author contributions. N. F. conceived the study. N. F., A. R., and A. K. ran the search and extracted and verified the data. N. F. conducted the statistical analysis. N. F. wrote the first draft, and all authors contributed to revisions and approved the final manuscript. All authors had full access

to the data in the study and had final responsibility for the decision for submit for publication.

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