

# Evaluating the HIV Continuum of Care within a Large Integrated Health System

by Michael J. Williams, PharmD and Thomas J. Dilworth, PharmD

## Abstract

**Objective:** The primary study objective was to describe the HIV continuum of care within a large integrated health system. Secondary objectives aimed to address potential gaps along this internal continuum and compare to national and statewide data.

**Methods:** Patients  $\geq 13$  years of age with a positive HIV antigen/antibody and/or HIV rapid antigen test(s) between January 2012 and August 2016 were identified using SAP business filtering software. The electronic health record of queried patients with a positive result was reviewed to determine each patient's place along the HIV continuum of care. Patients with a false positive test were excluded. The overall HIV continuum of care within our health system was then constructed and compared to national and statewide data.

**Results:** Of 79,442 HIV antigen/antibody and HIV rapid test collections, 211 (0.27%) were positive from which there were 115 (54.5%) unique patients; of these, 86 (74.8%) met our inclusion criteria. Among these 86 patients: 70.9% were linked to care, 58.1% remained engaged in care, 34.9% were retained in care, and 45.3% achieved viral suppression within one year after HIV diagnosis. Our internal linkage to care results are comparable to national data yet lie below Wisconsin statewide data. Retention in care offered the greatest opportunity compared to statewide data.

**Conclusion:** To this end, we will investigate internal resources to improve linkage to care and patient retention, as the latter revealed a strong correlation to viral suppression. We recommend replication of this evaluation at other institutions in which patients are diagnosed with HIV.

The Centers for Disease Control and Prevention (CDC) claim that as of 2015, nearly one million persons  $\geq 13$  years of age in the United States are infected and living with human immunodeficiency virus (HIV), a disease associated with approximately 12,000 deaths from any cause per year.<sup>1</sup> This infection, which targets CD4 T-cells, can cause severe immunosuppression allowing for the development of opportunistic infections to infiltrate the system as the CD4 count declines. Progression of immunosuppression to a CD4 count  $< 200$  cells/mm<sup>3</sup> is referred as the acquired immunodeficiency syndrome (AIDS). A diagnosis of AIDS is associated with a worsened prognosis as the CDC reported nearly 7,000 deaths directly attributable to AIDS in 2014 alone. Transmission of HIV from HIV-infected persons occurs primarily via sexual intercourse and the sharing of intravenous needles. Less common methods of HIV transmission include vertical transmission from an HIV-infected mother to their newborn or exposure of an open wound or mucosal membrane to infected bodily fluids.<sup>2</sup> Appropriate management of the HIV-infected population is vital in order to optimize survival and quality of life, as well as to prevent additional HIV transmission.

While there is no known cure for HIV, antiretroviral therapy (ART) induces viral suppression, defined in this report by an undetectable HIV RNA quantified laboratory value ( $< 40$  copies/mL). The efficacy of these medications is not only dependent on patient adherence, but also on appropriate drug combination selection based on patient-specific factors, including the presence of HIV drug resistance mutation(s). Recently published national data suggest only 37% of people diagnosed with HIV are on active ART, and less than one-third of HIV-infected persons

in the U.S. are virally suppressed.<sup>3</sup> When assessing survival rates of individuals on ART, compared to those without HIV, life expectancy is nearly equivalent.<sup>4</sup> As a result, ART is the standard of care for achieving HIV suppression and is now recommended for all people with HIV, regardless of CD4 count.<sup>5,6</sup>

In 2013, the CDC sought to gain a comprehensive understanding of the United States' HIV population. Referenced as the HIV Care Continuum, the project categorized persons living with HIV along a five-step pathway to viral suppression following a formal HIV diagnosis. These stages include: linkage to care, engagement and retention in care, initiation of ART, and viral suppression (Table 1, Figure 1).<sup>7</sup>

The state of Wisconsin Department of Health Services (WDHS) performed a similar evaluation of the state's HIV population. Utilizing the same methodology, it was determined that 6,337 people living with HIV resided in Wisconsin as of December 31, 2015.<sup>8</sup> While 85% of those diagnosed had completed a follow-up office visit within three months of diagnosis, only 61% of the infected population had achieved viral suppression at the end of the analyzed time period. The proportion of persons in Wisconsin diagnosed with concomitant HIV and AIDS decreased from 30% to 18% between 2012 and 2015.<sup>9</sup>

In response to both the CDC and WDHS results, as well anticipation of National HIV/AIDS Strategy for 2020 goals (NHAS) which advocate for an 85% linkage to care within 30 days and a 90% retention rate, we sought to describe the HIV continuum of care within Aurora Health Care (AHC).<sup>10</sup> As the largest not-for-profit health system in the state, AHC provides healthcare services in Wisconsin through 16 hospitals and more than 150 outpatient clinics.

## Methods

### Patient Criteria

Patients who had an HIV test performed at an AHC facility were identified via systematic extraction from the electronic health record (EHR) using SAP Business Objects Business Intelligence platform filtering software 4.1, version 14.1.5.1568 (SAP America, Inc., Newtown Square, PA). Patients with a positive HIV rapid antigen and/or HIV antibody test(s) between January 1, 2012 and August 1, 2016 were included in our analysis. Patients were excluded if they were less than 13 years old at the time of HIV diagnosis and/or if the HIV test result was determined to be a false positive as identified by chart review. Patients who had a positive HIV test within AHC but had an established history of HIV infection prior to the study period were also excluded from our analysis. Patient demographics were recorded including: age, gender, and race.

### Data Collection and Analysis

Patients were matched against the pre-defined stages along the continuum (Table 1). Those who received HIV care outside of AHC but for whom documentation of HIV care and outcomes was described in the limited capacity inter-institutional shared EHR were included in the study. Subjects lost to follow-up, referred elsewhere, and/or lacking adequate subsequent documentation were noted as such and included in the analysis. Patients who presented within three months of diagnosis for any reason other than an HIV follow-up office visit (e.g. emergency room visit) were not considered to be linked or engaged in care. Initial HIV viral load (VL) (copies/mL) and CD4 count (cells/mm<sup>3</sup>) were recorded as the first value measured since HIV diagnosis. Patients with a VL or CD4 count obtained on the day of diagnosis were not considered to be linked to care. However, subsequent laboratory

**TABLE 1. The HIV Continuum of Care Defined.<sup>7</sup>** Defines the stages along the continuum of care within which a patient is categorized.

<b>Diagnosed with HIV</b>	≥ 13 years of age diagnosed within the time period and still living at the end of the investigated period
<b>Linked to Care<sup>a</sup></b>	Had at least one CD4 or VL obtained within 3 months of HIV diagnosis, not including patients for whom a CD4 or VL was obtained on the day of diagnosis. Subsequent CD4 or VL values obtained after the day of diagnosis, but within 3 months were considered linked
<b>Engaged<sup>a</sup></b>	Had at least one CD4 or VL obtained outside of the first three months but within a year of diagnosis
<b>Retained in Care<sup>a</sup></b>	Had at least one CD4 or VL obtained within a year of HIV diagnosis but at least 3 months after being engaged in care
<b>Prescribed ART<sup>b</sup></b>	Documentation of prescribed ART in the electronic medical record
<b>Achieved Viral Suppression<sup>a</sup></b>	Serum VL <40 copies/mL or undetectable by current lab techniques within a year of HIV diagnosis
<sup>a</sup> VL=viral load <sup>b</sup> ART=antiretroviral therapy	

value collection within 90 days qualified as linkage to care. Furthermore, if a patient did not become linked to care, he or she remained eligible to become engaged or retained in care.

Subsequent analyses were performed within two subgroups. The first group, patients without documented ART, was evaluated via electronic health record review for any comments regarding rationale for lack of ART. The second subgroup analysis focused on patients who were newly diagnosed but failed to establish documented follow-up within or outside of the AHC system. This project was reviewed by the Aurora Health Care Institutional Review Board and granted approval with no oversight necessary per board review given the nature of data collection and handling.

### Primary and Secondary Objectives

The primary objective of our study was to describe the HIV continuum of care within the AHC system as previously performed on both state and national levels. Our secondary objective was to use these data to identify any opportunities to improve the quality of HIV care within AHC. A special focus was placed on any

potential gaps in patients without ART and patients not linked to care.

### Statistical Analysis

Subjects' baseline characteristics were summarized using descriptive statistics. Continuous variables were summarized using the mean and standard deviation or the median and interquartile range (IQR). The annual proportion of newly diagnosed HIV patients who were diagnosed with concomitant HIV and AIDS was compared across all study years using the likelihood ratio chi-squared test. A *p*-value of ≤ 0.05 was considered statistically significant. All analyses were performed in JMP Pro version 12.2.0 (SAS Institute Inc., Cary, NC, United States).

## Results

### Baseline Population

The initial sample query resulted in 79,442 HIV antigen/antibody and HIV rapid test collections. After filtering by reactive and positive results, 211 (0.27%) data points remained. As both tests may be used in the same patient to establish an HIV diagnosis, duplicate medical record numbers were removed, leaving 115 (54.5%) unique patients. Patient match

**FIGURE 1. The HIV Continuum of Care Steps.<sup>7</sup>**

Illustrates the steps of the continuum defined in Table 1.



**TABLE 2. Baseline Patient Characteristics.** Describes the baseline characteristics of the inclusion population (n=86).

Characteristic	Result <sup>a</sup>
Male	71 (82.6)
<b>Race</b>	
White	43 (50.0)
Black/African American	37 (43.0)
Asian	3 (3.5)
Other	3 (3.5)
<b>Ethnicity</b>	
Non-Hispanic or Latino	69 (80.2)
Hispanic or Latino	14 (16.3)
Other	3 (3.5)
Age at diagnosis (years), median (IQR <sup>b</sup> )	39 (30, 49)
Viral load (copies/mL), median (IQR <sup>b</sup> )	63,327 (16,952, 226,391)
CD4 count (cells/mm <sup>3</sup> ), median (IQR <sup>b</sup> )	203 (33, 492)
<b>Diagnosis Encounter Type</b>	
Lab services/not specified	52 (60.4)
Hospital	30 (34.9)
Office visit	4 (4.7)

<sup>a</sup> All data summarized using number (percentage) unless otherwise noted.  
<sup>b</sup> IQR = interquartile range

against exclusion criteria further eliminated 29 from participation in the analysis with 86 (74.8%) appropriate patients remaining from the initial 211 (Figure 2). The baseline population consisted primarily of Caucasian males with a median age of 39 years (IQR 30, 49) (Table 2). Sixty percent of patients were diagnosed at a laboratory visit and 35% were diagnosed in the hospital. The remaining patients were diagnosed in a clinic setting.

### Primary Objective

Of 86 eligible patients, 61 (70.9%) were appropriately linked to care; this does not account for 11 patients (12.8%) who had a CD4 and/or viral load collected on the day of diagnosis. Mean time to linkage was 14.6 ± 18.1 days. Regarding NHAS 2020 goals, 57.4% of patients linked to care met the new 30-day to linkage metric. Additionally, 58% of the total diagnosed population was engaged in care followed by a subsequent 35% retained in care. Of those retained in care, 96.7% of patients were prescribed ART and a subsequent 83.3% achieved viral suppression. Forty-five percent of the total sample achieved viral suppression within a year of diagnosis (Figure 3). The proportion of patients diagnosed with concomitant HIV and AIDS was 43.7% overall, and there was no statistically significant difference in this

proportion per annum ( $p=0.779$ ).

### Secondary Objectives

Our internal HIV continuum of care evaluation produced useful information and revealed opportunities for HIV care improvement. Linkage to care within the AHC system was comparable to the national average but fell below the state of Wisconsin average by 14%. Eleven patients within AHC were excluded from linkage to care analysis because a CD4 and/or viral load was collected on the date of diagnosis. In comparison to the state's decreasing annual proportion of patients diagnosed with concomitant HIV and AIDS, we observed a consistently high proportion of patients receiving this concomitant diagnosis within our health system.

Nineteen patients (22.1%) were found to be without documented ART. Of these, one patient had an undetectable viral load at baseline and a year from diagnosis without recorded therapy. Rationale for lack of therapy among the 19 patients included: referred for HIV care outside of AHC with no documented follow-up (n=11), lost to follow-up (n=7), and moved out of state (n=1).

Of the entire sample size, 14 (16.3%) did not establish linkage to care within three months of diagnosis. Six of the 14 patients (42.9%) were referred outside of

AHC for HIV care without documentation of HIV outcomes in the electronic medical record. Additionally, 6 patients (42.9%) were lost with no documented referral to care after HIV diagnosis. The remaining 2 subjects (14.3%) established care after the 90-day linkage period had expired.

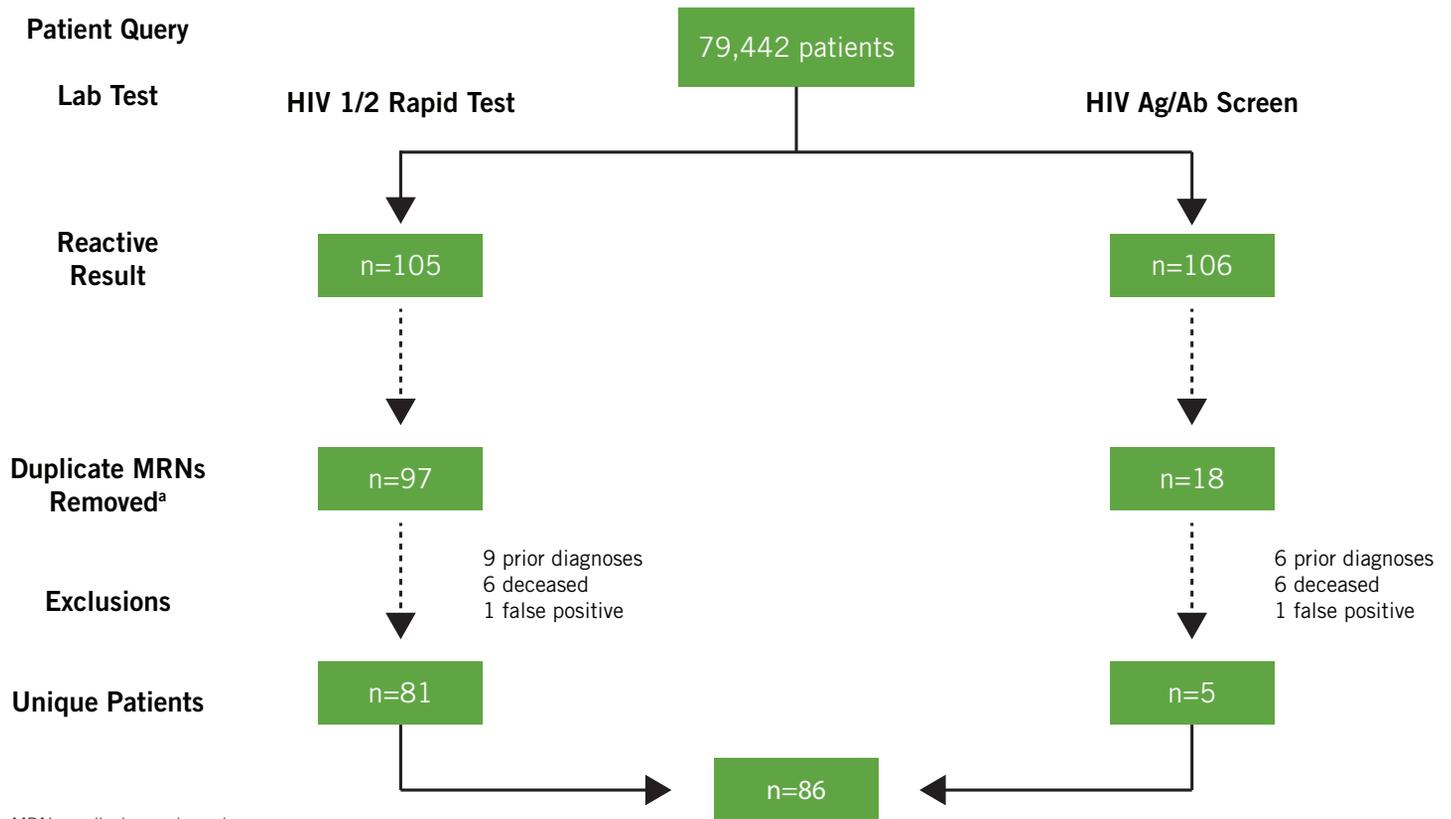
### Discussion

The results of our internal HIV continuum of care analysis suggest many similarities with both national and statewide data; however, we did identify opportunities for improvement. Patient capture within the first month of diagnosis is the initial focus in order to positively affect the subsequent stages, especially considering NHAS 2020 goals. Engagement in care best identifies patients who have willingly attended an HIV-specific follow-up appointment outside of the linkage to care time period. In our evaluation, engagement may appear falsely low as four additional patients have time remaining within their year from diagnosis to become engaged in care; thus, there is potential for this proportion of patients to increase should these any of these four patients complete engagement follow-up criteria. In comparison to national data, AHC patients are more likely to be engaged in care.<sup>3</sup> Retention in care data has the potential to improve if any of the twelve patients with time remaining in their year from diagnosis fulfill retention criteria.

The incidence of undetectable viral loads at one year from HIV diagnosis was 45% with potential to improve if the seven patients with time remaining in the year achieve viral suppression. It is important to note that our laboratory testing sensitivities defined an undetectable viral load as <40 copies/mm<sup>3</sup>. This criteria is stricter than both national and state definitions which classified patients with viral loads <200 copies/mm<sup>3</sup> as virally suppressed, thus having potential to reflect a lower percentage of virally suppressed patients within our health system. Both AHC and statewide data show a higher number of patients achieving viral suppression compared to those retained in care, which is contrary to national data. This increased percentage likely occurred for two reasons. The first is that some patients may have achieved an undetectable viral load at the

**FIGURE 2. Patient Selection.**

Illustrates the filtering process from initial patient query to unique patients who meet inclusion criteria.



<sup>a</sup>MRN=medical record number

engagement to care mark and thus did not continue to meet retention criteria. However, these patients then did have confirmatory viral suppression values after one year from diagnosis suggesting maintained viral suppression. A second explanation is based on the pre-specified definition of patient retention. While some patients engaged in care had multiple lab values confirming viral suppression, the collections occurred within three months of engagement, thus disallowing characterization within the retention metric. In comparison to statewide data, we did not observe a decline in the proportion of patients with a dual HIV/AIDS diagnosis during the study period.<sup>9</sup> However, over one-third of the patients in our study were diagnosed with HIV in the hospital, and these patients may have presented with an AIDS-associated opportunistic infection.

Ultimately, identifying and resolving gaps in HIV patient care is an issue that has been addressed within other health systems. Das and colleagues discussed barriers in patient adherence to the continuum.<sup>11</sup>

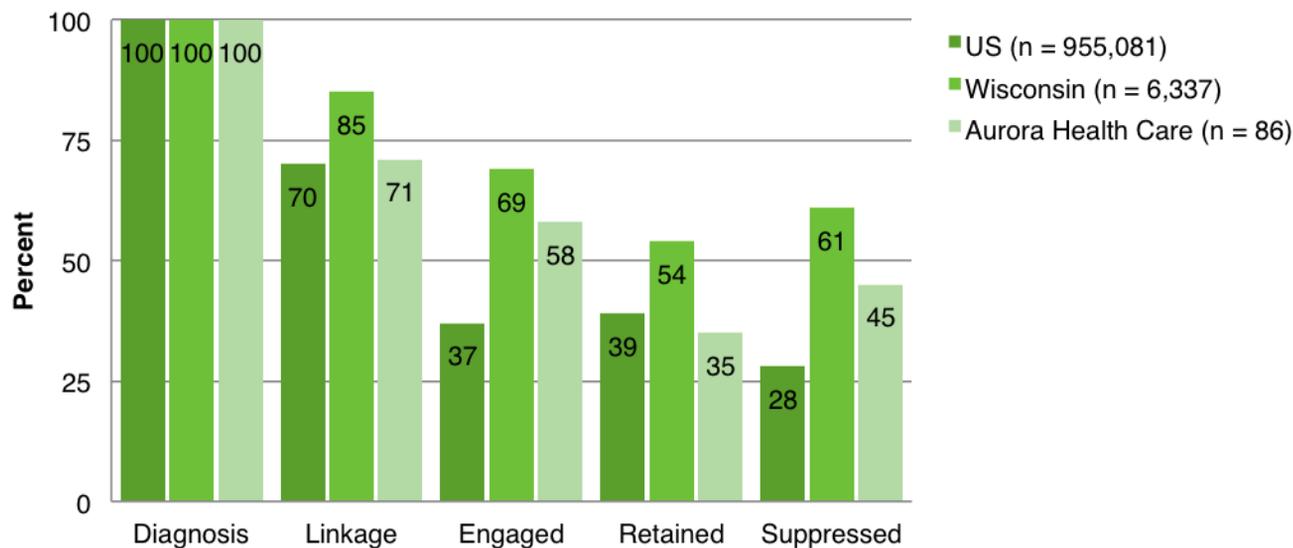
One strategy suggested by the authors was that patients return to the provider for confirmatory testing of an initial HIV positive test suggestive of infection, rather than notifying the patient of the initial test result and relying on the patient for follow-up.<sup>11</sup> At the confirmatory visit, it is predicted that the patient may then become better linked to care with an increased chance of ART offer.

A second opportunity for improvement recognized within our assessment is the lack of documented follow-up after a referral has been made. While this disparity is surely multifactorial, Das et al. noted one key potential issue: patient referral and subsequent follow-up at external healthcare facilities may occur, but this information is not universally accessible given lack of unification in the electronic medical record.<sup>11</sup> As observed within AHC, fewer patients were lost completely than those who were referred elsewhere and then lost to follow-up; inability to electronically track patients post-referral may contribute to inadequate surveillance of patients throughout the continuum of care within

a health system. While a primary factor in the validity of follow-up statistics depends upon the patients' cooperation, an integrated electronic medical record may ease facilitation of HIV care among different health care organizations.

In recent years, researchers have been investigating methods to appropriately address gaps in the continuum of care. One method studied is the use of short message service (SMS) technology in which patient with an HIV diagnosis may be sent appointment reminders through a secure text messaging vendor. This was trialed in one HIV clinic with the objective of improving appointment attendance.<sup>12</sup> Unfortunately, nearly half of the population declined the service while others disconnected their mobile device during the study. Of the patients who completed the study, there was no significant difference in appointment attendance between those who received text message interventions and those who did not (72% versus 81%,  $p=0.42$ ). Currently, a larger trial is evaluating a similar intervention using appointment reminders coupled with

**FIGURE 3. HIV Continuum of Care Across Multiple Levels: Nation, State, System.**<sup>a,b,c,d,1,2,3,7,8</sup>  
Compares the stages of the HIV continuum of care between national, state, and system levels.



<sup>a</sup> The national sample size is extrapolated from 2014 data citing 955,081 persons with an HIV diagnosis. However, the only continuum of care data available comes from 2009 and 2011 CDC reports. Linkage to care and retained in care data are extrapolated from 2009 data with a total diagnosed population of n=902,000. Engaged in care and viral suppression data are extrapolated from 2011 data based on a total diagnosed population of n=1,032,000.

<sup>b</sup> Aurora Health Care (AHC) data reported does not account for four patients who are not engaged, but still have time remaining within a year from diagnosis to become engaged in care.

<sup>c</sup> Within the AHC population, twelve patients not yet retained still had time remaining to become retained.

<sup>d</sup> Within the AHC population, seven patients still have time remaining to become virally suppressed.

three times a week encouragement messages at select HIV clinics in San Francisco.<sup>13</sup> The results may support mobile interventions to increase rates of viral suppression as well as patient retention in care.

A second theory involves the delegation of an HIV patient services coordinator. This role of accountability and organization would expectedly increase initial linkage to care, subsequent engagement and retention in care, ART acceptance, and ultimately viral suppression. One multi-center trial demonstrated significant improvement in patient follow-up within a year of diagnosis in the case-managed group versus control (64% versus 49%,  $p=0.006$ ).<sup>14</sup> A second study utilized case managers to re-engage patients who had been lost to follow-up. Of 409 patients verified to be lost to follow-up, 57% returned for a clinic visit as a result of case management contact.<sup>15</sup> While these authors did not further evaluate patients along the HIV continuum of care, our data suggest a favorable correlation between follow-up, ART, and viral suppression as nearly all patients retained in care were on ART, a majority of whom achieved viral suppression.

## Conclusions

As observed in our evaluation, the HIV continuum of care within AHC contains opportunities to improve care for HIV-infected patients, notably in retention to care – our largest observed disparity compared with state and national data that has a strong relationship to viral suppression. We plan to take steps to improve these aspects of HIV care within our health system by first continuing to investigate external references as well as by potentially creating a network of HIV care providers within AHC to whom these patients can be referred after diagnosis. Ongoing research may inform methods to improve care for HIV-infected patients, including mobile reminders, an HIV services coordinator, or other novel approaches. We recommend that institutions and health systems in which patients are diagnosed with HIV perform a similar evaluation of their HIV continuum of care. ●

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**PR** This article has been peer-reviewed.  
The contribution in reviewing is greatly appreciated!

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# ADVANCED PHYSICAL ASSESSMENT



July 31, 2017

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