

# Comprehensive Geriatric Assessment in Older Persons With HIV

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With increased longevity related to the advent of antiretroviral therapy, there are increasing proportions of older persons with HIV (PWH). Prior studies have demonstrated increased prevalence of geriatric syndromes in older PWH and recommended the Comprehensive Geriatric Assessment (CGA) in this population. However, there is currently no peer-reviewed literature that outlines how to perform the CGA in PWH in the clinical setting. In this article, we offer a review on how to perform the CGA in PWH, outline domains of the CGA and their importance in PWH, and describe screening tools for each domain focusing on tools that have been validated in PWH, are easy to administer, and/or are already commonly used in the field of geriatrics.

**Keywords.** comprehensive geriatric assessment; geriatric syndromes; HIV; persons with HIV.

## EPIDEMIOLOGY

There are increasing proportions of older persons with HIV (PWH). It is estimated that at year-end 2018, persons aged 50–54 years made up the largest percentage of PWH (15%). From 2011 to 2015, the largest increase in rates of PWH was among persons aged 65 years and older (57%; from 94.2 in 2011 to 148.0 in 2015) [1]. Part of this group consisted of individuals who have aged with chronic HIV infection, but a large proportion also resulted from new HIV diagnosis, with 16.6% of all new HIV transmissions in 2016 diagnosed in PWH aged ≥50 years [1]. By 2020, ~21% of PWH globally will be aged ≥50 years [2].

HIV infection has an independent effect on the process of aging and contributes to increasing multimorbidity [3]. Whether due to acceleration (development of age-associated comorbidities at an earlier age compared with HIV-negative persons) or accentuation (increased age-associated comorbidities at similar ages compared with HIV-negative persons), prior studies found that older PWH are at risk of geriatric syndromes such as frailty, polypharmacy, and falls [4]. Consequently, multiple studies have recommended the Comprehensive Geriatric Assessment (CGA) in older PWH [4–6]. However, performing

the CGA in older PWH is currently challenging for multiple reasons. First, although there are numerous studies outlining either the domains that could be part of the CGA in older PWH or the screening processes for specific domains of the CGA such as frailty, we could not find a peer-reviewed resource that provides a review that contains, within 1 source, both a comprehensive outline of CGA domains and a description of how to screen the aforementioned domains that providers can easily refer to in the clinical setting. Moreover, although there are existing comprehensive guidelines on how to perform the CGA in older HIV-negative persons, such resources may not apply to older PWH for 2 reasons. First, as older PWH may experience accelerated and/or accentuated aging, administration of the CGA should perhaps be adjusted based on physiologic age in PWH rather than the traditional chronologic age cutoff used among HIV-negative persons. Additionally, certain CGA screening tools used in older HIV-negative persons could not be translated to use in older PWH due to different pathophysiology, and providers should instead use tools that are validated specifically in PWH. For example, in older PWH who present with cognitive impairment, an appropriate tool needs to screen for HIV-associated neurocognitive disorder, in addition to other causes of cognitive impairment in older HIV-negative persons such as Alzheimer's dementia. Consequently, this article aims to provide a consolidated review that discusses both a comprehensive outline of CGA domains and associated screening tools targeted to older PWH.

## DEFINITION OF THE CGA

The CGA is defined as a multidisciplinary diagnostic and treatment process that evaluates medical, psychosocial, and

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functional deficits in order to develop a coordinated intervention/plan to maximize overall health with aging [7]. The CGA is based on the idea that a systematic evaluation of an older patient may lead to early detection of geriatric problems, help prevent complications, and aid the formation of comprehensive treatment plans [8].

### **EFFICACY OF THE CGA**

Currently, the literature that demonstrates the efficacy of the CGA in older PWH is limited. In the uninfected, use of the CGA in the home may improve functional status, prevent institutionalization, and reduce mortality [9]. Use of the CGA in the hospital, especially in dedicated units, may improve survival [10]. However, use of the CGA in outpatient settings has not been found to consistently show benefits [7], possibly due to variability in adherence to recommendations in the CGA [11], especially if there is a lack of additional support to implement interventions from the CGA. Studies have shown that more complex CGA programs that address adherence or target patients at higher risk of admission may improve outcomes including physical functioning, social functioning, pain, mental/physical/emotional health, and overall well-being [12]. Use of the CGA as part of inpatient geriatric consultation (except for specific conditions such as hip fracture) has shown little benefit [7, 10].

### **PERFORMING THE CGA**

Providers should avoid assessing all domains of the CGA in a single visit; this could be overwhelming and tiring for older patients and caregivers. It may make sense to prioritize addressing domains that are most likely to be abnormal or most urgent (likely to cause complications or catastrophic outcomes) and manage remaining nonurgent domains at subsequent visits. Multiple prioritization strategies for PWH with multimorbidity have also been described, including the Geriatric 5Ms Model [13].

Certain domains of the CGA may be delegated to allied health professionals based on expertise or availability. For example, in the United States, a pharmacist or other support staff within Ryan White–funded clinics may be trained to assess patients for polypharmacy instead of a physician. We also discussed strategies for integration of geriatric and HIV services to increase capacity for the CGA and other care needs elsewhere [14]. In resource-limited settings, providers should be mindful to avoid performing domains of the CGA on which they are unable to intervene. For example, providers should not assess patients for nutritional issues if they cannot provide access to dietitians or community resources to improve food security.

There is no consensus on selection criteria for PWH who may benefit from the CGA. However, prior programs in uninfected patients have used criteria such as age, medical comorbidities/

complexity, specific geriatric syndromes such as falls/dementia, and previous or predicted high utilization rates; they have also used the CGA at times of transition, such as from hospital to home or from home to nursing home.

### **CGA DOMAINS AND SCREENING METHODS**

There is no consensus on which domains should be included in the CGA for PWH and which tools are appropriate for each domain. Most programs include some or all of the following domains. When applicable, we discuss tools that have been validated in PWH, are easy to administer, and/or are already commonly used in the field of geriatrics. Table 1 provides an easy-to-use summary of preferred screening tools for each domain of the CGA.

#### **Function**

Prior studies have reported correlations between functional limitations and severity of HIV infection and increased mortality [15]. Routine assessment of function may improve care by identifying PWH who may benefit from close monitoring [6], targeting early intervention to support residual function, or providing later intervention to facilitate task performance that may prevent progression of disability [15].

The Activity of Daily Living (ADL) and Instrumental Activity of Daily Living (IADL) are commonly used in studies on PWH, can be performed without specific training, and can readily identify deficits that may guide interventions [15, 16]. To assess function, providers may ask whether PWH could perform ADL/IADL independently, with partial or with total assistance [15]. ADL consist of bathing, dressing, grooming, toileting, transferring, and eating. IADL consist of cooking, shopping, managing medications, using the phone, doing housework, doing laundry, driving or using public transportation, and managing finances [17]. Other tools used in PWH include the Short Form (SF)–36 physical function domains [18], the Quality of Well-Being Scale [19], and Karnofsky Performance Status [20].

#### **Mobility/Falls**

As the leading cause of injury-related morbidity and mortality in older adults, falls are common among older PWH, with 46% of 60–80-year-old PWH experiencing at least 1 fall in the prior year [21].

For subjective measures, prior studies assessed whether PWH had a fall in the past 12 months, defined as unexpectedly dropping to the floor or ground from a standing, walking, or bending position [16, 22–24]. For objective measures, multiple HIV studies used the Timed Up-and-Go (TUG) test [16, 25, 26], in which the patient is timed while he/she rises from a chair, walks 3 meters, turns, walks back, and sits down again. The TUG explores multiple components of mobility, including gait speed, balance, and proximal muscle strength, and correlates with functional capacity and more formal tests on balance

**Table 1. List of CGA Domains and Associated Recommended Screening Tools in Older PWH**

CGA Domains	Recommended Screening Methods	Validated in PWH	Reasoning for Recommended Screening Tools
Function	ADL/IADL	No	<ul style="list-style-type: none"> <li>- Minimal training required</li> <li>- Practical, focus on daily task deficits that can guide interventions and directly improve quality of life</li> </ul>
<b>Mobility/falls</b>			
Subjective	Fall in past 12 mo	No	<ul style="list-style-type: none"> <li>- History of falls increases risk for future falls</li> </ul>
Objective	TUG test	No	<ul style="list-style-type: none"> <li>- Explore multiple components of mobility (gait speed, balance, proximal muscle strength)</li> <li>- Correlate with function and more formal tests</li> </ul>
Frailty	Fried frailty phenotype	No	<ul style="list-style-type: none"> <li>- Well-defined diagnostic cutoff</li> <li>- Utilize TUG test, which can also assess mobility/falls</li> <li>- Can be operationalized for clinical practice</li> </ul>
Cognition	MoCA	No	<ul style="list-style-type: none"> <li>- Commonly used to screen for both HAND and other causes of cognitive impairment</li> </ul>
<b>Mood</b>			
Depression	PHQ-2/PHQ-9	No	<ul style="list-style-type: none"> <li>- All 4 tests have been used extensively in prior studies in PWH</li> </ul>
	BDI-II	No	
	CES-D	No	
PTSD	PCL-5	Yes	<ul style="list-style-type: none"> <li>- Contain self-reported measures that can be completed by patient without assistance from staff</li> <li>- Take 5–10 min to complete [74]</li> </ul>
<b>Polypharmacy</b>			
Medication reconciliation yearly	“Brown bag” method, yearly	No	<ul style="list-style-type: none"> <li>- Commonly performed in geriatrics</li> </ul>
Medication review every visit	<ul style="list-style-type: none"> <li>- Review drug interactions</li> <li>- Deprescribe</li> <li>- Consider adverse drug events</li> <li>- Consider nonpharmacologic approaches</li> <li>- Substitute with safer alternatives</li> <li>- Ensure appropriate dosing</li> <li>- Simplify dosing regimen</li> <li>- Ensure indicated therapy is prescribed</li> </ul>	No	<ul style="list-style-type: none"> <li>- Commonly performed in geriatrics</li> </ul>
<b>Social</b>			
Assess for existing help in the home	N/A	No	<ul style="list-style-type: none"> <li>- Help determine what additional services may be needed</li> </ul>
Screen for caregiver burnout	Zarit Burden Interview (ZBI)	No	<ul style="list-style-type: none"> <li>- Commonly used in both PWH and HIV-negative population</li> </ul>
Screen for elder abuse if worrisome signs	Elder Abuse Suspicion Index (EASI)	No	<ul style="list-style-type: none"> <li>- Assess for risk, neglect, verbal, psychological, emotional, financial, physical, and sexual abuse</li> <li>- Take 2 min to complete</li> <li>- Identified for use by Centers for Medicare and Medicaid Services Elder Mistreatment Symposium with available psychometrics (sensitivity, 0.77; specificity, 0.44) [75]</li> </ul>
Financial	Determine financial power of attorney	No	<ul style="list-style-type: none"> <li>- In case patients become unable to manage finances</li> </ul>
Nutrition	RNS-H	Yes	<ul style="list-style-type: none"> <li>- Comprehensively address important outcomes such as food security, anthropometric measures, and nutritional complications</li> <li>- Take 10 min to complete</li> </ul>
Symptom burden	HIV Symptom Index	Yes	<ul style="list-style-type: none"> <li>- Demonstrate strong associations with disease severity, physical and mental health</li> </ul>
Pain	BPI-SF	No	<ul style="list-style-type: none"> <li>- Both are recommended by IDSA</li> </ul>
	PEG	No	
Advance care planning	Respecting Choices paradigm	No	<ul style="list-style-type: none"> <li>- Its 3-stage approach can be applied to all states of health</li> </ul>

Abbreviations: ADL, Activities of Daily Living; BDI-II, Beck Depression Inventory II; BPI-SF, Brief Pain Inventory–Short Form; CES-D, Center for Epidemiological Studies; CGA, Comprehensive Geriatric Assessment; HAND, HIV-associated neurocognitive disorder; IADL, Instrumental Activities of Daily Living; IDSA, Infectious Disease Society of America; MoCA, Montreal Cognitive Assessment; PCL-5, Post-Traumatic Stress Disorder Checklist; PEG, average Pain intensity, interference with Enjoyment of life, and interference with General activity; PHQ-9, Patient Health Questionnaire 9; PTSD, post-traumatic stress disorder; PWH, persons with HIV; RNS-H, Rapid Nutrition Screening for HIV disease; TUG, Timed Up-and-Go.

and gait speed [27]. Although various cutoffs have been used, the Centers for Disease Control and Prevention recommends that an older adult who takes  $\geq 12$  seconds to complete the TUG be considered at risk of falling [28]. Other tools used in PWH include short gait speed (over 4–6 m), longer corridor walk (typically 400 m or distance covered in 6 minutes), or a short physical performance battery (SPPB) [18].

### Frailty

Frailty is defined as a condition of physical weakness and vulnerability due to declines in physiologic reserves that result in decreased ability to cope with stressors. PWH are at increased risk of frailty, which correlates with falls, hospitalization, and mortality [29].

There is no consensus on the best tools to assess for frailty in older PWH [30, 31]. The Fried frailty phenotype [32] is commonly used in HIV research and has been operationalized for clinical use [33] with 5 components (no items = robust, 1–2 = prefrail, 3–5 = frail):

1. Weight loss: defined as loss of either  $\geq 10$  pounds or  $\geq 5\%$  of body weight in the past year
2. Exhaustion (poor endurance and energy): defined as self-reporting of feeling “tired all the time”
3. Low physical activity levels and energy expenditure: defined as needing assistance with walking to being unable to walk
4. Slowness: defined as a time of  $\geq 19$  seconds on the TUG test
5. Weakness: defined as abnormal strength on physical examination

The Veterans Aging Cohort Study index is another frailty tool validated in PWH [34]. It correlates with functional status [35], severity of illness [36], and cause-specific [37] as well as all-cause mortality [34]. An online calculator is accessible at <https://vacs-apps2.med.yale.edu/calculator> for ease of use. Prior HIV studies have also used the frailty index. Because it follows the cumulative deficit approach and assesses for at least 30 and up to 75 health variables [38], this may prove cumbersome in clinical practice.

### Cognition

Although many research studies of cognitive impairment screening in PWH focus on the entity of HIV-associated neurocognitive disorder (HAND), in clinical practice, providers should screen for cognitive impairment from all causes, as age is a risk factor for cognitive impairment associated with HIV as well as other entities, such as Alzheimer’s or vascular dementia [39]. With advances in antiretroviral therapy (ART), HIV-associated dementia (HAD) is also now rare (2%–4%) [40]. Providers may consider using the Montreal Cognitive Assessment (MoCA), as it has been used in PWH [16, 41] and is commonly utilized to screen for other causes

of cognitive impairment. The HIV Dementia Scale [42] and the International HIV Dementia Scale [43] were developed to screen for HAND, but their effectiveness in screening for other causes of dementia is unclear. The Mini-Mental Status Exam (MMSE) is regularly used in HIV-negative individuals, but it does not assess executive function, which may be impaired in HAND [44]. Neuropsychological testing may be inaccessible or cumbersome for older PWH to complete.

### Mood

Depression and post-traumatic stress disorder (PTSD) are common in older PWH, especially in women and men who have sex with men (MSM) [45]. Screening for depression and assessment of its severity are important, as depression affects quality of life, medical compliance, and ART adherence [46]. Multiple tools have been used in PWH to screen for depression, including a screening Patient Health Questionnaire (PHQ-2) with subsequent diagnostic PHQ-9 [46, 47], the Beck Depression Inventory II (BDI-II) [48], or the Center for Epidemiological Studies (CES-D) [49]. Although as many as 14 tools have been used to screen for PTSD in PWH [45], the Post-Traumatic Stress Disorder Checklist (PCL-5) has been validated for use in HIV primary care [50]. Because the understanding and perception of depression, PTSD, and other mental illnesses can be affected by culture, it is important to use tools that have been validated locally if available [16].

### Polypharmacy

Older PWH are at increased risk of polypharmacy [51], defined as prescribing medications that are inappropriate for the patient’s medical condition, using medications that cause adverse drug events, or underutilizing beneficial therapy. Polypharmacy in older PWH may result from multiple factors including increased multimorbidity requiring multiple medications, HIV-related factors affecting cytochrome P450 isoenzymes, and the fact that few pharmacokinetic studies are conducted in older PWH. ART can also react with other medications or create complications related to multiple organ systems, contributing to increased risk of adverse drug events and polypharmacy. For example, tenofovir disoproxil fumarate (TDF) is nephrotoxic, while older generations of ART were associated with lipodystrophy, hepatotoxicity, or peripheral neuropathy [52].

We recommend a medication review at every visit and a medication reconciliation yearly [53], preferably by HIV pharmacists integrated as part of the care team. The first step involves reviewing the patient’s current medications, making sure to include over-the-counter products, ointments, vitamins, ophthalmic solutions, and herbal medicines, as many patients do not consider these to be medications. A way to ensure that all medications are reviewed is “the brown bag method,” in which patients are asked to bring all bottles of everything they take to the visit to be reviewed.

After the current medication list is determined, providers should review medications in a systematic manner, as outlined below [54]:

- Review current therapy for drug interactions with routine use of up-to-date electronic resources such as Epocrates, Lexi-Comp, Tarascon, or <http://www.hiv-druginteractions.org>.
- Discontinue unnecessary therapy (deprescribing).
- Consider adverse drug events as a potential cause for any new symptom.
- Consider nonpharmacological approaches.
- Substitute with safer alternatives using validated instruments such as the Beers criteria from the American Geriatrics Society [55] or the Screening Tool of Older Person's Prescriptions (STOPP) criteria [45] to screen for inappropriate medications.
- Ensure appropriate dosing of all medications.
- Simplify the dosing regimen.
- Ensure that beneficial/indicated therapy is prescribed.

After the list of appropriate medications is determined, providers should monitor for compliance and resolve any barriers that may prevent patients from taking medications as prescribed. Afterwards, the medication list should be reviewed periodically, at least when the following occurs:

- A change in severity of disease or renal/liver function at which time medication dosing needs to be adjusted
- A new symptom that may be secondary to a medication side effect
- A change in goals of care at which time certain medications may no longer be in line with the patient's wishes

#### **Social/Financial Issues**

Prior studies in PWH have focused on social support, which is linked to mental health outcomes, adherence to medical treatments, morbidity, and mortality. At least 38 social support measures have been developed, but the 3-item Multifactorial Assessment of Perceived Social Support–Short Form (MAPSS-SF) was validated specifically for HIV primary care [56].

Although extensively studied, lack of social support may not translate readily to interventions in clinical practice [56]. Consequently, in addition to a complete social history, providers should ask about the types of help present in the home (family caregivers, nursing, physical therapy, home health aides) to determine what additional services may be needed. Providers should also screen caregivers periodically for burnout [57] and elder mistreatment/abuse [58] when there are worrisome signs such as bruises, burn/bite marks, pressure ulcers, or malnutrition without clinical explanation, although evidence

in asymptomatic older adults is insufficient [59]. A financial history should include determination of health insurance and identification of financial power of attorney in case patients become unable to manage their finances.

#### **Nutrition/Weight Changes**

Food insecurity and malnutrition are common among PWH due to multiple risk factors including low income, limited access to food, and mental health [60]. These conditions are associated with lower ART adherence, decreased viral suppression, and increased mortality [60].

There is no consensus on an appropriate nutritional screening tool in older PWH, as there are few studies in this area [61]. The Rapid Nutrition Screening for HIV disease (RNS-H) is the only validated tool in PWH [62]. It has 7 questions, takes 10 minutes to administer, and includes important outcomes such as food security, anthropometric measures, and nutritional complications such as dysphagia or diarrhea.

#### **Symptom Burden/Pain**

The HIV Symptom Index [63] was developed to assess bothersome HIV-related symptoms [64, 65] and demonstrates strong associations with disease severity and physical and mental health [63]. Other symptom assessment tools used in PWH include the Edmonton Symptom Assessment Scale [66] and the Memorial Symptom Assessment Scale–Short Form (MSAS-SF) [67]. These scales can help providers determine the types of symptoms present, evaluate the overall symptom burden, and track the severity of the symptoms over time.

The first step in pain management involves assessing the characteristics of the pain and conducting a biopsychosocial diagnostic evaluation of the pain, including assessing for associated conditions such as depression/anxiety or substance abuse. The Infectious Disease Society of America recommends using the Brief Pain Inventory–Short Form (BPI-SF) [68] or the PEG (average Pain intensity, interference with Enjoyment of life, and interference with General activity) [69] to understand the functional impact of pain. Using this information, providers can develop treatment plans that improve not only pain but also physical and emotional function.

#### **Advance Care Planning**

Advance care planning is defined as a process of communication between individuals and their health care agents to understand, reflect on, discuss, and plan for future health care decisions for a time when individuals are not able to make their own health care decisions in order to help maximize patient autonomy [70]. Advance care planning is essential among older PWH due to increased risk of neurocognitive impairment and debility from multimorbidity. Additionally, without clear documentation for surrogates, decision-making may be legally deferred to estranged family members who are unaware of the



patient's preferences or HIV status [71]. Although there are no specific guidelines for PWH, the US Department of Health and Human Services recommends advance care planning in all patients with life-limiting illness or anyone 55 years and older regardless of health status [72].

There is no formal guideline on the optimal time to initiate advance care planning in PWH. A conversation that is too early may result in changing patient preferences over time or the discussion becoming too abstract/far off in the future. A conversation that is too late may result in patients being too sick/cognitively impaired to communicate preferences, leading to care that does not match patient preferences. With the lack of validated tools in PWH, providers may use the well-established "Respecting Choices" paradigm [73], which details 3 stages of planning based on the patient's state of health. It should be noted that in cases of late diagnosis with advance disease at the time of ART initiation, short-term prognosis depends on the severity of the acute illness (such as opportunistic infections), while long-term prognosis depends on patient's adherence to ART and their retention in HIV primary care. Consequently, advance care planning in this setting needs to balance the optimism surrounding the effectiveness of ART against the severity of the acute illness and the long-term challenges of retention in HIV primary care.

## CONCLUSIONS

There is an increasing proportion of older PWH. Due to increased risk of geriatric syndromes related to accentuated aging in older PWH, the CGA can be performed in this population to inform comprehensive care plans that may prevent complications, improve outcomes, and reflect patients' preferences. The efficacy of the CGA will depend on implementation, which should be tailored to resource availability, local culture, and clinical workflow.

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## References

- Centers for Disease Control and Prevention. HIV surveillance report, 2018 (updated); vol. 31. 2020. Available at: <http://www.cdc.gov/hiv/library/reports/hiv-surveillance.html>. Accessed 23 June 2020

- Autenrieth CS, Beck EJ, Stelzle D, et al. Global and regional trends of people living with HIV aged 50 and over: estimates and projections for 2000–2020. *PLoS One* 2018; 13:e0207005.
- Sangarlangkarn A, Appelbaum JS. Caring for older adults with the human immunodeficiency virus. *J Am Geriatr Soc* 2016; 64:2322–9.
- Guaraldi G, Milic J, Mussini C. Aging with HIV. *Curr HIV/AIDS Rep* 2019; 16:475–81.
- Guaraldi G, Cossarizza A. Geriatric-HIV medicine: a science in its infancy. *Virulence* 2017; 8:504–7.
- Greene M, Justice AC, Covinsky KE. Assessment of geriatric syndromes and physical function in people living with HIV. *Virulence* 2017; 8:586–98.
- Stuck AE, Siu AL, Wieland GD, et al. Comprehensive geriatric assessment: a meta-analysis of controlled trials. *Lancet* 1993; 342:1032–6.
- Bellera CA, Rainfray M, Mathoulin-Péllissier S, et al. Screening older cancer patients: first evaluation of the G-8 geriatric screening tool. *Ann Oncol* 2012; 23:2166–72.
- Huss A, Stuck AE, Rubenstein LZ, et al. Multidimensional preventive home visit programs for community-dwelling older adults: a systematic review and meta-analysis of randomized controlled trials. *J Gerontol A Biol Sci Med Sci* 2008; 63:298–307.
- Ellis G, Gardner M, Tsiachristas A, et al. Comprehensive geriatric assessment for older adults admitted to hospital. *Cochrane Database Syst Rev* 2017; 9:CD006211.
- Bitas C, Jones S, Singh HK, et al. Adherence to recommendations from comprehensive geriatric assessment of older individuals with HIV. *J Int Assoc Provid AIDS Care* 2019; 18:2325958218821656.
- Reuben DB, Frank JC, Hirsch SH, et al. A randomized clinical trial of outpatient comprehensive geriatric assessment coupled with an intervention to increase adherence to recommendations. *J Am Geriatr Soc* 1999; 47:269–76.
- Erlandson KM, Karris MY. HIV and aging: reconsidering the approach to management of comorbidities. *Infect Dis Clin North Am* 2019; 33:769–86.
- Sangarlangkarn A, Avihingsanon A, Appelbaum JS. Application of geriatric principles and care models in HIV and aging. *Interdiscip Top Gerontol Geriatr* 2017; 42:119–33.
- Stanton DL, Wu AW, Moore RD, et al. Functional status of persons with HIV infection in an ambulatory setting. *J Acquir Immune Defic Syndr* (1988) 1994; 7:1050–6.
- Sangarlangkarn A, Apornpong T, Justice AC, Avihingsanon A. Screening tools for targeted comprehensive geriatric assessment in HIV-infected patients 50 years and older. *Int J STD AIDS* 2019; 30:1009–17.
- Katz S, Ford AB, Moskowitz RW, et al. Studies of illness in the aged. The index of ADL: a standardized measure of biological and psychosocial function. *JAMA* 1963; 185:914–9.
- Erlandson KM, Schrack JA, Jankowski CM, et al. Functional impairment, disability, and frailty in adults aging with HIV-infection. *Curr HIV/AIDS Rep* 2014; 11:279–90.
- Kaplan RM, Anderson JP, Wu AW, et al. The Quality of Well-Being Scale. Applications in AIDS, cystic fibrosis, and arthritis. *Med Care* 1989; 27:S27–43.
- Wu AW, Mathews WC, Brysk LT, et al. Quality of life in a placebo-controlled trial of zidovudine in patients with AIDS and AIDS-related complex. *J Acquir Immune Defic Syndr* (1988) 1990; 3:683–90.
- Erlandson KM, Zhang L, Ng DK, et al. Risk factors for falls, falls with injury, and falls with fracture among older men with or at risk of HIV infection. *J Acquir Immune Defic Syndr* 2019; 81:e117–26.
- Erlandson KM, Allshouse AA, Jankowski CM, et al. Risk factors for falls in HIV-infected persons. *J Acquir Immune Defic Syndr* 2012; 61:484–9.
- Ruiz MA, Reske T, Cefalu C, Estrada J. Falls in HIV-infected patients: a geriatric syndrome in a susceptible population. *J Int Assoc Provid AIDS Care* 2013; 12:266–9.
- Erlandson KM, Plankey MW, Springer G, et al. Fall frequency and associated factors among men and women with or at risk for HIV infection. *HIV Med* 2016; 17:740–8.
- Grinspoon S, Corcoran C, Lee K, et al. Loss of lean body and muscle mass correlates with androgen levels in hypogonadal men with acquired immunodeficiency syndrome and wasting. *J Clin Endocrinol Metab* 1996; 81:4051–8.
- Grinspoon S, Corcoran C, Askari H, et al. Effects of androgen administration in men with the AIDS wasting syndrome. A randomized, double-blind, placebo-controlled trial. *Ann Intern Med* 1998; 129:18–26.
- Podsiadlo D, Richardson S. The Timed "Up & Go": a test of basic functional mobility for frail elderly persons. *J Am Geriatr Soc* 1991; 39:142–8.
- Centers for Disease Control and Prevention. Assessment Timed Up & Go (TUG). Available at: [https://www.cdc.gov/steady/pdf/TUG\\_Test-print.pdf](https://www.cdc.gov/steady/pdf/TUG_Test-print.pdf). Published 2017. Accessed 23 June 2020.
- Willig AL, Overton ET, Saag MS. The silent epidemic—frailty and aging with HIV. *Total Patient Care HIV HCV* 2016; 1:6–17.

30. Conroy S. Defining frailty—the holy grail of geriatric medicine. *J Nutr Heal Aging* **2009**; 13:390–4.
31. Brothers TD, Rockwood K. Frailty: a new vulnerability indicator in people aging with HIV. *Eur Geriatr Med* **2019**; 10:219–26.
32. Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: evidence for a phenotype. *J Gerontol Ser A* **2001**; 56:M146–57.
33. Rockwood K, Andrew M, Mitnitski A. A comparison of two approaches to measuring frailty in elderly people. *J Gerontol A Biol Sci Med Sci* **2007**; 62:738–43.
34. Justice AC, Modur SB, Tate JP, et al; NA-ACCORD and VACS Project Teams. Predictive accuracy of the Veterans Aging Cohort Study index for mortality with HIV infection: a North American cross cohort analysis. *J Acquir Immune Defic Syndr* **2013**; 62:149–63.
35. John M, Hessel N, Hare CB, et al. 1607: Veterans Aging Cohort Study (VACS) index, functional status, and other patient reported outcomes in older HIV-positive (HIV+) adults. *Open Forum Infect Dis* **2014**; 1:S428–9.
36. Justice A, Tate J, Brown S, et al. Can the Veterans Aging Cohort Study Index improve clinical judgment for both HIV infected and uninfected veterans? *J Gen Intern Med* **2013**; 29:1218–23.
37. Justice AC, Tate J, Freiberg M, et al. Reply to Chow *et al*. *Clin Infect Dis* **2012**; 55:751–2.
38. Searle SD, Mitnitski A, Gahbauer EA, et al. A standard procedure for creating a frailty index. *BMC Geriatr* **2008**; 8:24.
39. Chan P, Brew BJ. HIV associated neurocognitive disorders in the modern antiviral treatment era: prevalence, characteristics, biomarkers, and effects of treatment. *Curr HIV/AIDS Rep* **2014**; 11:317–24.
40. Saloner R, Cysique LA. HIV-associated neurocognitive disorders: a global perspective. *J Int Neuropsychol Soc* **2017**; 23:860–9.
41. Rosca EC, Albarqouni L, Simu M. Montreal Cognitive Assessment (MoCA) for HIV-associated neurocognitive disorders. *Neuropsychol Rev* **2019**; 29:313–27.
42. Power C, Selnes OA, Grim JA, McArthur JC. HIV dementia scale: a rapid screening test. *J Acquir Immune Defic Syndr Hum Retrovirology* **1995**; 8:273–8.
43. Sacktor NC, Wong M, Nakasujja N, et al. The International HIV Dementia Scale: a new rapid screening test for HIV dementia. *AIDS* **2005**; 19:1367–74.
44. Valcour V, Paul R, Chiao S, et al. Screening for cognitive impairment in human immunodeficiency virus. *Clin Infect Dis* **2011**; 53:836–42.
45. Gallagher P, Ryan C, Byrne S, et al. STOPP (Screening Tool of Older Person's Prescriptions) and START (Screening Tool to Alert doctors to Right Treatment). Consensus validation. *Int J Clin Pharmacol Ther* **2008**; 46:72–83.
46. Chibanda D, Verhey R, Gibson LJ, et al. Validation of screening tools for depression and anxiety disorders in a primary care population with high HIV prevalence in Zimbabwe. *J Affect Disord* **2016**; 198:50–5.
47. European AIDS Clinical Society. Guidelines version 10.0. Available at: <https://www.eacsociety.org/guidelines/eacs-guidelines/eacs-guidelines.html>. Accessed 23 June 2020.
48. Rodkjaer L, Gabel C, Laursen T, et al. Simple and practical screening approach to identify HIV-infected individuals with depression or at risk of developing depression. *HIV Med* **2016**; 17:749–57.
49. Mueses-Marín H, Montaña D, Galindo J, et al. Psychometric properties and validity of the Center for Epidemiological Studies Depression Scale (CES-D) in a population attending an HIV clinic in Cali, Colombia. *Biomedica* **2019**; 39:33–45.
50. Verhey R, Chibanda D, Gibson L, et al. Validation of the posttraumatic stress disorder checklist–5 (PCL-5) in a primary care population with high HIV prevalence in Zimbabwe. *BMC Psychiatry* **2018**; 18:109.
51. Hughes CA, Tseng A, Cooper R. Managing drug interactions in HIV-infected adults with comorbid illness. *CMAJ* **2015**; 187:36–43.
52. Chang HM, Tsai HC, Lee SS, et al. Noncirrhotic portal hypertension associated with didanosine: a case report and literature review. *Jpn J Infect Dis* **2012**; 65:61–5.
53. American Academy of HIV Medicine. Recommended treatment strategies for clinicians managing older patients with HIV. Available at: <https://aahivm-education.org/hiv-age/chapter-13/ddi-polypharmacy>. Accessed 29 July 2020.
54. Rochon PA, Gurwitz JH. Drug therapy. *Lancet* **1995**; 346:32–6.
55. American Geriatrics Society 2012 Beers Criteria Update Expert Panel. American Geriatrics Society updated Beers Criteria for potentially inappropriate medication use in older adults. *J Am Geriatr Soc* **2012**; 60:616–31.
56. Fredericksen RJ, Fitzsimmons E, Gibbons LE, et al. Development and content validation of the Multifactorial Assessment of Perceived Social Support (MAPSS), a brief, patient-reported measure of social support for use in HIV care. *AIDS Care* **2019**; 31:1–9.
57. Adelman RD, Tmanova LL, Delgado D, et al. Caregiver burden: a clinical review. *JAMA* **2014**; 311:1052–60.
58. Administration for Community Living. National Center on Elder Abuse (NCEA). Available at: <https://ncea.acl.gov/>. Accessed 29 July 2020.
59. US Preventive Services Task Force. Screening for intimate partner violence, elder abuse, and abuse of vulnerable adults: US Preventive Services Task Force final recommendation statement. *JAMA* **2018**; 320:1678–87.
60. Hessel NA, Zepf R, Zobell E, et al. Food insecurity and aging outcomes in older adults living with HIV. *AIDS Behav* **2017**; 21:3506–14.
61. Ruiz M, Kamerman LA. Nutritional screening tools for HIV-infected patients: implications for elderly patients. *J Int Assoc Physicians AIDS Care (Chic)* **2010**; 9:362–7.
62. Wright L, Epps JB. Development and validation of a HIV disease-specific nutrition screening tool. *Top Clin Nutr* **2020**; 35:264–9.
63. Justice AC, Holmes W, Gifford AL, et al; Adult AIDS Clinical Trials Unit Outcomes Committee. Development and validation of a self-completed HIV symptom index. *J Clin Epidemiol* **2001**; 54:S77–90.
64. Kilbourne AM, Justice AC, Rollman BL, et al. Clinical importance of HIV and depressive symptoms among veterans with HIV infection. *J Gen Intern Med* **2002**; 17:512–20.
65. Whalen CC, Antani M, Carey J, Landefeld CS. An index of symptoms for infection with human immunodeficiency virus: reliability and validity. *J Clin Epidemiol* **1994**; 47:537–46.
66. Rao D, Nainin N, Williams L, et al. Art therapy for relief of symptoms associated with HIV/AIDS. *AIDS Care* **2009**; 21:64–9.
67. Wakeham K, Harding R, Levin J, et al. The impact of antiretroviral therapy on symptom burden among HIV outpatients with low CD4 count in rural Uganda: nested longitudinal cohort study. *BMC Palliat Care* **2017**; 17:1–9.
68. Goodin BR, Owens MA, White DM, et al. Intersectional health-related stigma in persons living with HIV and chronic pain: implications for depressive symptoms. *AIDS Care* **2018**; 30:66–73.
69. Merlin JS, Westfall AO, Long D, et al. A randomized pilot trial of a novel behavioral intervention for chronic pain tailored to individuals with HIV. *AIDS Behav* **2018**; 22:2733–42.
70. International Society of Advance Care Planning & End of Life Care. The definition of advance care planning. Available at: <https://www.acp-i.org/mission/>. Accessed 20 July 2020.
71. Sangarlangkarn A, Merlin JS, Tucker RO, Kelley AS. Advance care planning and HIV infection in the era of antiretroviral therapy: a review. *Top Antivir Med* **2016**; 23:174–80.
72. Agency for Health Research and Quality: National Guideline Clearinghouse. Advanced care planning guideline. Available at: <http://www.guideline.gov/content.aspx?id=47803>. Accessed 18 October 2015.
73. Pecanac KE, Repenshek MF, Tennenbaum D, Hammes BJ. Respecting Choices® and advance directives in a diverse community. *J Palliat Med* **2014**; 17:282–7.
74. National Center for PTSD. PTSD Checklist for DSM-5 (PCL-5)–PTSD. Available at: <https://www.ptsd.va.gov/professional/assessment/adult-sr/ptsd-checklist.asp>. Accessed 23 September 2020.
75. National Center on Elder Abuse. Elder abuse screening tools for healthcare professionals. Available at: <http://eldermistreatment.usc.edu/wp-content/uploads/2016/10/Elder-Abuse-Screening-Tools-for-Healthcare-Professionals.pdf>. Accessed 22 September 2020.