Clinical and Economic Benefits of Preventing Physical Frailty and Falls Among PWH in the US

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This work was supported by the National Institute of Nursing Research (R01AR080638) and the National Institute of Arthritis and Musculoskeletal and Skin Diseases (P30AR072577)

BACKGROUND

- People with HIV (PWH) experience higher rates of physical frailty and falls than age-matched people without HIV.

OBJECTIVE

- To estimate the life-years lost and costs attributable to pre-frailty, frailty, and falls among PWH with viral suppression in the US.

METHODS

- We used a microsimulation model to project lifetime outcomes related to pre-frailty, frailty, and falls among PWH in the US.
- We simulated hypothetical individuals representing PWH with viral suppression in the US aged 40 and older in 2022.
- We compared a status quo simulation with three alternative simulations, which respectively removed the presence of (1) pre-frailty, (2) frailty, and (3) falls from the simulation.
  - We calculated life-years lost and attributable costs as the difference in outcomes compared to the status quo.
  - Results are reported as the mean and 95% uncertainty interval of 1000 simulations.
- We conducted sensitivity analyses with parameters derived from published studies not used in base case estimates.
- Cohort characteristics and key parameters are shown in Table 1.

Table 1a. Cohort Characteristics

Characteristic	Value	Derived From
Population Size	529,733	CDC, *HIV Surveillance Report Vol. 35*, 2022
Mean Age (y)	56	
% Female	25%	
% Pre-Frail / % Frail	42% / 7%	ACTG HAILO Study

Table 1b. Key Model Input Parameters

Mortality Increase	Hazard Ratio (HR) (Range)	Derived From
Frailty	3.19 (1.02, 9.98)	Verheij, *JID,* 2020
Hip Fracture	6.28 (4.82, 8.19)	Tosteson, *Osteoporos Int,* 2007
Annual Costs	**Cost (Range)**	**Derived From**
Pre-Frailty	$800 ($500, $1,300)	Ensrud, *Ann Intern Med*, 2023
Frailty	$7,100 ($4,900, $9,800)	
Fall-Related Injuries		
Non-Fracture Injury	$3,200 ($2,100, $4,600)	Hansen, *Milliman Research Report*, 2021; Peterson, *Inj Prev,* 2021; Haddad, *J Aging Health*, 2020
Hip Fracture	$50,500 ($32,800, $71,800)	
Spine Fracture	$20,500 ($13,200, $29,200)	
Wrist/Arm Fracture	$12,600 ($8,200, $18,000)	
Other Fracture	$14,400 ($9,400, $20,500)	

Ranges shown in the table represent the 2.5th and 97.5th percentiles of the distributions used for each parameter. Costs are in 2022 USD.

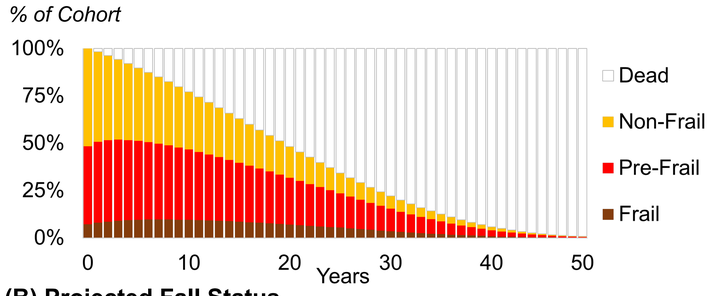
Among PWH with viral suppression in the United States, pre-frailty, frailty, and falls would lead to projected life-years lost (attributable costs) of 34,300 ($5.1 billion), 1,293,600 ($8.2 billion), and 179,700 ($3.4 billion).

RESULTS

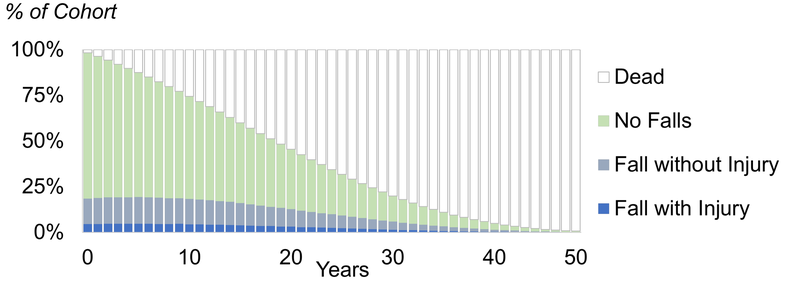
- We projected that over their remaining lifetime, PWH with viral suppression would experience an average of:
  - 9.7 (9.0, 10.5) years with pre-frailty and 2.3 (1.8, 2.9) years with frailty.
  - 10.0 (8.2, 12.0) falls and 1.1 (0.9, 1.4) fall-related injuries.
- Figure 1 shows the percentage of the cohort in each frailty or fall health state over the duration of the status quo simulation.

Figure 1. Projected Frailty and Fall Status.

(A) Projected Frailty Status



(B) Projected Fall Status



RESULTS (CONTINUED)

Table 2. Projected Life Expectancy and Lifetime Per-Person Frailty and Fall-Related Costs

	Life Expectancy	Lifetime Frailty and Fall-Related Costs
Status Quo	20.34 (19.73, 20.83)	$31,400 ($24,200, $40,700)
No Pre-Frailty	20.40 (19.80, 20.89)	$21,800 ($15,700, $30,400)
No Frailty	22.78 (20.73, 26.48)	$16,000 ($11,300, $22,300)
No Falls	20.67 (20.11, 21.16)	$24,900 ($17,900, $33,900)

In the simulations without pre-frailty or frailty, all individuals who would have had pre-frailty or frailty were assumed to be non-frail. 95% uncertainty intervals are in parentheses.

Table 3. Life-Years Lost and Lifetime Costs Attributable to Pre-Frailty, Frailty, and Falls

	Life-Years Lost		Lifetime Costs	
Attributable to	**Per Person**	**Population Total**	**Per Person**	**Population Total**
Pre-Frailty	0.06 (0.03, 0.11)	34,300 (14,700, 59,200)	$9,600 ($6,100, $13,800)	$5.1B ($3.2B, $7.3B)
Frailty	2.44 (0.14, 6.07)	1,293,600 (75,900, 3,216,200)	$15,400 ($8,200, $24,900)	$8.2B ($4.3B, $13.2B)
Falls	0.34 (0.21, 0.50)	179,700 (112,400, 266,400)	$6,500 ($4,300, $9,200)	$3.4B ($2.3B, $4.9B)

Population totals are for the estimated 529,733 PWH with viral suppression aged 40+ in the US in 2022. 95% uncertainty intervals are in parentheses. Abbreviations: B, billion.

Sensitivity Analyses

- With an alternative estimate for the association of pre-frailty and mortality (HR 1.96 vs 1 in the base case), pre-frailty would result in 2.68 life-years lost per person.
- With an alternative estimate for the association of frailty and mortality (HR of 1.98 vs 3.19 in the base case), frailty would result in 1.06 life-years lost per person.
- With an alternative estimate for the annual cost of pre-frailty ($1,500 vs $800 in the base case), pre-frailty would result in $14,400 in attributable costs per person.

LIMITATIONS

- Studies used to parameterize the model may not be representative of all PWH.
- Cost input parameters were from studies of the general population.

CONCLUSIONS

- The life-years lost and lifetime costs attributable to pre-frailty, frailty, and falls among PWH with viral suppression in the US could be substantial.
- Effective interventions to prevent frailty and falls may improve survival, and savings could in part offset other health-related spending.