OneStep

WHITE PAPER · FALL RISK

Clinical Validation of the OneStep Fall Risk Assessment in Senior Living

Time to first fall by risk tier in 644 residents across multiple organizations and care settings

ONESTEP RESEARCH | SEPTEMBER 2026 | ONESTEP.CO/RESOURCES

OneStep

COVER LETTER

RE Clinical Validation of the OneStep Fall Risk Assessment in Senior Living: Time to First Fall by Risk Tier in 644 Residents Across Multiple Organizations

Everyone is high-risk. Who falls first?

In senior living, most residents already screen as high-risk, which tells a care team almost nothing about where to put the next therapy slot or one-to-one hour. This study asks the question leadership actually has: who is at the highest risk of falling in the next few weeks?

644	1 in 4	1 in 8	0
Residents, multiple organizations	Very High tier fell within 28 days	High tier fell within 28 days	Falls in the Low tier

Falls recorded in the EHR were followed for 28 days after each resident's baseline assessment: four weeks, the time a senior living team has to act. The four tiers separated cleanly and in order: 26%, 12%, 6% and 0%. The Very High tier pulled away from day one, with 36 first falls by day 10. A resident scored Very High fell more than twice as often as one scored High, which is the distinction a broadly frail population needs and traditional screens do not give.

What this means for an operator

Admission triage

An FRA within 48 hours of intake flags the residents who need clinical review before an incident, not after. The continuous 0–100 score ranks residents within a tier as well as between tiers.

Defensible documentation

Every resident is scored the same way, by any staff member, with a timestamped objective record. That is what CMS F-Tag 689 asks a facility to show during a survey.

Resources where they count

Therapy, restorative nursing and one-to-one assistance are capped. Ordering residents by validated risk puts them where the next fall is most likely.

THE TWO STUDIES TOGETHER

Our 2025 validation showed the tiers stratify risk inside two facilities with a tenfold difference in baseline fall rates. This study, across senior living at large, **puts a number on each tier.** One shows it works everywhere; the other shows what it means.

To see how the FRA would rank fall risk among your own residents, contact us at hello@onestep.co or through our contact form.

© 2026 OneStep

The full white paper follows.

WHITE PAPER · SEPTEMBER 2026

Clinical Validation of the OneStep Fall Risk Assessment in Senior Living

Time to first fall by risk tier in 644 residents across multiple organizations and care settings

OneStep Research Team
OneStep · Correspondence: info@onestep.co

ABSTRACT

Background. Falls in senior living and post-acute care drive avoidable hospitalizations, serious injury, regulatory citations and cost. Most admitted residents already meet traditional thresholds for "high risk", so conventional screening offers little guidance for allocating limited clinical resources. The practical question is not who might fall, but who is at the highest immediate risk. An earlier two-facility validation showed that OneStep's Fall Risk Assessment (FRA) stratifies relative fall risk within facilities whose baseline fall rates differ tenfold.

Objective. To validate the FRA's four risk tiers against prospectively recorded falls across a broad senior living population, and to estimate the absolute 28-day (four-week) risk of a first fall in each tier.

Methods. Retrospective time-to-event analysis of 644 residents of senior-living and post-acute communities across multiple partner organizations and locations, each with a baseline FRA inside an active EHR fall-reporting window. The FRA combines smartphone-recorded gait with Timed Up and Go, Sit-to-Stand, self-reported fear of falling and fall history into a 0–100 score mapped to Low, Medium, High and Very High tiers. Time to first fall over 28 days, a four-week window pre-specified to match the horizon in which senior living teams act, was analysed with Kaplan–Meier curves, the log-rank test and the concordance index.

Results. The cohort was elderly (mean age 79.6, SD 10.3; 63% female) and clinically complex: 78% had difficulty walking and 77% generalized muscle weakness. Twenty-eight-day first-fall risk was monotonic across tiers: Very High 26%, High 12%, Medium 6%, Low 0% (0 of 14). The Very High curve separated from the first day (36 first falls by day 10). C-index 0.656; log-rank $p = 8.9 \times 10^{-6}$.

Conclusions. Across a broad senior living population the FRA separates a uniformly frail cohort into ordered tiers with clinically distinct short-term fall risk, isolating a Very High group in which about one in four residents falls within four weeks. Combined with the 2025 two-facility study, the evidence shows that the tiers hold across very different environments and what each tier means in absolute terms.

KEY POINTS

Question	Across senior living at large, does the FRA's risk tier predict how soon a resident will fall, and what is the absolute four-week risk in each tier?
Findings	In 644 residents across multiple organizations, 28-day first-fall risk rose in order from Low (0%) to Medium (6%), High (12%) and Very High (26%), with Very High separating from day one; log-rank $p = 8.9 \times 10^{-6}$.
Meaning	The FRA turns a broadly high-risk population into an ordered list, so limited fall-prevention resources can go to the residents most likely to fall in the coming weeks.

KEYWORDS fall risk · senior living · skilled nursing · time-to-event · Kaplan–Meier · risk stratification · triage · smartphone gait analysis

1 Introduction

Falls in skilled nursing facilities (SNFs) and senior living communities are a primary driver of avoidable hospitalizations, serious injuries, regulatory citations and rising operating costs.[1] A central reality of these settings is that the majority of residents are already broadly defined as high-risk: on traditional screens a large share meet the threshold, which offers little practical guidance on how to allocate limited care.[2,3]

For clinical leadership this is a triage problem. Physical therapy, restorative nursing and one-to-one assistance are capped resources that cannot be deployed to every resident at once. Leaders do not simply need to know who might fall; they need to know who is at the highest risk of

© 2026 OneStep · www.onestep.co

falling in the coming weeks, so that interventions can be prioritized where they matter most.

OneStep's Fall Risk Assessment (FRA) is designed for that question. Administered with a standard smartphone in the resident's pocket during a short walk, it synthesizes objective spatiotemporal gait parameters (speed, turning, asymmetry and others) with physical performance tests, self-reported fear of falling and fall history into a continuous 0–100 score mapped to four tiers: Low, Medium, High and Very High.[4]

An earlier validation in two SNFs with a tenfold difference in baseline fall rates showed that the tiers stratify relative risk within each facility, where single metrics such as gait speed or Timed Up and Go time did not hold up in the higher-risk environment.[5] Because that study was confined to two organizations, it could show that the tiers order residents correctly but not what a tier means in absolute terms for senior living generally. This study extends the validation to a broad population across multiple organizations and locations, and asks how quickly residents in each tier go on to fall.

2 Methods

2.1 Cohort and setting

Residents were drawn from senior-living and post-acute partner organizations across several locations, where fall incidents are prospectively logged as structured EHR data. The cohort comprises 644 residents who completed a baseline FRA within an active fall-reporting window. Each assessment centred on a short smartphone-recorded walk, completed by nearly all residents, and in many cases also included a Timed Up and Go or Sit-to-Stand test and a fear-of-falling questionnaire, together with the resident's fall history. Each additional measure increases the confidence and precision of the score, so completing the full battery at intake is recommended wherever feasible.

2.2 Risk score and tiers

The FRA algorithm incorporates gait parameters, performance on the TUG and Sit-to-Stand tests, self-reported fear of falling and documented fall history, weighting recent and clinically negative data more heavily, and attaches a confidence measure reflecting the volume, relevance and recency of the data. Scores range from 0 to 100 and map to the four tiers. The baseline (first) assessment in the reporting window defined each resident's tier for this analysis.

2.3 Outcome and follow-up window

The outcome was time from baseline assessment to the resident's first fall. First falls, rather than all falls, were analysed so that repeat fallers do not distort the evaluation and the score is judged on its ability to anticipate an initial breakdown in mobility. Follow-up was 28 days, pre-specified before analysis: four weeks is the horizon in which a senior living team can act on a risk signal, and it keeps the question concrete, who will fall before the next review. Residents without a fall were censored at discharge or at the 28-day cutoff.

2.4 Statistical analysis

Cumulative incidence of first fall by tier was estimated with Kaplan–Meier curves and compared with the log-rank test. Discrimination of the continuous score over the horizon was summarized with the concordance index (C-index). Tier-level 28-day risks are reported as Kaplan–Meier cumulative incidence at day 28.

3 Results

3.1 Cohort

The population was elderly (mean age 79.6 years, SD 10.3; median 80) and predominantly female (63%) (Figure 1). It was also clinically complex: over 89% carried at least one active diagnosis. Mobility and functional deficits were near-universal, with difficulty walking recorded in 78% and generalized muscle weakness in 77%, alongside a heavy burden of cardiovascular, metabolic and behavioural-health comorbidity (Figure 2). With more than three-quarters of residents showing weakness and difficulty walking, standard mobility screening alone cannot separate those who are stable from those on the verge of a fall; this is the gap the FRA is designed to close.

© 2026 OneStep · www.onestep.co

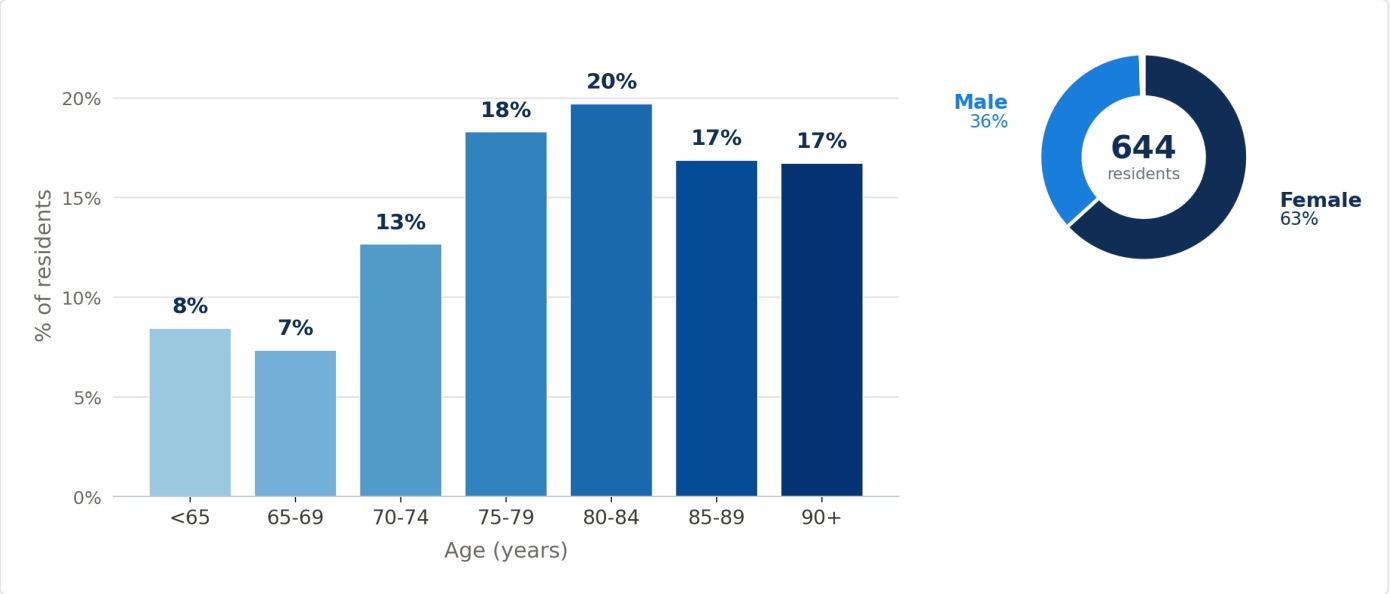


Figure 1. Cohort demographics. Age distribution (left) and sex (right) of the 644 residents.

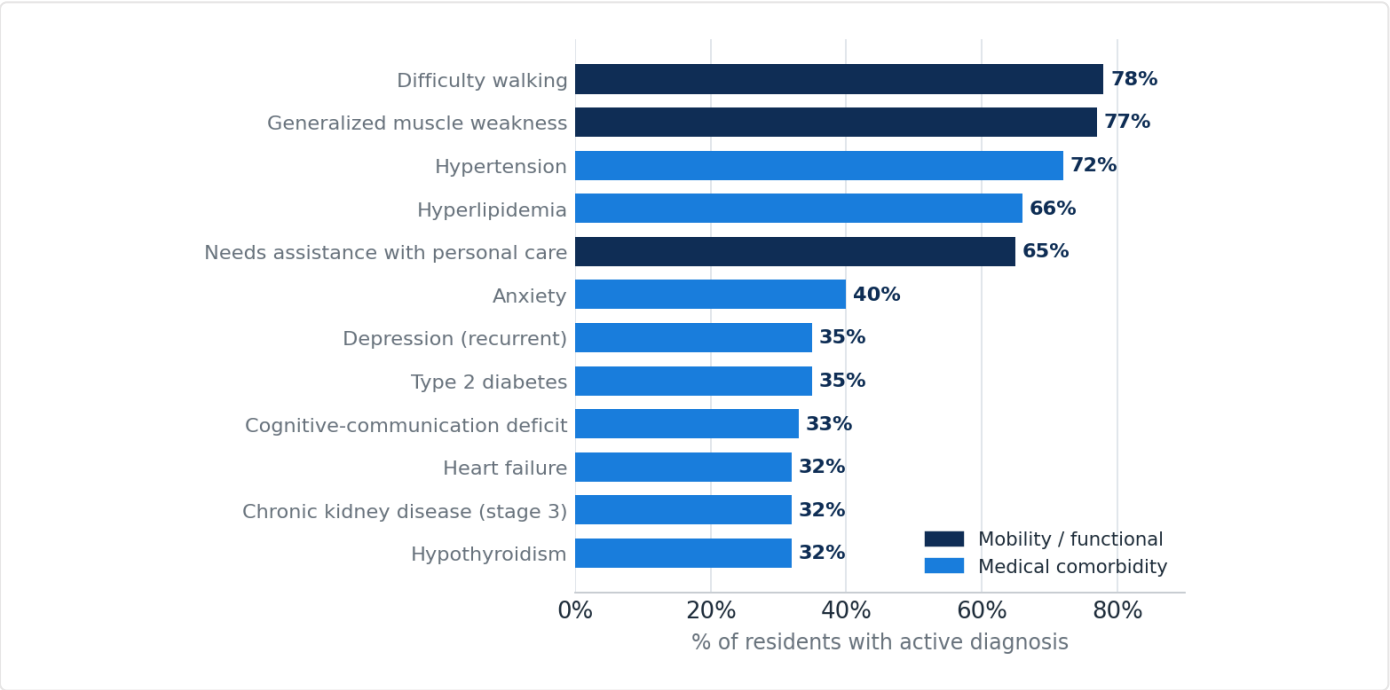


Figure 2. Most common active diagnoses among the 644 residents (% with the condition on record). Mobility and functional deficits in navy, medical comorbidity in blue.

3.2 Tier distribution

The cohort was concentrated in the upper tiers: 241 residents (37%) were Very High, 329 (51%) High, 60 (9%) Medium and 14 (2%) Low. This is itself informative: in a population where nearly nine in ten residents score High or above, the clinically useful distinction is between the two upper tiers, and the analysis below shows that it is a large one.

3.3 Time to first fall

The Kaplan–Meier curves separated by tier across the whole horizon (Figure 3), with a C-index of 0.656 and a highly significant log-rank test ($p = 8.9 \times 10^{-6}$). The numbers followed, censored and fallen in each tier at each time point are given in the appendix (Table A1); by day 25, 80 residents had experienced a first fall (103 falls in total).

- **Immediate hazard in the Very High tier.** The Very High curve separates from the others almost immediately, rising from the first day after assessment. By day 10, 36 first falls had already occurred in this group: Very High residents warrant attention on admission.
- **Steady separation in the High tier.** The High tier accumulates events at a steady, moderate pace and stays clearly below the Very High curve throughout.
- **Low, late-emerging risk in the Medium tier.** Medium tracked well below High and Very High, with its first

© 2026 OneStep · www.onestep.co

falls appearing only in the third week.

- **No events in the Low tier.** Residents classified Low sustained no falls across the window.

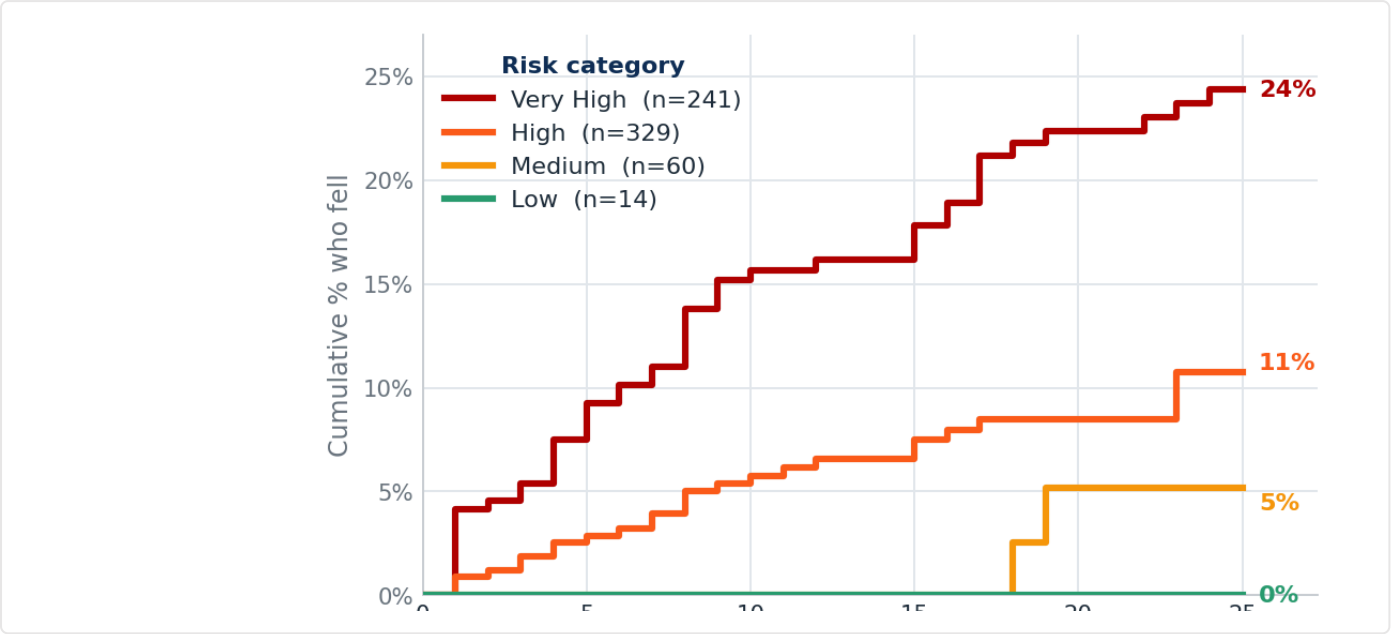


Figure 3. Cumulative share of residents who had fallen after assessment, by FRA tier (Kaplan–Meier). Curves shown through day 25; the 28-day endpoint values are given in Table 1; numbers at risk are in the appendix.

3.4 Four-week fall risk by tier

Table 1 and Figure 4 summarize the validated 28-day risk of a first fall in each tier. A resident classified Very High carries about a 1-in-4 probability of falling within four weeks, roughly double the High tier (about 1 in 8) and about four times the Medium tier (about 1 in 17), and far above the Low tier, where no residents fell.

FRA tier	Residents n (%)	28-day first-fall risk	
Very High	241 (37%)	26%	about 1 in 4
High	329 (51%)	12%	about 1 in 8
Medium	60 (9%)	6%	about 1 in 17
Low	14 (2%)	0%	0 in 14

Table 1. 28-day first-fall risk by FRA tier (Kaplan–Meier cumulative incidence at day 28).

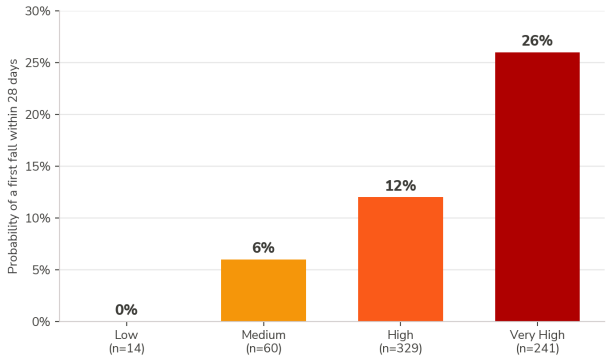


Figure 4. Validated 28-day probability of a first fall, by FRA tier (Kaplan–Meier cumulative incidence at day 28).

4 Discussion

Across a broad senior living population, the FRA separated a uniformly frail cohort into four tiers whose short-term fall risk rises in order, and isolated a Very High group in which about one in four residents fell within four weeks. The Very High tier's risk is more than double that of High, which is the distinction that matters in a population where almost everyone would be flagged by a conventional screen.

Read with the 2025 two-facility study,[5] the two validations answer complementary questions. That study showed the tiers stratify relative risk within environments whose baseline fall rates differ tenfold, and that absolute risk per tier depends on the facility: Very High residents fell within 30 days in 4.8% of cases in one SNF and 28.8% in the

© 2026 OneStep · www.onestep.co

other. This study, pooled across senior living at large, estimates what each tier means on average. A facility should expect its own absolute rates to sit above or below the pooled figures according to its environment, staffing and reporting practices, while the ordering of the tiers holds.

The C-index of 0.656 indicates moderate discrimination of the continuous score over the four-week horizon. The practical value of the FRA in this setting lies in the calibration of its tiers, which is what care teams act on, and in the early separation of the Very High curve, which indicates that the signal is available in time to intervene.

4.1 Prioritization beyond the tiers

The tiers are not the only ordering available. Because the FRA produces a continuous 0–100 score, residents can be ranked finely within a tier, distinguishing a resident at the top of the High band from one at its lower edge. Teams can therefore sequence limited resources even among residents who share a category, using the score itself as the ordering signal. The specific interventions attached to each tier are best defined by each facility, since fall-prevention resources and protocols differ; the FRA's role is to order residents so that whatever measures a facility uses reach the highest-risk residents first.

4.2 Limitations

The two lowest tiers are small and account for only a small fraction of the cohort, so their estimates carry wide statistical uncertainty; the Low tier's result should be read as "very low risk" rather than a precise rate. The robust signal is the ordered progression from Low to Very High, carried by the two large tiers, which are clearly distinct. The analysis is retrospective and unadjusted, and as in the earlier study the facilities were using the FRA in care, so residents flagged at higher risk may have received more attention; this would attenuate the observed differences, meaning the true separation between tiers is likely larger than reported. Hazard ratios with confidence intervals and age- and sex-adjusted estimates are the natural next step and are planned.

5 Conclusion

By replacing subjective screening with objective, time-to-event risk prioritization, senior living and post-acute operators can direct limited fall-prevention resources to the residents most likely to fall in the coming weeks. Because every resident is scored the same way, the FRA also surfaces residents missed by clinical screening and makes risk comparable across clinicians and buildings. Together with the 2025 validation, the evidence now shows both that the tiers hold across very different environments and what each tier means.

References

1. Shao L, Shi Y, Xie XY, et al. Incidence and risk factors of falls among older people in nursing homes: systematic review and meta-analysis. *J Am Med Dir Assoc.* 2023;24(11):1708–1717.
2. Nunan S, Brown Wilson C, Henwood T, Parker D. Fall risk assessment tools for use among older adults in long-term care settings: a systematic review. *Australas J Ageing.* 2018;37(1):23–33.
3. Miura T, Kanoya Y. Fall risk assessment and prevention strategies in nursing homes: a narrative review. *Healthcare (Basel).* 2025;13(4):357.
4. Contreras C, Stanley EC, Deschamps-Prescott C, et al. Evaluation of smartphone technology on spatiotemporal gait in older and diseased adult populations. *Sensors (Basel).* 2024;24(17):5839.
5. OneStep Research Team. Real-world validation of a smartphone-based, gait-centric fall risk assessment in skilled nursing facilities. OneStep White Paper; April 2025. onestep.co/resources

Suggested citation. OneStep Research Team. Clinical validation of the OneStep Fall Risk Assessment in senior living: four-week risk of a first fall by tier in 644 residents. OneStep White Paper; September 2026. Available at onestep.co/resources.

© 2026 OneStep · www.onestep.co

Appendix

Tier		Day 0	Day 5	Day 10	Day 15	Day 20	Day 25
Very High (n = 241)	Still followed	241	210	176	153	129	111
	Left the community	0	13	34	52	69	190
	Falls so far	0	22	36	40	48	51
High (n = 329)	Still followed	329	287	246	201	171	154
	Left the community	0	38	76	117	136	302
	Falls so far	0	9	17	21	23	27
Medium (n = 60)	Still followed	60	54	49	42	36	34
	Left the community	0	6	13	21	22	58
	Falls so far	0	0	0	0	2	2
Low (n = 14)	Still followed	14	13	12	12	12	12
	Left the community	0	1	2	2	2	14
	Falls so far	0	0	0	0	0	0

Table A1. Residents followed, censored and fallen by tier over the first 25 days. "Left the community" counts residents discharged or censored at the cutoff; the day-25 figure includes all remaining residents reaching the end of the 25-day curve.

© 2026 OneStep · www.onestep.co