

# Impact of location and VF damage on step-adjusted fall rates in glaucoma

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**Purpose:** Previous studies examining falls in the visually impaired have not distinguished how visual impairment affects the risk of falls in different locations. Here, we integrate falls calendar, accelerometer, and GPS data to define impact of visual field (VF) damage on step-normalized fall rates at and away from home in a cohort of glaucoma patients

**Methods:** 245 patients with suspect or manifest glaucoma prospectively submitted falls calendars for at least 12 months to identify falls, and phone-administered follow-up questionnaires identified whether falls occurred at or away from home. Steps at and away from home were estimated by integrating accelerometer and GPS data collected over a one-week trial on a minute-by-minute level. Right and left eye 24-2 VF data were used to calculate integrated visual field (IVF) sensitivity. Negative binomial regression models evaluated fall rates at and away from home after adjusting for relevant covariates.

**Results:** Mean patient age was 70.3 (SD=7.7) years, while average IVF sensitivity and better-eye mean deviation were 27.2 (4.5) and -4.5 (-6.6) dB, respectively. Patients took an average of 1,923 steps/day at home, and 1,573 steps/day away from home ( $p=0.009$ ); the difference between at-home and away-from-home steps did not vary with IVF sensitivity ( $\beta=5.03$ , 95%CI=-308.09 to 318.14,  $p=0.98$ ). A total of 357 falls occurred in the cohort over the study period, including 110 falls at home and 247 falls away from home. Over the first year of follow-up, the cumulative probabilities of falls at and away from home were 20% and 35%, respectively. Worse IVF sensitivity was associated with a significantly higher rate of away-from-home falls/away-from-home steps (51% higher rate per 5 dB decrement in IVF sensitivity, 95% CI=18% to 94%,  $p=0.001$ ), but was not associated with a higher rate of at-home falls/at-home steps (28% higher per 5 dB, 95% CI=-10% to 83%,  $p=0.16$ ). Steps taken away from home were substantially more likely to be associated with a fall as compared to steps taken at home (rate ratio=3.84, 95% CI=2.75 to 5.36,  $p<0.001$ ).

**Conclusions:** While most walking occurs within the home, walking outside the home results in a substantially greater risk of falling, and glaucoma-related VF damage poses particular dangers when walking outside the home. Research is needed to develop strategies to prevent falls outside the home, particularly in persons with VF damage from glaucoma.