

# Researchers find diminished balance in those with poor vision

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UC Davis Health System Eye Center research has found that visually impaired individuals and those with uncorrected refractive error—those who could benefit from glasses to achieve normal vision but don't wear glasses—have a significantly greater risk of diminished balance with their eyes closed on a compliant, foam surface than individuals with normal vision.

The research, published in the June 6 issue of *JAMA Ophthalmology*, suggests that vision may play an important role in calibrating the vestibular system, which includes the bones and soft tissue of the inner ear, to help optimize physical balance. The work provides direction for more targeted studies on how poor vision impacts vestibular balance, and how to better develop fall prevention strategies for those with poor vision.

"We know that vision and balance are highly integrated in the brain, but we don't fully understand the relative contributions of the visual, proprioceptive, and vestibular systems in maintaining balance and preventing falls, especially among the visually impaired," said Jeffrey R. Willis, an ophthalmology resident at UC Davis Health System Eye Center and lead author of the study.

"Our research is the first large scale population study to compare objective measures of physical balance across individuals with normal vision, uncorrected refractive error, and the visually impaired, and the first to link poor vision with diminished vestibular balance," he said.

"These results have important implications for improving balance and mobility in the U.S. population and preventing falls."

According to the [Centers for Disease Control and Prevention](#), falls among older adults alone cost the U.S. health care system over \$30 billion in 2010. One in three [adults age](#) 65 and older falls each year, and of those who fall, 20 percent to 30 percent suffer moderate to severe injuries that make it hard for them to get around or live independently, and increase their risk of early death.

## Study methods

To objectively examine the relationship between poor vision and balance, Willis worked with the Dana Center for Preventative Ophthalmology at Johns Hopkins University and senior author Pradeep Ramulu to conduct a cross-sectional study, evaluating data from 4,590 adults aged 40 or older, who participated in the 2001-2004 National Health and Nutrition Examination Survey (NHANES). The national survey, which aimed to assess balance in a nationally representative population, included tests of participants' ability to stand with feet together unassisted under increasing challenging conditions: standing on a firm surface with eyes open and then closed, and standing on a compliant, foam surface with eyes opened and then closed.

Foam-surface testing with eyes opened measured the effects of the visual and vestibular systems to work together to maintain postural balance, while the same test with eyes closed primarily assessed the impact of the [vestibular system](#) alone, as visual and proprioceptive inputs were minimized. Balance was graded as pass or fail, with the time-to-balance failure recorded for each of the tests. Participants failed the test when they began to fall, moved their arms or feet for stability, or needed help to maintain balance for 15 seconds while on the firm surface or for 30 seconds while on the foam surface. The researchers also gathered

data on each participant's self-reported difficulty with falling during the last year.

The researchers found that participants with visual impairment and those with uncorrected [refractive error](#) had significantly higher rates of failing the eyes-closed foam-surface balance test—a proxy for vestibular balance – when compared to participants with normal vision. There was no significant difference in the rate of balance failure during balance tests with eyes opened or eyes closed on a firm surface. In addition, subjects with visual impairment, relative to those with normal vision, were more likely to self-report falling difficulties.

"Future research should focus on better understanding how poor vision may affect the vestibular-ocular reflex, and thus vestibular balance," said Willis. "Studies should also address how [poor vision](#) may lead to lower levels of physical and balance activities, as well as on how vision-related fall prevention strategies can be integrated with other fall prevention strategies to more effectively limit falls in our society."

Provided by UC Davis

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