

## Orthostatic hypotension in elderly nursing home residents who fall: Are they dizzy?

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Citation for this version and the definitive version are shown below.

**Citation to Publisher** Gray-Miceli, Deanna, Ratcliffe, Sarah J., Liu, Sizhu, Wantland, Dean & Johnson, Jerry. (2012).  
**Version:** Orthostatic hypotension in elderly nursing home residents who fall: Are they dizzy?. *Clinical Nursing Research* 21(1), 64-78. <https://dx.doi.org/10.1177/1054773811434045>.

**Citation to this Version:** Gray-Miceli, Deanna, Ratcliffe, Sarah J., Liu, Sizhu, Wantland, Dean & Johnson, Jerry. (2012). Orthostatic hypotension in elderly nursing home residents who fall: Are they dizzy?. *Clinical Nursing Research* 21(1), 64-78. Retrieved from [doi:10.7282/T3959KFW](https://doi.org/10.7282/T3959KFW).

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## Running Head: Orthostatic Hypotension and Dizziness

Orthostatic Hypotension in Elderly Nursing Home Residents Who Fall: Are They Dizzy?

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### **Abstract**

Orthostatic hypotension (OH) and symptoms of dizziness have been identified as key factors in falls among older adults; however, gaps in the research literature about the presence of asymptomatic OH and its association with falls exist and have prompted this study to determine if falls among nursing home residents are associated with orthostatic hypotension in the absence of dizziness. A secondary analysis was conducted on blood pressure data and symptom experience of 77 older adult residents who experienced a fall while residing in a continuing care retirement community (CCRC). Data of interest were extrapolated from the Post-Fall Index. Of the 77 individuals with 194 RN documented falls, the majority (n=89, 46%) did not meet the diagnostic criteria of OH; 18 (9%) met criteria, and 8 (4%) nearly met OH criteria. OH blood pressure determinations were incomplete or absent in 41% (n=79). Of the 18 residents who fell and met OH criteria, none experienced dizziness. Conclusion: We conclude older nursing home residents do not exhibit symptoms of dizziness prior to orthostatic drops in blood pressure resulting in a fall. Further study is indicated to identify reliable predictors, besides symptom experience of OH in this population.

## **Introduction**

It is well understood that a drop in blood pressure (BP) is associated with dizziness and subsequent falls in nursing home residents aged 65 and over (Duthie, Katz, & Malone, 2007). However, little is known if a drop in blood pressure without dizziness is associated with falls in older adult nursing home residents.

## **Background**

Falls among older adults in the United States represent a leading cause of death and disability (CDC, 2010). One out of three adults age 65 and older falls each year and among those age 65 and older, falls are the leading cause of injury death (CDC, 2010). About 1,800 older adults living in nursing homes die each year from fall-related injuries (CDC, 2010). Within nursing homes, professional registered nurses care for a large number of residents who fall. Each year, an average nursing home with 100 beds reports 100 to 200 falls (CDC, 2010). Many of the residents who fall are recurrent fallers. In a recent longitudinal, three year study conducted in one nursing home, the recurrent fall incidence was sixty percent by 77 individuals over 365 days (Gray-Miceli, Ratcliffe, & Johnson, 2010).

Due to the high morbidity and injury rate of falls, the identification of key predictors is important in the prevention of additional falls. One physiological predictor of falls is orthostatic hypotension (OH). OH is defined as a drop in BP greater than 20 mmHg systolic and/or a drop of more than 10mmHg diastolic within 3 minutes of sitting or standing (American Autonomic Society and the American Academy of Neurology, 1996). OH can produce symptoms of dizziness among all age groups, particularly in older adults over age 65 (Rubenstein, 2006). For the purposes of this secondary analysis, dizziness is defined as an acute or "sudden

lightheadedness" which was not associated with vertigo (room moving). In the nursing home setting, orthostatic hypotension (OH) and related symptoms of dizziness have been identified as key predictors in falls among residents (Duthie et al, 2007).

Even though the association of OH, dizziness, and subsequent falls in older adults has been well researched there exists among a sub-set of older adults a condition called asymptomatic OH where the older adult does not experience dizziness (Bradley et al, 2003). We have limited information on asymptomatic OH among elderly fallers in long-term care settings. According to Shibao & Biaggioni (2010), asymptomatic OH is a common but often unrecognized condition. Among the elderly, the reported prevalence rate is between 6% to 35% or more, depending on age and associated comorbidities (Shibao & Biaggioni, 2010). Unperceived dizziness can be attributed to underlying disease (such as, cognitive impairment) or the use of medications blunting this symptom (Shibao & Biaggioni, 2010). There is a large gap in the literature regarding the occurrence of asymptomatic OH and its association with falls among older adults residing in nursing homes.

### **Study Purpose**

The primary purpose of this study is to determine if falls among nursing home residents are associated with orthostatic hypotension in the absence of dizziness. Specifically our research question sought to address what proportion of older adults, aged 65 and older residing in a nursing home who fell will experience asymptomatic (defined as no dizziness) orthostatic hypotension?

## **Methods**

A secondary descriptive analysis was conducted on data from the intervention year of a 3-year prospective, longitudinal, quasi-experimental study examining the effectiveness of the Post-Fall Index (PFI) in reducing recurrent falls. A full description of the study can be found in Gray-Miceli, Ratcliffe and Johnson (2010). The primary sample for this secondary analysis is drawn from 77 older adult residents who experienced a fall while residing on one of four units, assisted living or skilled nursing, from a 110 bed continuing care retirement community (CCRC) located in the Northeastern United States during the intervention year (June 1, 2006-May 31, 2007).

Data on the residents' blood pressure, reported symptoms of dizziness, fall number and cognitive status were extrapolated from an electronic database housing the Post-Fall Index software, which is designed to collect salient post fall variables at the time of a resident fall by trained staff nurses. All fall related data were collected by these staff nurses as part of facility wide protocol in the CCRC, substituting use of the PFI in place of their current post fall assessment tools during the intervention year of a three year study (2006-2009). In previous research we have described the psychometric properties of the PFI as a reliable and valid measure to comprehensively assess older adult residents' condition after a fall (Gray-Miceli, Ratcliffe, & Johnson, 2006).

## **Procedures**

## Definitions of Variables of Interest

### Defining Orthostatic Hypotension

Orthostatic hypotension was coded according to one of four categories: Yes (meeting the criteria for OH), No (not meeting the criteria for OH), Near for BP readings that were close to meeting the criteria (a drop of 16 to 19 points systolic and/or a drop of 8 to 9 points diastolic), and Missing for incomplete data (one or more readings was missing for supine, sitting, or standing. A trained RA originally coded the blood pressure data with a second research assistant independently coding the readings to ensure accuracy in the coding scheme.

### Patient Symptom Experience of Dizziness

Dizziness was obtained by trained staff nurses (as part of the parent study protocol) who asked residents at the time of their fall if they felt dizzy or not. Staff nurses were trained to substitute the term “lightheadedness” if they obtained a negative response from the question; “are you dizzy?” For the purposes of this study, the patient symptom experience of dizziness was analyzed as a dichotomous variable: present or absent.

### Cognitive Impairment

Cognitive impairment was determined according to raw Mini-Mental scores entered by the staff nurse into the PFI database. Scores range from zero (0) to 30, with any score less than 24 suggestive of cognitive impairment.

## Statistical Analysis

The rate of OH was calculated based on the number of falls experienced. Demographic and clinical characteristics of the sample was calculated and compared between the OH groups.

Since a resident could experience more than one fall during the study period, Generalized Estimating Equations (GEEs) were used to compare the groups. Analyses were conducted using SPSS version 17.0 and Stata MP 11.2.

## Results

This secondary analysis is drawn from the parent sample of 77 older adult residents who experienced a total of 194 RN documented falls, of which 44 (57.1%) were recurrent falls (fell more than once). This sample had an average age of 90 years, were predominantly female and 82% resided in assisted living at the time of their fall. The mean Mini-mental State Examination at the time of the fall was 14.1 (Table 1).

Of the total number of 194 falls, 18 (9.3%) met the diagnostic criteria of OH, 91 (46.9%) did not meet criteria, 8 (4.1%) were within 4 points systolic and 2 points diastolic of meeting the criteria (Figure 1), and 77 (39.7%) readings were incomplete/missing. Thus, the incidence of OH in this sample was 15.4 per 100 falls (95% CI=9.4-23.8).

Of the 18 residents who fell and met OH criteria, none experienced dizziness (Table 1). The four OH groups had similar demographic and clinical profiles. Subjects with missing blood pressure data were less likely to experience loss of balance at the time of the fall, compared to the other OH groups ( $p=0.004$ ).

The RN assessment of the underlying cause of the fall is shown in Table 2. Only causes that are related to blood pressure are shown. Of the 18 falls with OH, only 8 (44.4%) were assessed by the RN as potentially related to a blood pressure issue, with most being categorized as chronic generalized weakness ( $n=7$ ). Similar assessments were also made in the near OH group.



## **Discussion**

The findings indicate that of 194 RN documented falls among 77 residents, 18 RN documented falls met the OH criteria, and none reported dizziness. Of those 4 RN documented falls with reported dizziness, none had OH. The findings of this pilot study indicate that falls related to OH is not associated with resident's report of symptoms of dizziness. Residents with asymptomatic OH accounted for the majority of falls (46% of total falls). This is a surprising result because there is an extensive amount of research concerning the association between OH, dizziness, and falls. Further research is indicated in the underlying cause of asymptomatic OH in the elderly. Some research suggests that it may be a normal part of aging where there is an alteration in baroreceptor responsiveness to changes in blood pressure, association with underlying disease, medication, or a combination of multiple factors. If we can understand the factors that predispose an older adult to asymptomatic OH, we can take preventative falls measures earlier.

One factor may be the presence or absence of cognitive impairment. Meaning the older adult could have dizziness, but due to cognitive impairment is unable to adequately express their complaints outright when questioned or has limited awareness of the symptom of dizziness altogether. The average MMSE score of the sample is 19.79 suggesting that some residents who fell have some degree of cognitive impairment. The implication of this finding is that future research is needed on how cognitive impairment may affect an elderly nursing home resident's perception of dizziness secondary to OH or their ability to report dizziness secondary to OH. For

instance, could nursing interventions to help residents identify the symptom experience be developed and tested?

There are several limitations to the study. One major limitation to the study is the small group of residents who had orthostatic hypotension (n=18). We attribute three major explanations for this finding:

First, this is a small sample size, with missing or incomplete data. Results indicated that 41% of falls were missing BP data, indicating that either BP was not taken or BP was taken but not documented by the RN. This implies that our sample could have excluded residents who may have met the OH criteria. If BP readings were properly documented as required in study protocol, the results of this study could have been different. In essence, there could be many more older persons who have orthostatic hypotension at the time of their fall. Ways to improve staff adherence to thorough documentation are indicated. An important lesson learned is that any future nursing home study using a quality improvement framework must include measures to ensure treatment fidelity.

Second, one question raised from this study includes the use of the current American Autonomic Society and the American Academy of Neurology definition for the diagnosis of orthostatic hypotension. The result of our findings showed only 18 residents who were able to meet the OH criteria. We believe that when looking at fall rates it is important to discuss patients who met OH criteria as well as residents whose drops in blood pressure were close to meeting the OH criteria because the latter also could have suffered life threatening injuries and complications from the fall. The current OH criteria may be too restrictive and may overlook populations who do not meet strict OH criteria but still are at risk for falls and related injuries.

Additionally, we did not measure the length of time nurses assisted patients to a sitting or standing position. It is conceivable staff nurses did not wait the recommended 3 minutes between positional changes to reassess blood pressures, thus also skewing our findings. Having a research assistant or study nurse monitor this aspect of the blood pressure readings may have auto-corrected this potential error.

Third, as the study by Rubenstein et al, indicates, orthostatic hypotension is a less common cause of falls because older adults with OH become used to it and are able to sit down before falling, or are able to prevent feelings of dizziness by rising slowly (Rubenstein et al, 2006). However, little is known if this is also true among the frail, cognitively impaired, or recurrent fallers residing in the skilled or intermediate units of a continuing care retirement community.

The fourth limitation to this study is that the sample is not randomized, thus limiting external generalizability. Generally speaking, data drawn from one institution may not truly represent all older adult populations residing within CCRC's. Data on co-morbid conditions and medications are needed in follow-up studies since they may alter the perception of dizziness (Shibao & Baggioni, 2010).

Another area where further research is indicated is in the patient reported symptoms of dizziness. In 194 residents who fell during the intervention year, only 4 reported dizziness. While this observation could be attributed to comorbidities that may blunt the symptom of dizziness, there is also a possibility that the resident may not recall the dizziness symptom or many deny its existence due to other fears or concerns tied to reporting. Older adult's perception may be that by reporting symptoms of dizziness to the healthcare professional may lead to other potentially

intrusive evaluations or a change in their level of care for closer monitoring. It could also include the fear of loss of independence by use of devices or aides such as canes or walkers, which can bestow a “stigma” on the once functionally independent older resident. Thus, the subjective patient experience of dizziness, and the reporting of dizziness and its cognitive, social and emotional implications need further exploration.

## **Conclusion**

Results of our analysis suggest falls related to OH are *not* necessarily associated with dizziness. The significance of this finding is that older adults over the age of 65 who reside in nursing homes may not exhibit symptoms of dizziness before experiencing an orthostatic drop in blood pressure and subsequent fall. Although previous research has established the association of dizziness with OH and subsequent falls, the value of this study is that the absence of dizziness does not rule out a resident’s risk for OH related falls. Consequently, nurses may not rely solely on dizziness as a predictor of OH, as we do in clinical practice with younger individuals. In fact, based on our findings it would be insufficient for nurses in practice to rely on reports or denials of dizziness as a predictor of OH. Further study is indicated to identify reliable predictors of OH besides patient symptoms.

Figure 1. Percentages of elderly fallers who met, nearly met or did not meet criteria for orthostatic hypotension.

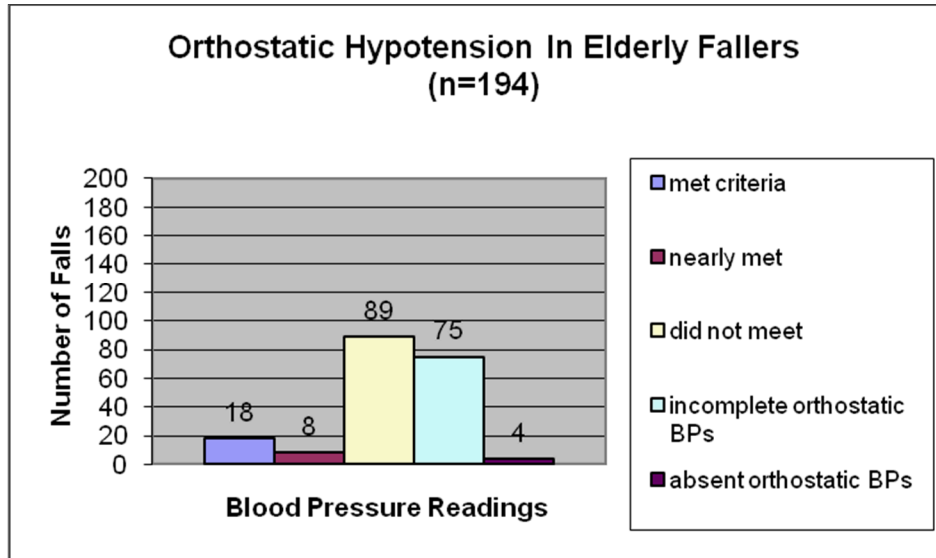


Table 1: Demographic and clinical characteristics at the time of the fall by OH group. Mean  $\pm$  st.dev or n(%) is shown.

Characteristic	Entire Fall Sample (n=194)	OH				p-value <sup>1</sup>
		Yes (n=18)	Near (n=8)	No (n=91)	Missing (n=77)	
Age <sup>2</sup>	90.0 $\pm$ 5.8	90.6 $\pm$ 5.6	92.9 $\pm$ 6.7	90.4 $\pm$ 5.5	89.2 $\pm$ 6.0	0.790
Female	159 (82.0)	14 (77.8)	5 (62.5)	79 (86.1)	61 (79.2)	0.923
MMSE <sup>3</sup>	14.1 $\pm$ 12.1	11.2 $\pm$ 13.6	11.8 $\pm$ 13.1	15.9 $\pm$ 11.5	12.9 $\pm$ 12.2	0.487
<i>History of:</i>						
OH	5 (2.6)	0	1 (12.5)	3 (3.0)	1 (1.3)	n/a
Parkinson's	13 (6.7)	2 (11.1)	0	4 (4.4)	7 (9.2)	0.417
Neuropathy - lower extremity	9 (4.7)	2 (11.1)	1 (12.5)	4 (4.4)	2 (2.6)	0.411
Diabetes	44 (2.8)	6 (33.3)	5 (62.5)	15 (16.5)	18 (23.7)	n/a
<i>Medications:</i>						
Anti-hypertensive	126 (65.3)	11 (61.1)	7 (87.5)	62 (68.1)	46 (60.5)	0.283
Diuretic	90 (46.6)	9 (50.0)	4 (50.0)	46 (50.6)	31 (40.8)	0.931

Vasodilators	7 (3.6)	3 (16.7)	0	2 (2.2)	2 (2.6)	0.082
Anti-anginal	23 (11.9)	5 (27.8)	2 (25.0)	8 (8.8)	8 (10.5)	0.206
Blood thinners	33 (17.1)	6 (33.3)	2 (25.0)	17 (18.7)	8 (10.5)	0.411
Insulin	27 (14.0)	3 (16.7)	3 (37.5)	9 (9.9)	12 (15.8)	0.132
Oral hypoglycemic	18 (9.3)	1 (5.6)	2 (25.0)	7 (7.7)	8 (10.5)	0.334
Urinary incontinence agents	11 (5.7)	2 (11.1)	0	5 (5.5)	4 (5.3)	0.674
<i>Resident experienced</i>						
Loss of Balance	86 (44.6)	9 (50.0)	5 (62.5)	51 (56.0)	21 (27.6)	0.004
Light Headedness	3 (1.6)	0	1 (12.5)	1 (1.1)	1 (1.3)	n/a
Dizziness	3 (1.6)	0	1 (12.5)	1 (1.1)	1 (1.3)	n/a
Fainting	2 (1.0)	0	0	1 (1.1)	1 (1.3)	n/a

<sup>1</sup> OH groups compared using GEEs to adjust for the multiple falls from the same subjects. n/a = insufficient numbers to perform meaningful statistical test.

<sup>2</sup> n=177

<sup>3</sup> n=194

Table 2: RN assessment of fall cause(s).

Cause; n(%)	Entire Fall Sample (n=193 <sup>1</sup> )	OH			
		Yes (n=18)	Near (n=8)	No (n=91)	Missing (n=76)
Orthostatic Hypertension	2 (1.0)	1 (5.6)	0	1 (1.1)	0
Black-out	2 (1.0)	0	0	1 (1.1)	1 (1.3)
Acute Loss of Balance	31 (16.1)	3 (16.7)	1 (12.5)	18 (19.8)	9 (11.8)
Changes in Blood Pressure	4 (2.1)	2 (11.1)	0	2 (2.2)	0
Chronic Dizziness	3 (1.6)	0	0	2 (2.2)	1 (1.3)
Chronic Generalized Weakness	39 (20.2)	7 (38.9)	3 (37.5)	15 (16.5)	14 (18.4)
At least 1 of the above causes	64 (33.2)	8 (44.4)	4 (50.0)	30 (33.0)	22 (28.9)

<sup>1</sup> Excluded 1 subject with missing assessment.



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