Published in final edited form as:
J Am Geriatr Soc. 2013 March ; 61(3): 371–379. doi:10.1111/jgs.12147.

Geriatric Syndromes and Incident Disability in Older Women: Results from the Women's Health Initiative Observational Study

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Abstract

Background/Objectives—Geriatric syndromes are common in older women and contribute to disability risk. Little is known about how the number of geriatric syndromes is associated with incident disability in community-based populations of older adults.

Design—Longitudinal analysis from the Women's Health Initiative Observational Study (WHI).

Setting—Community-based.

Participants—29,544 women aged 65 or older, who were enrolled in the WHI and free of disability in activities of daily living (ADL) at baseline.

Measurements—Geriatric syndromes were self-reported at baseline and three year follow-up and included high depressive symptoms, dizziness, falls, hearing or visual impairment, osteoporosis, polypharmacy, syncope, sleep disturbance, and urinary incontinence. Disability was defined as dependence in any ADL and was assessed at baseline and follow-up. Chronic diseases were measured by a modified Charlson index.

Results—Geriatric syndromes were common in this population of women; 76.3% had at least one syndrome present at baseline. Increased number of geriatric syndromes at baseline was significantly associated with increased risk of incident ADL disability at follow-up ($p \leq 0.001$). The adjusted risk ratio (RR) and 95% confidence interval (CI) for a single syndrome compared to

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Conflict of Interest: The editor in chief has reviewed the conflict of interest checklist provided by the authors and has determined that the authors have no financial or any other kind of personal conflicts with this paper.

Conflicts of interest: There are no conflicts of interest to report.

Author's Contributions: All authors meet the criteria for authorship stated in the Uniform Requirements for Manuscripts Submitted to Biomedical Journals. All authors contributed to conception and design of the paper. Andrea Rosso conducted analyses. Andrea Rosso and Yvonne Michael drafted the paper. All authors contributed to critical revision of the paper and have approved publication.

no syndromes was 1.21 (0.78, 1.87). For women with five or more geriatric syndromes, the RR (CI) was 6.64 (4.15, 10.62). These results were only slightly attenuated after adjustment for number of chronic diseases or pain.

Conclusion—Geriatric syndromes are significantly associated with onset of disability in older women; this association is not simply a result of chronic disease or pain. A better understanding of how these conditions contribute to disablement is needed. Geriatric syndrome assessment should be considered along with chronic disease management in the prevention of disability in older women.

Keywords

Geriatric syndromes; disability; aging; women's health

INTRODUCTION

Disability in the elderly is an important and growing public health concern. Disability results in higher usage of medical care, increased institutionalization, and poorer physical and mental health [1–3]. Approximately 9% of the US population over 65 years of age has one or more disabilities in basic Activities of Daily Living (ADLs)[4]. Identifying contributors to disability onset is important in prevention, but identification is complicated by the complexity of multiple co-morbidities and risk factors which are the norm rather than the exception in older patients [5]. The presence of multiple disease states leads to increased vulnerability to stressors and consequently to higher rates of disability in this population [2]. Though often ignored when assessing elders' risk of disablement, geriatric syndromes may be as important as clinically-recognized diseases in determining disability [4–6]. Failure to account for geriatric syndromes may lead to an incomplete understanding of how pathology progresses to disability [3].

Geriatric syndromes are a loosely-defined group of conditions that are common in the geriatric population and are often the result of cumulative insults to multiple organ systems[4, 5]. There is no consensus as to which conditions to consider as geriatric syndromes, but falls, incontinence, depressive symptoms, cognitive impairment, dizziness, and sensory impairment are often included[4, 5, 7]. Geriatric syndromes often co-occur with each other and with other chronic medical conditions [4, 6, 8] and share numerous overlapping pathways and risk factors [5, 7, 9]. In addition, geriatric syndromes may occur as a result of a chronic disease or its treatment [10, 11].

Geriatric syndromes arise from multifactorial impairments of bodily systems [5]. Presence of multiple geriatric syndromes may indicate a general phenotype of vulnerability whereas those occurring in isolation may be more localized in their etiology. Geriatric syndromes are related to, but distinct from, disability, which is commonly defined as difficulty in carrying out usual activities due to a physical or mental health limitation[3]. The disablement process describes the way in which pathology due to disease or injury may develop into disability when risk factors are present [3]. Geriatric syndromes likely play a role in the disablement process, but the nature of that role is not clear. The physiologic vulnerability that under lies on set of geriatric syndromes may also increase susceptibility to disability; alternatively, geriatric syndromes may be a direct risk factor for disability[12].

While two cross-sectional studies support a relation between multiple geriatric syndromes and disability [4, 6], longitudinal studies are needed to assess the impact of total number of geriatric syndromes on incident disability. Although this relation is likely bi-directional, longitudinal assessment can demonstrate that geriatric syndromes are not simply a consequence of disability but can precede and potentially contribute to disability onset.

This study was designed to examine the association of the number of baseline geriatric syndromes with incident disability in activities of daily living at three years among community-dwelling women aged 65 years and older. We hypothesized that risk for disability increases with an increasing number of geriatric syndromes and that this association is not simply a consequence of the association of geriatric syndromes with chronic diseases or pain.

METHODS

Study population

The WHI enrolled 93,676 women aged 50–79 years into an observational study (details previously published [13]). Women were recruited at 40 clinical centers across the United States from 1994 to 1998 through community-based methods [14]. Exclusion criteria for the WHI were minimal and included the presence of conditions with predicted survival of less than 3 years, or those that would interfere with compliance, such as substance abuse [13]. All women provided informed consent prior to participation. The current analysis was approved by the Drexel University Institutional Review Board.

Women aged 65 years and older were included in these analyses (n=43,599). Women who died by follow-up (n=1,276) were not included in these analyses. In addition, women were excluded if they had missing data on baseline (n=1,600) or three year (n=4,081) ADLs, or on any geriatric syndromes (n=2,176). Women with any ADL disability at baseline (n=874) also were excluded. To avoid possible confounding due to the strong association of cancer and its treatment with geriatric syndromes and with disability[15, 16], women with history of cancer at baseline or a cancer diagnosis during the follow-up period also were excluded (n=8,262). Women excluded from these analyses were older ($p<0.001$), had more geriatric syndromes ($p<0.001$), and were more likely to be non-white ($p<0.001$), less educated ($p<0.001$), lower income ($p<0.001$), and to be current or former smokers ($p<0.001$), compared to the general WHI population 65 years and older.

Geriatric Syndromes

All geriatric syndromes were assessed at baseline and three year follow-up by self-report questionnaires. Geriatric syndromes were selected for consideration in this study based on common definitions of geriatric syndromes and data availability[4, 5, 8].

Depressive symptoms were measured by the shortened CES-D/DIS screening instrument with a cut-off of 0.06 used to identify those meeting criteria for high depressive symptoms [17].

Presence and severity of any dizziness was self-reported over the previous four weeks. Any reported dizziness was considered as a geriatric syndrome here.

Any trouble in hearing and vision were assessed over the previous four weeks and were considered as separate geriatric syndromes. Trouble with vision was specified as any trouble seeing that was uncorrected by lenses.

Women were asked how many times they had fallen and landed on the floor or ground in the past year and were defined as fallers if they reported at least two falls in the previous year.

Osteoporosis was defined as ever having been told by a doctor that they had the condition.

Polypharmacy was defined here as current use of five or more prescription and over the counter medications based on in-person medication review[18].

Sleep disturbance was defined as five or fewer hours' reported sleep on a typical night in the past four weeks[19].

Syncope was self-reported as having fainted, blacked out, passed out, or lost consciousness in the past twelve months.

Urinary incontinence (UI) was defined here as having urine leakage at least once per week in the past year [9].

Disability

Disability was measured by four activities of daily living (ADL). ADLs included eating, dressing, getting in and out of bed, and taking a bath or shower [20]. For each, participants were asked if they could do it without help (score=1), with some help (score=2), or if they were unable to complete the activity (score=3). Scores were summed for all activities with a score of 4 indicating independence in all activities and higher scores indicating greater ADL disability. The ADL construct was assessed at baseline and at year three. Incident disability was defined as having at least one ADL disability at the year three visit.

Covariates

Demographic variables were recorded at either the screening or baseline visit. Age was reported to the nearest year. Self-reported race/ethnicity, current marital status, educational achievement, income and smoking status were categorized as shown in Table 1. Number of chronic diseases was quantified according to a modified Charlson Index [21]. This included self-report at baseline of: congestive heart failure, diabetes, myocardial infarction, peripheral artery disease, stroke, transient ischemic attacks, Alzheimer's disease, arthritis, stomach ulcers, liver disease, asthma and emphysema. The total number of these diseases was calculated to obtain a Charlson score for each individual at baseline. The Charlson score was updated for incidence of disease by year three follow-up. Pain was assessed at baseline and at year three follow-up by the Bodily Pain subscale of the SF-36 which includes questions determining amount of bodily pain over the past four weeks and extent to which pain interfered with one's normal work [22]. These were each coded from 0–100 and then averaged together to obtain a single score with 100 indicating no pain and 0 indicating severe pain with extreme interference.

Statistical Analysis

Mean number of geriatric syndromes at baseline and year three were compared using paired t-tests. Co-occurrence and 95% confidence intervals (CI) of geriatric syndromes were calculated using binomial proportions. Log binomial regression was used to calculate risk ratios (RR) and 95% CIs for incident disability. Backward selection based on statistical significance ($p \leq 0.1$) of the covariate was used to build the regression models beginning with the least significant covariates and continuing until all remaining covariates were statistically significantly associated with the outcome. All eliminated covariates were reintroduced individually into the model and those that changed the main effect estimate by 10% or more were retained in the final model [23]. Based on backward selection, all models were adjusted for age, smoking and income. Additional models were adjusted for Charlson or pain scores. Additional log binomial regression analyses were conducted using year three follow-up information for geriatric syndrome number with and without the updated Charlson or pain scores. All analyses were performed in SAS 9.2.

RESULTS

A total of 29,544 women were included in these analyses. Women with more geriatric syndromes at baseline were, on average, older, more likely to have chronic diseases, less likely to be married, less educated, and more likely to have lower income than women with fewer geriatric syndromes (all $p \leq 0.001$; Table 1).

Geriatric syndromes at baseline were common; 76.3% of women had at least one syndrome (Table 1). For those with four or fewer geriatric syndromes, hearing impairment and urinary incontinence were the most common syndromes (Table 2). Approximately three quarters of women who had five or more geriatric syndromes had dizziness, urinary incontinence, hearing impairment or visual impairment. Co-occurrence of individual geriatric syndromes is shown in Table 3. Mean Charlson score increased and mean pain score decreased (indicating more pain and pain interference)in a linear fashion as the number of geriatric syndromes increased ($p \leq 0.001$; Table 1).

By the three-year follow-up visit, 742 (2.5%) women had developed ADL disability. Difficulty with showering was the most common disability (n=383; 1.3%). In addition, 210 (0.7%) women had difficulty eating, 201 (0.7%) women had difficulty dressing, and 158 (0.5%) women had difficulty getting in and out of bed. Only 150 (0.5%) women had disability in multiple domains at the three year follow-up. Scores on the ADL construct were generally low. Of those women with a disability at follow-up, 454 (61.2%) indicated need for assistance with one activity. In addition, 190 (25.6%) indicated either need for assistance on two activities or inability to complete one activity. Only 98 (13.2%) of women indicated having a higher level of disability.

Women with two or more geriatric syndromes at baseline had a greater risk of developing ADL disability over three years compared to women with no syndromes (Table 4). Risk of disability increased with increasing number of geriatric syndromes (test for trend: $p<0.001$). Women with a single geriatric syndrome were 1.21 (95% CI: 0.78–1.87) times as likely as those with no geriatric syndromes to become disabled by the three year visit. In contrast, women with five geriatric syndromes at baseline were 6.64 (95% CI: 4.15, 10.62) times as likely to develop disability by the three year follow-up as women with no geriatric syndromes. Adjustment for the Charlson score somewhat attenuated these associations (Table 4) but did not eliminate the trend ($p<0.001$). After adjustment for chronic diseases, compared to women with no geriatric syndromes, women with one syndrome were 1.14 (95% CI: 0.73, 1.76) times as likely and women with five geriatric syndromes were 4.67 (95% CI: 2.88, 7.56) times as likely to develop disability. Similarly, adjustment for pain attenuated but did not eliminate the association of geriatric syndromes with incident disability (Table 4; test for trend $p<0.001$). Models that adjusted for both Charlson score and pain were not substantially different from the models adjusting for each individually (data not shown).

Each individual geriatric syndrome had a significant association with incident disability before adjustment for chronic diseases (Table 4). After adjustment for the Charlson score, hearing impairment and sleep disturbance were no longer significantly associated with incident disability. Adjustment for pain eliminated the association of hearing impairment, sleep disturbance, syncope, and urinary incontinence with incident disability (Table 4).

Additional analyses were conducted to assess the sensitivity of the results to inclusion of particular geriatric syndromes at baseline. Removal of each individual geriatric syndrome did not qualitatively change the results(data not shown).

The mean number of geriatric syndromes increased significantly from baseline (1.6) to follow-up (2.0; $p \leq 0.001$). Only 33.8% of women had the same count of geriatric syndromes at follow-up as they did at baseline. However, the majority of women (75.8%) differed by no more than 1 geriatric syndrome from their baseline count. It was more common for women to acquire new geriatric syndromes (45.2%) rather than reduce their count (21.0%) (Table 5). Falls, dizziness, and visual impairment were the most likely geriatric syndromes to have abated and when combined accounted for half of the observed decrease in geriatric syndrome count. Results using follow-up measures of geriatric syndromes were not qualitatively different than those using baseline measures (Table 5). Adjustment for the Charlson score or pain at follow-up attenuated the results slightly as with adjustment at baseline (data not shown). It is not possible from the available data to determine whether the geriatric syndromes at follow-up preceded onset of disability.

DISCUSSION

A significant association between number of geriatric syndromes and incident disability was observed in this population of women aged 65 years and older. As the number of geriatric syndromes increased, the risk of developing disability in activities of daily living over a three-year period increased. Women who had five or more geriatric syndromes were more than six times as likely to have incident disability as women with no syndromes. This association persisted with adjustment for the Charlson score and pain, indicating that it is not dependent on presence of chronic disease or pain.

These findings are consistent with existing literature, most of which has focused on clinical populations or on single geriatric syndromes. Individual geriatric syndromes are known to be associated with functional impairment [7, 12, 24–29] and assessments in clinical samples have demonstrated strong associations between multiple geriatric syndromes and functional outcomes [30, 31]. Two cross-sectional studies have shown an association between multiple geriatric syndromes and disability or functioning in the general population [4, 6]. Cigolle and colleagues demonstrated a strong association between presence of geriatric syndromes and ADL dependency in a nationally representative sample of adults aged 65 years and older. This association was stronger for those with multiple syndromes and was independent of chronic diseases [4]. A previous analysis of WHI data found a cross-sectional association of geriatric syndromes with physical and social functioning that was modified by the presence of cardiovascular disease or diabetes [6]. An increasing number of chronic diseases has been shown to predict incident ADL disability [32] and in many studies, geriatric syndromes have been as good or better indicators of health outcomes as chronic diseases [4, 6, 30, 31].

This is the first study to assess number of geriatric syndromes and incident disability in a community-dwelling population providing evidence that geriatric syndromes precede and may contribute to onset of disability. Importantly, these results indicate that risk of disability is elevated for women with three or more geriatric syndromes suggesting that presence of multiple geriatric syndromes may be an important clinical indicator.

Although the results presented here suggest that geriatric syndromes contribute to disability in older women, their role in the disablement process is not yet clear. These syndromes may represent underlying pathology, system impairment, or presence of other risk factors [3]. Comorbidity, frailty, prior disability [2], related disruption to multiple organ systems, degradation of compensatory systems [5, 7], and multi-system impairments [1] all may be part of the path through which geriatric syndromes impact disablement in the elderly. The multi-factorial nature of geriatric syndromes and frailty complicates our understanding of these pathways. In addition, the current evidence does not establish that geriatric syndromes lead directly to disability. Geriatric syndromes and disability could be separate end points of

shared risk factors. Understanding mechanisms through which geriatric syndromes contribute to disablement has important clinical implications [12] and should be the basis for future research.

This study has some limitations. Incidence of ADL disability in the current sample was similar to but slightly lower than that reported in other community-based samples and may reflect a healthy volunteer effect [33–36]. We did not have regular assessment of geriatric syndromes in this population. Given our interest in establishing the temporal sequence between geriatric syndromes and disability, we focused our primary analysis on the association between baseline geriatric syndromes and incidence of disability. However, many of these geriatric conditions are intermittent in nature and chronicity may be an important factor to consider [7]. In this population, 42% of the women acquired new geriatric syndromes during the follow-up period. Analyses that considered the count of geriatric syndromes at year 3 in relation to new disability over the follow-up period were similar to the results of the analysis with baseline geriatric syndromes. Additional studies with more frequent follow-up of geriatric syndromes are needed to evaluate short-term and long-term patterns in geriatric syndromes and the relation between these patterns and incidence of disability in community-dwelling older adults.

There is currently no consensus on which conditions should be considered geriatric syndromes [4]. Standardization of this definition would help advance research and clinical practice. Some of the conditions included in these analyses could arguably be considered chronic conditions, notably osteoporosis. In addition, polypharmacy may be a risk factor for geriatric syndromes, rather than a true geriatric syndrome itself [37]. We included conditions that are frequently cited in lists of geriatric syndromes among community-dwelling older adults[4, 5, 8] and for which there was biological justification. Older adults are at risk for high depressive symptoms as a result of neurologic and vascular changes to the brain and the response to adverse life events [38, 39]. Dizziness is common in older adults and is typically not due to a single cause [7, 40]. Sensory impairments are common in older adults and arise from anatomical changes to sensory organs and neuronal impairments [41, 42]. Falls are a well-recognized geriatric syndrome that arise from disturbances in neurologic systems, musculature, and balance [7, 39]. Osteoporosis arises from disturbance of hormonal and inflammatory controls of bone formation and resorbtion[43]. Polypharmacy may indicate over prescription or inappropriate combinations of medications resulting in adverse health outcomes and increased physical vulnerability [37, 44]. Problems with sleep are generally multifactorial and can be caused from a combination of physiological declines and psychosocial influences [45]. Syncope is often mediated by cardiologic and neurologic causes, though is often of unexplained origin [46]. Finally, Urinary incontinence can arise from problems in the urinary tract itself or from vascular changes in the brain [7, 39]. Our sensitivity analyses indicate that these results are not conditional on the inclusion of any particular condition.

There is also no standard concerning severity of conditions to be considered geriatric syndromes. In these analyses geriatric syndromes were considered present or absent without consideration of severity due to lack of consistent data on severity of conditions. Restricting inclusion to more severe forms might have reduced prevalence of these conditions and possibly changed the observed associations.

We may have excluded important conditions, most notably cognitive impairment, due to lack of data available for this sample of women. Prevalence of cognitive impairment at baseline for the Women's Health Initiative Memory Study (a sub-study of the clinical trial portion of the WHI) was 5.8% [47]. While we do not know how inclusion of cognitive impairment may have impacted these results, our sensitivity analysis indicates that exclusion

of any one geriatric syndrome did not alter our findings; this may also be true for cognitive impairment. Given the strong association of cognitive impairment with disability [48, 49], we may be underestimating the association of geriatric syndromes with disability.

Finally, this study was limited by the restriction to women. Women have higher prevalence of geriatric syndromes but not ADL disability compared to men[50]. Evidence from studies of effect modification by sex for the association of chronic diseases with ADL disability have generally found that associations were the same for men and women [50]. Future studies should include both genders and assess whether the association of number of geriatric syndromes with disability differs by sex.

To our knowledge, this was the first longitudinal study to assess the relation between number of geriatric syndromes and incident disability in community dwelling older adults. Our results demonstrate that presence of geriatric syndromes precedes dependency in ADL. Most previous papers focused on clinical or hospitalized patients. We demonstrate that multiple geriatric syndromes are an important health indicator among healthy community-dwelling older women. Future research should focus on understanding how geriatric syndromes contribute to the disablement process. Geriatric syndromes and their common risk factors may represent an important target for prevention of disability in older women.

Acknowledgments

This work was supported by the National Institute of Aging (R03AG031973) to YLM. The WHI program is funded by the National Heart, Lung, and Blood Institute, National Institutes of Health, U.S. Department of Health and Human Services through contracts HHSN268201100046C, HHSN268201100001C, HHSN268201100002C, HHSN268201100003C, HHSN268201100004C, and HHSN271201100004C.

Sponsor's Role: None

References

1. Fried LP, Guralnik JM. Disability in older adults: Evidence regarding significance, etiology, and risk. J Am Geriatr Soc. 1997; 45:92–100. [PubMed: 8994496]
2. Fried LP, Ferrucci L, Darer J, et al. Untangling the concepts of disability, frailty, and comorbidity: Iimplications for improved targeting and care. J Gerontol A Biol Sci Med Sci. 2004; 59:255–263. [PubMed: 15031310]
3. Verbrugge LM, Jette AM. The disablement process. Soc Sci Med. 1994; 38:1–14. [PubMed: 8146699]
4. Cigolle C, Langa KM, Kabeto MU, et al. Geriatric conditions and disability: The Health and Retirement Study. Ann Intern Med. 2007; 147:156–164. [PubMed: 17679703]
5. Inouye SK, Studenski S, Tinetti ME, et al. Geriatric syndromes: Clinical, research, and policy implications of a core geriatric concept. J Am Geriatr Soc. 2007; 55:780–791. [PubMed: 17493201]
6. Rosso AL, Eaton CB, Wallace R, et al. Combined impact of geriatric syndromes and cardiometabolic diseases on measures of functional impairment. J Gerontol A Biol Sci Med Sci. 2011; 66:349–354. [PubMed: 21317242]
7. Tinetti ME, Inouye SK, Gill TM, et al. Shared risk factors for falls, incontinence, and functional dependence. Unifying the approach to geriatric syndromes. JAMA. 1995; 273:1348–1353. [PubMed: 7715059]
8. Lee PG, Cigolle C, Blaum C. The co-occurrence of chronic diseases and geriatric syndromes: The health and retirement study. J Am Geriatr Soc. 2009; 57:511–516. [PubMed: 19187416]
9. Brown JS, Vittinghoff E, Wyman JF, et al. Urinary incontinence: does it increase risk for falls and fractures? Study of Osteoporotic Fractures Research Group. J Am Geriatr Soc. 2000; 48:721–725. [PubMed: 10894308]
10. Imazio M, Cotroneo A, Gaschino G, et al. Management of heart failure in elderly people. Int J Clin Pract. 2008; 62:270–280. [PubMed: 18070044]

11. Lu FP, Lin KP, Kuo HK. Diabetes and the risk of multi-system aging phenotypes: a systematic review and meta-analysis. PLoS One. 2009; 4:e4144. [PubMed: 19127292]
12. Coll-Planas L, Denkinger MD, Nikolaus T. Relationship of urinary incontinence and late-life disability: Implications for clinical work and research in geriatrics. Z Gerontol Geriatr. 2008; 41:283–290. [PubMed: 18685805]
13. Prentice R, Rossouw J, Furberg C, et al. Design of the Women's Health Initiative clinical trial and observational study. The Women's Health Initiative Study Group. Control Clin Trials. 1998; 19:61–109. [PubMed: 9492970]
14. Hays J, Hunt JR, Hubbell FA, et al. The Women's Health Initiative recruitment methods and results. Ann Epidemiol. 2003; 13:S18–77. [PubMed: 14575939]
15. Mohile SG, Xian Y, Dale W, et al. Association of a cancer diagnosis with vulnerability and frailty in older Medicare beneficiaries. J Natl Cancer Inst. 2009; 101:1206–1215. [PubMed: 19638506]
16. Mohile SG, Fan L, Reeve E, et al. Association of cancer with geriatric syndromes in older Medicare beneficiaries. J Clin Oncol. 2011; 29:1458–1464. [PubMed: 21402608]
17. Tuunainen A, Langer RD, Klauber MR, et al. Short version of the CES-D (Burnam screen) for depression in reference to the structured psychiatric interview. Psychiatry Res. 2001; 103:261–270. [PubMed: 11549413]
18. Bjerrum L, Rosholm JU, Hallas J, et al. Methods for estimating the occurrence of polypharmacy by means of a prescription database. Eur J Clin Pharmacol. 1997; 53:7–11. [PubMed: 9349923]
19. Chen JC, Brunner RL, Ren H, et al. Sleep duration and risk of ischemic stroke in postmenopausal women. Stroke. 2008; 39:3185–3192. [PubMed: 18635832]
20. Lawton MP, Brody EM. Assessment of older people: Self-maintaining and instrumental activities of daily living. Gerontologist. 1969; 9:179–186. [PubMed: 5349366]
21. Gold R, Michael YL, Whitlock EP, et al. Race/ethnicity, socioeconomic status, and lifetime morbidity burden in the women's health initiative: A cross-sectional analysis. J Womens Health (Larchmt). 2006; 15:1161–1173. [PubMed: 17199457]
22. Ware JE Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. Med Care. 1992; 30:473–483. [PubMed: 1593914]
23. Weng HY, Hsueh YH, Messam LL, et al. Methods of covariate selection: directed acyclic graphs and the change-in-estimate procedure. Am J Epidemiol. 2009; 169:1182–1190. [PubMed: 19363102]
24. Scuteri A, Spazzafumo L, Cipriani L, et al. Depression, hypertension, and comorbidity: disentangling their specific effect on disability and cognitive impairment in older subjects. Arch Gerontol Geriatr. 2011; 52:253–257. [PubMed: 20416961]
25. Boult C, Murphy J, Sloane P, et al. The relation of dizziness to functional decline. J Am Geriatr Soc. 1991; 39:858–861. [PubMed: 1885859]
26. Crews JE, Campbell VA. Vision impairment and hearing loss among community-dwelling older Americans: Implications for health and functioning. Am J Public Health. 2004; 94:823–829. [PubMed: 15117707]
27. Johnell O, Kanis J. Epidemiology of osteoporotic fractures. Osteoporos Int. 2005; 16 (Suppl 2):S3–7. [PubMed: 15365697]
28. Dam TT, Ewing S, Ancoli-Israel S, et al. Association between sleep and physical function in older men: The osteoporotic fractures in men sleep study. J Am Geriatr Soc. 2008; 56:1665–1673. [PubMed: 18759758]
29. Cao YJ, Mager DE, Simonsick EM, et al. Physical and cognitive performance and burden of anticholinergics, sedatives, and ACE inhibitors in older women. Clin Pharmacol Therapeutics. 2008; 83:422–429.
30. Anpalahan M, Gibson SJ. Geriatric syndromes as predictors of adverse outcomes of hospitalization. Intern Med J. 2008; 38:16–23. [PubMed: 17542997]
31. Sanchez E, Vidan MT, Serra JA, et al. Prevalence of geriatric syndromes and impact on clinical and functional outcomes in older patients with acute cardiac diseases. Heart. 2011; 97:1602–1606. [PubMed: 21795299]

32. Di Bari M, Virgillo A, Matteuzzi D, et al. Predictive validity of measures of comorbidity in older community dwellers: The Insufficienza Cardiaca negli Anziani Residenti a Dicomano Study. J Am Geriatr Soc. 2006; 54:210–216. [PubMed: 16460370]
33. Seeman TE, Bruce ML, McAvay GJ. Social network characteristics and onset of ADL disability: MacArthur studies of successful aging. J Gerontol B Psychol Sci Soc Sci. 1996; 51:S191–200. [PubMed: 8673648]
34. Choi NG, Schlichting-Ray L. Predictors of transitions in disease and disability in pre- and early-retirement populations. J Aging Health. 2001; 13:379–409. [PubMed: 11813732]
35. Dunlop DD, Manheim LM, Song J, et al. Incidence of disability among preretirement adults: the impact of depression. Am J Public Health. 2005; 95:2003–2008. [PubMed: 16254232]
36. Clark DO, Stump TE, Hui SL, et al. Predictors of mobility and basic ADL difficulty among adults aged 70 years and older. J Aging Health. 1998; 10:422–440. [PubMed: 10346693]
37. Hajjar ER, Cafiero AC, Hanlon JT. Polypharmacy in elderly patients. Am J Geriatr Pharmacother. 2007; 5:345–351. [PubMed: 18179993]
38. Anstey KJ, Burns R, Butterworth P, et al. Cardiovascular risk factors and life events as antecedents of depressive symptoms in middle and early-old age: PATH Through Life Study. Psychosom Med. 2009; 71:937–943. [PubMed: 19834045]
39. Kuo HK, Lipsitz LA. Cerebral white matter changes and geriatric syndromes: Is there a link? J Gerontol A Biol Sci Med Sci. 2004; 59:818–826. [PubMed: 15345732]
40. Gassmann KG, Rupprecht R. Dizziness in an older community dwelling population: A multifactorial syndrome. J Nutr Health Aging. 2009; 13:278–282. [PubMed: 19262968]
41. Van Eyken E, Van Camp G, Van Laer L. The complexity of age-related hearing impairment: contributing environmental and genetic factors. Audiol Neuro-otol. 2007; 12:345–358.
42. Watson GR. Low vision in the geriatric population: Rehabilitation and management. J Am Geriatr Soc. 2001; 49:317–330. [PubMed: 11300245]
43. Sandhu SK, Hampson G. The pathogenesis, diagnosis, investigation and management of osteoporosis. J Clin Pathol. 2011; 64:1042–1050. [PubMed: 21896577]
44. Gnjidic D, Hilmer SN, Blyth FM, et al. High-risk prescribing and incidence of frailty among older community-dwelling men. Clin Pharmacol Ther. 2012; 91:521–528. [PubMed: 22297385]
45. Vaz Fragoso CA, Gill TM. Sleep complaints in community-living older persons: A multifactorial geriatric syndrome. J Am Geriatr Soc. 2007; 55:1853–1866. [PubMed: 17916123]
46. Ungar A, Mussi C, Del Rosso A, et al. Diagnosis and characteristics of syncope in older patients referred to geriatric departments. J Am Geriatr Soc. 2006; 54:1531–1536. [PubMed: 17038070]
47. Rapp SR, Espeland MA, Shumaker SA, et al. Effect of estrogen plus progestin on global cognitive function in postmenopausal women: The Women's Health Initiative Memory Study: A randomized controlled trial. JAMA. 2003; 289:2663–2672. [PubMed: 12771113]
48. Dodge HH, Kadowaki T, Hayakawa T, et al. Cognitive impairment as a strong predictor of incident disability in specific ADL-IADL tasks among community-dwelling elders: The Azuchi Study. Gerontologist. 2005; 45:222–230. [PubMed: 15799987]
49. Purser JL, Fillenbaum GG, Pieper CF, et al. Mild cognitive impairment and 10-year trajectories of disability in the Iowa Established Populations for Epidemiologic Studies of the Elderly cohort. J Am Geriatr Soc. 2005; 53:1966–1972. [PubMed: 16274380]
50. Rodrigues MA, Facchini LA, Thume E, et al. Gender and incidence of functional disability in the elderly: A systematic review. Cadernos de saude publica / Ministerio da Saude, Fundacao Oswaldo Cruz, Escola Nacional de Saude Publica. 2009; 25 (Suppl 3):S464–476.

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J Am Geriatr Soc. Author manuscript; available in PMC 2014 March 01.

Table 1

Baseline characteristics of women aged 65 years and older from the Women's Health Initiative Observational Study by number of geriatric syndromes (GS)*

	Total (n=29544)	0 GS (n=6771)	1 GS (n=8586)	2 GS (n=6635)	3 GS (n=3718)	4 GS (n=1780)	5+ GS (n=1040)
Prevalence (%)		23.7	30.1	23.3	13.0	6.2	3.7
Mean (SD) Age (years)	70.1 (3.7)	69.5 (3.5)	70.0 (3.6)	70.2 (3.7)	70.6 (3.8)	70.8 (3.8)	71.0 (3.9)
Mean (SD) Charlson score	0.95 (0.90)	0.67 (0.74)	0.84 (0.81)	1.02 (0.90)	1.16 (0.95)	1.34 (1.00)	1.60 (1.12)
Mean (SD) Pain score	74.9 (23.0)	83.6 (18.1)	78.2 (20.9)	72.9 (22.9)	67.7 (24.1)	61.9 (24.9)	53.2 (25.9)
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Race							
Caucasian	25802 (87.6)	5897 (87.5)	7545 (88.1)	5814 (87.9)	3282 (88.6)	1576 (89.0)	898 (86.5)
African American	1584 (5.4)	360 (5.3)	436 (5.1)	346 (5.2)	189 (5.1)	88 (5.0)	54 (5.2)
Hispanic	668 (2.3)	129 (1.9)	176 (2.1)	142 (2.2)	71 (1.9)	47 (2.7)	39 (3.8)
Asian	954 (3.2)	253 (3.8)	299 (3.5)	203 (3.1)	121 (3.3)	36 (2.0)	15 (1.5)
American Indian	91 (0.3)	18 (0.3)	18 (0.2)	25 (0.4)	14 (0.4)	6 (0.3)	6 (0.6)
Other	349 (1.2)	84 (1.3)	95 (1.1)	86 (1.3)	29 (0.8)	18 (1.0)	26 (2.5)
Marital Status							
Never Married	1170 (4.0)	284 (4.2)	338 (4.0)	260 (3.9)	140 (3.8)	83 (4.7)	25 (2.4)
Divorced/Separated	3530 (12.0)	810 (12.0)	977 (11.4)	771 (11.7)	462 (12.5)	223 (12.6)	145 (14.0)
Widowed	7804 (26.5)	1575 (23.4)	2194 (25.7)	1820 (27.5)	1053 (28.4)	514 (29.0)	338 (32.6)
Married/ Cohabitating	16917 (57.5)	4076 (60.4)	5042 (59.0)	3758 (56.9)	2049 (55.3)	951 (53.7)	529 (51.0)
Education							
< High school	1594 (5.4)	259 (3.9)	399 (4.7)	351 (5.3)	242 (6.6)	131 (7.4)	97 (9.4)
High school diploma	5322 (18.1)	1187 (17.7)	1517 (17.8)	1211 (18.4)	675 (18.3)	319 (18.0)	215 (20.9)
Some college or technical school	11003 (37.5)	2418 (36.0)	3239 (38.0)	2506 (38.0)	1366 (37.0)	710 (40.1)	406 (39.4)
College degree	3337 (11.4)	859 (12.8)	1010 (11.8)	737 (11.2)	387 (10.5)	166 (9.4)	84 (8.2)
Post-graduate degree	8088 (27.6)	2000 (29.8)	2369 (27.8)	1783 (27.1)	1026 (27.8)	444 (25.1)	229 (22.2)
Income							
< $50,000	19104 (70.5)	4131 (66.7)	5423 (68.6)	4388 (71.9)	2483 (72.4)	1259 (77.2)	776 (81.6)
$50–74,999	4512 (16.7)	1133 (18.3)	1397 (17.7)	968 (15.9)	565 (16.5)	217 (13.3)	103 (10.8)
$75–99,999	1763 (6.5)	479 (7.7)	544 (6.9)	366 (6.0)	195 (5.7)	88 (5.4)	39 (4.1)

	Total (n=29544)	0 GS (n=6771)	1 GS (n=8586)	2 GS (n=6635)	3 GS (n=3718)	4 GS (n=1780)	5+ GS (n=1040)
> $100,000	1709 (6.3)	452 (7.3)	538 (6.8)	382 (6.3)	185 (5.4)	66 (4.1)	33 (3.5)
Smoking							
Never	15820 (54.3)	3784 (56.5)	4597 (54.3)	3477 (53.1)	1924 (52.4)	931 (52.9)	578 (56.4)
Former	12062 (41.4)	2606 (38.9)	3503 (41.3)	2810 (42.9)	1609 (43.8)	750 (42.6)	397 (38.7)
Current	1252 (4.3)	306 (4.6)	373 (4.4)	260 (4.0)	142 (3.9)	78 (4.4)	50 (4.9)

*includes total number of high depressive symptoms, dizziness, falls, hearing impairment, osteoporosis, polypharmacy, sleep disturbance, syncope, urinary incontinence, and visual impairment

**all p-values comparing across number of geriatric syndromes are <0.001

Table 2

Baseline prevalence (percent) and 95% confidence interval (CI) of individual geriatric syndromes (GS) by GS total for women aged 65 years and older from the Women's Health Initiative Observational Study at baseline.

	Total Prevalence (n=29544)	1 GS (n=8586)	2 GS (n=6635)	3 GS (n=3718)	4 GS (n=1780)	5+ GS (n=1040)
	Prevalence (95% CI)	Prevalence (95% CI)	Prevalence (95% CI)	Prevalence (95% CI)	Prevalence (95% CI)	Prevalence (95% CI)
Depressive symptoms	8.0 (7.7, 8.3)	3.4 (3.0, 3.8)	8.2 (7.5, 8.9)	14.4 (13.3, 15.6)	24.5 (22.5, 26.5)	44.5 (41.5, 47.5)
Dizziness	18.6 (18.1, 19.0)	9.0 (8.4, 9.6)	21.3 (20.3, 22.3)	36.8 (35.2, 38.3)	53.1 (50.8, 55.4)	74.5 (71.9, 77.2)
Falls	11.3 (10.9, 11.6)	5.8 (5.3, 6.3)	13.2 (12.4, 14.0)	21.4 (20.1, 22.7)	30.7 (28.6, 32.9)	46.7 (43.7, 49.8)
Hearing Impairment	29.2 (28.6, 29.7)	21.9 (21.0, 22.8)	38.6 (37.4, 39.8)	53.0 (51.4, 54.6)	64.1 (61.9, 66.3)	73.4 (70.7, 76.1)
Osteoporosis	11.8 (11.4, 12.1)	7.5 (6.9, 8.0)	14.1 (13.3, 15.0)	21.7 (20.4, 23.0)	29.3 (27.2, 31.4)	39.9 (36.9, 42.9)
Polypharmacy	22.0 (21.6, 22.5)	14.1 (13.4, 14.8)	28.6 (27.5, 29.7)	41.3 (39.8, 42.9)	53.0 (50.7, 55.4)	68.2 (65.3, 71.0)
Sleep Disturbance	7.7 (7.4, 8.0)	4.3 (3.9, 4.7)	9.2 (8.5, 9.9)	14.4 (13.3, 15.6)	19.3 (17.4, 21.1)	31.0 (28.2, 33.8)
Syncope	2.4 (2.2, 2.6)	1.0 (0.8, 1.2)	2.4 (2.1, 2.8)	4.3 (3.7, 5.0)	7.8 (6.5, 9.0)	13.7 (11.6, 15.7)
Urinary Incontinence	29.3 (28.8, 29.9)	22.3 (21.5, 23.2)	39.3 (38.1, 40.4)	52.9 (51.3, 54.5)	62.6 (60.4, 64.9)	73.8 (71.1, 76.4)
Visual Impairment	20.5 (20.0, 20.9)	10.7 (10.1, 11.4)	25.1 (24.1, 26.1)	39.7 (38.2, 41.3)	55.6 (53.3, 57.9)	74.3 (71.7, 77.0)

J Am Geriatr Soc. Author manuscript; available in PMC 2014 March 01.

Table 3

Baseline prevalence (percent) and 95% confidence interval of individual geriatric syndromes (GS) among women aged 65 years and older from the Women's Health Initiative Observational Study (n=29544). Table is to be read horizontally; for example, among women who had depressive symptoms, 32.3% also had dizziness.

	Depressive symptoms	Dizziness	Falls	Hearing Impairment	Osteoporosis	Polypharmacy	Sleep Disturbance	Syncope	UI	Visual Impairment
Overall Prevalence	8.0 (7.7, 8.3)	18.6 (18.1, 19.0)	11.3 (10.9, 11.6)	29.2 (28.6, 29.7)	11.8 (11.4, 12.1)	22.0 (21.6, 22.5)	7.7 (7.4, 8.0)	2.4 (2.2, 2.6)	29.3 (28.8, 29.9)	20.5 (20.0, 20.9)
Depressive symptoms	--	32.3 (30.4, 34.2)	16.6 (15.1, 18.1)	35.2 (33.3, 37.2)	14.5 (13.1, 15.9)	31.2 (29.4, 33.1)	18.0 (16.4, 19.5)	3.9 (3.1, 4.7)	37.5 (35.5, 39.4)	33.0 (31.1, 34.9)
Dizziness	13.9 (13.0, 14.9)	--	16.1 (15.1, 17.0)	38.8 (37.5, 40.1)	14.2 (13.3, 15.2)	29.8 (28.5, 31.0)	10.8 (10.0, 11.7)	5.6 (5.0, 6.2)	36.1 (34.8, 37.3)	33.0 (31.7, 34.2)
Falls	11.8 (10.7, 12.9)	26.5 (25.0, 28.0)	--	34.8 (33.2, 36.5)	15.2 (14.0, 16.4)	27.7 (26.2, 29.2)	9.7 (8.7, 10.8)	6.0 (5.1, 6.8)	38.1 (36.5, 39.8)	28.3 (26.8, 29.9)
Hearing Impairment	9.7 (9.1, 10.3)	24.7 (23.8, 25.6)	13.5 (12.7, 14.2)	--	13.6 (12.9, 14.3)	24.9 (24.0, 25.8)	8.5 (7.9, 9.1)	2.4 (2.1, 2.7)	34.1 (33.1, 35.2)	29.2 (28.2, 30.1)
Osteoporosis	9.9 (8.9, 10.9)	22.6 (21.2, 24.1)	14.7 (13.5, 15.8)	33.9 (32.3, 35.5)	--	29.9 (28.4, 31.4)	9.5 (8.5, 10.5)	3.5 (2.9, 4.1)	33.8 (32.2, 35.4)	24.5 (23.0, 25.9)
Polypharmacy	11.4 (10.6, 12.1)	25.1 (24.0, 26.1)	14.2 (13.3, 15.0)	33.0 (31.8, 34.1)	15.9 (15.0, 16.8)	--	8.5 (7.8, 9.2)	3.3 (2.9, 3.8)	37.7 (36.5, 38.9)	26.0 (24.9, 27.0)
Sleep Disturbance	18.7 (17.1, 20.3)	26.2 (24.4, 28.0)	14.2 (12.8, 15.7)	32.3 (30.4, 34.2)	14.5 (13.0, 15.9)	24.3 (22.5, 26.0)	--	3.3 (2.6, 4.1)	32.2 (30.3, 34.1)	25.6 (23.8, 27.4)
Syncope	13.0 (10.5, 15.5)	43.2 (39.5, 46.8)	27.8 (24.5, 31.1)	28.7 (25.3, 32.0)	16.8 (14.0, 20.0)	30.4 (27.0, 33.8)	10.6 (8.4, 12.9)	--	34.2 (30.7, 37.7)	26.9 (23.6, 30.2)
Urinary Incontinence	10.2 (9.6, 10.9)	22.9 (22.0, 23.8)	14.6 (13.9, 15.4)	33.9 (32.9, 34.9)	13.6 (12.8, 14.3)	28.3 (27.3, 29.2)	8.5 (7.9, 9.1)	2.8 (2.5, 3.2)	--	24.6 (23.7, 25.5)
Visual Impairment	12.9 (12.0, 13.7)	29.8 (28.7, 31.0)	15.6 (14.7, 16.5)	41.5 (40.2, 42.7)	14.0 (13.1, 14.9)	27.9 (26.8, 29.1)	9.6 (8.8, 10.3)	3.2 (2.7, 3.6)	35.3 (34.1, 36.5)	--

Table 4

Risk Ratios (RR) and 95% confidence intervals (CI) for total number or type of geriatric syndrome (GS) at baseline and 3-year incidence of ADL disability for women aged 65 years and older from the Women's Health Initiative Observational Study (n=29544)

	RR Adjusted	95% CI	RR Adjusted + Charlson	95% CI	RR Adjusted+ Pain	95% CI
0 GS	1.0		1.0		1.0	
1 GS	1.21	0.78, 1.87	1.14	0.73, 1.76	1.05	0.68, 1.63
2 GS	1.56	1.01, 2.41	1.32	0.85, 2.04	1.21	0.78, 1.87
3 GS	3.41	2.25, 5.17	2.70	1.77, 4.13	2.41	1.57, 3.68
4 GS	4.98	3.21, 7.73	3.76	2.40, 5.89	3.17	2.01, 4.98
5 GS	6.64	4.15, 10.62	4.67	2.88, 7.56	3.63	2.22, 5.94
Depressive symptoms	2.41	1.82, 3.20	2.10	1.58, 2.79	1.75	1.32, 2.34
Dizziness	2.01	1.59, 2.56	1.73	1.35, 2.20	1.58	1.24, 2.02
Falls	2.03	1.54, 2.67	1.85	1.41, 2.44	1.71	1.30, 2.25
Hearing Impairment	1.46	1.04, 1.66	1.24	0.98, 1.57	1.20	0.95, 1.52
Osteoporosis	2.04	1.56, 2.67	1.69	1.29, 2.23	1.65	1.26, 2.16
Polypharmacy	2.45	1.96, 3.07	1.95	1.54, 2.46	1.88	1.12, 1.50
Sleep Disturbance	1.44	1.01, 2.07	1.27	0.88, 1.82	1.13	0.79, 1.62
Syncope	1.94	1.13, 3.33	1.77	1.04, 3.02	1.54	0.90, 2.63
Urinary Incontinence	1.44	1.15, 1.81	1.27	1.00, 1.60	1.20	0.95, 1.51
Visual Impairment	1.74	1.37, 2.21	1.60	1.26, 2.04	1.49	1.17, 1.89

Adjusted by age, income, smoking status

Table 5

Prevalence of geriatric syndromes (GS) at baseline (n=29544) and year 3 follow-up (n=22099) and associations (relative risk (RR) and 95% confidence interval (CI)) with activities of daily living at follow-up among women aged 65 years and older from the Women's Health Initiative Observational Study

Number of GS*	Baseline – N (%)	Follow-up – N (%)	Baseline RR**	Baseline 95% CI	Follow-up RR**	Follow-up 95% CI
0	6768 (23.7)	3426 (15.5)	Ref	--	Ref	--
1	8582 (30.1)	5675 (25.7)	1.21	0.78, 1.87	1.04	0.51, 2.11
2	6635 (23.3)	5497 (24.9)	1.56	1.01, 2.41	1.87	0.98, 3.55
3	3716 (13.0)	3741 (16.9)	3.41	2.25, 5.17	2.71	1.42, 5.14
4	1780 (6.2)	2182 (9.9)	4.98	3.21, 7.73	3.28	1.68, 6.41
5+	1040 (3.7)	1578 (7.1)	6.64	4.15, 10.62	7.93	4.26, 14.79

*includes total number of high depressive symptoms, dizziness, falls, hearing impairment, osteoporosis, polypharmacy, sleep disturbance, syncope, urinary incontinence, and visual impairment

**adjusted for age, income and smoking status