Published in final edited form as:
Spine (Phila Pa 1976). 2007 December 15; 32(26): E809–E815. doi:10.1097/BRS.0b013e31815cd422.

From Chronic Low Back Pain to Disability, a Multifactorial Mediated Pathway:

The InCHIANTI Study

Angelo Di Iorio, MD, PhD, MPH[*], **Michele Abate, MD**[†], **Jack M. Guralnik, MD, PhD**[‡], **Stefania Bandinelli, MD**[§], **Francesca Cecchi, MD**[¶], **Antonio Cherubini, MD, PhD**[**], **Andrea Corsonello, MD**[††], **Nunzia Foschini, MD**[*], **Marianna Guglielmi, MD**[*], **Fulvio Lauretani, MD**[‡‡], **Stefano Volpato, MD, MPH**[§§], **Giuseppe Abate, MD**[*], and **Luigi Ferrucci, MD, PhD**[¶¶]

[*]Department of Medicine and Sciences of Aging, Laboratory of Clinical Epidemiology, University "G. D'Annunzio" Chieti, Italy

[†]Department of Medicine and Sciences of Aging, Post graduate school of Physical Medicine and Rehabilitation, University "G. D'Annunzio" Chieti, Italy

[‡]Demography and Biometry, Laboratory of Epidemiology, National Institute on Aging, National Institutes of Health, Bethesda

[§]Geriatric Rehabilitation Unit, Azienda Sanitaria di Firenze, Florence, Italy

[¶]Fondazione Don Carlo Gnocchi, Institute for Recovery and Care with Scientific Character, Florence

[**]Institute of Gerontology and Geriatric, University of Perugia, Perugia Italy;

[††]Geriatric Unit, Istituto Nazionale di Ricovero e Cura per Anziani, Cosenza Italy

[‡‡]Laboratory of Clinical Epidemiology, Tuscany Regional Health Agency, Florence, Italy

[§§]Department of Clinical and Experimental Medicine University of Ferrara, Italy

[¶¶]Longitudinal Studies Section, Clinical Research Branch, National Institute on Aging, NIH, Baltimore, MD

Abstract

Study Design—Clinicoepidemiologic study in the Chianti area (Tuscany, Italy).

Objective—To evaluate whether performance measures of lower extremity function confounds the association of low back pain (LBP) with self-report disability in specific basic and instrumental activities of daily living (IADLs).

Summary of Background Data—LBP is high prevalent in older population and has a negative impact on functional status. Studies on the pathway leading from LBP to disability are limited and often the role played by important confounders is not considered.

Methods—A total of 956 InCHIANTI study participants aged 65 and older able to complete performance-based tests of lower extremity function were included in this analysis. LBP was defined as a self-report of back pain "quite often-almost every day" in the past 12 months. Lower extremity function was evaluated administering the Short Physical Performance Battery. In addition, participants were asked to walk on a 7-m course and collect an object from the ground. Depressive

Address correspondence and reprint request to Angelo Di Iorio, MD, PhD, MPH, Department of Medicine and Sciences of Aging, Laboratory of Clinical Epidemiology, Geriatric Unit, University "G. D'Annunzio" Chieti, Via dei Vestini 5, 66013 Chieti Scalo, Italy; E-mail: E-mail: a.diiorio@unich.it.

The manuscript submitted does not contain information about medical device(s)/drug(s).

symptoms (CES-D score), trunk flexion–extension range of motion, and hip–knee–foot pain were also considered in the pathway from LBP to disability.

Results—Compared with participants who did not report LBP, those with LBP were more likely to report difficulty in performing most activities of daily living. LBP was also associated with disability in the activities of bathing, doing the laundry, performing heavy household chores, cutting toenails, shopping, and carrying a shopping bag. The association between LBP and disability in selected ADLs and IADLs was no longer statistical significant, after adjustment for performance in lower extremity function, with exception of the activity of “carrying a shopping bag”.

Conclusion—The cross-sectional association between LBP and self-reported disability, in specific tasks is modulated by performance measures. Specific performance-based tests that explore the functional consequences of LBP may help design specific interventions of disability prevention and treatment in patients with LBP.

Keywords

back pain; physical performance; disability; elderly; InCHIANTI study

Studies have suggested that low back pain (LBP) has a negative impact on functional status and working ability in the young and adult population.[1,2] Despite the high prevalence of LBP in the older population,[3–5] data on the impact of LBP on functional status and disability in older persons is limited.[6,7]

The causal pathway leading from disease to disability is complex and multifactorial. Conditions such as osteoarthritis of the facet joints, degenerative disc disease, spinal stenosis, vertebral fractures, postural abnormalities, and other musculoskeletal disorders may all contribute to LBP in older individuals. In addition, other diseases and conditions not directly affecting the musculoskeletal system may cause physical and cognitive impairment, in older persons, thereby contributing to disability. Thus, when determining the independent impact of LBP on functional status in older individuals, adjustment for multiple potential confounders and intermediate factors in the causal pathway to disability becomes very important.[8,9]

In previous studies, conducted in older persons, the effect of LBP on physical function has been mainly explored by self-report questionnaire. Therefore, the impact of LBP on performance based measure of physical function remains largely unknown.[10–14] Only in few studies physical function was assessed using objective tests. Studying older disabled women, Leveille *et al* found that, LBP was associated with lower usual pace gait speed, knee extension and hip flexion strength and longer chair stand time, with a linear relationship between severity of pain and impaired physical performance.[13] Weiner *et al* included in their analysis only well-functioning older adults and observed that LBP frequency/intensity were associated with perceived difficulty in performing important functional tasks, but not with observed physical performance.[14] In the same population, participants who reported intense BP experienced a more pronounced decline of physical function over time than those who did not report this symptom.[15]

More recently, using data from a prospective study, Reid *et al* reported that LBP causing activity restriction (restricting LBP) was independently associated with accelerated decline in lower extremity physical function among community-dwelling older persons.[1]

The InCHIANTI study offers an unique opportunity for studying the effects of LBP on physical function and disability in a large representative cohort of persons with different level of health and functional status. Recently, Cecchi *et al*, have shown that 7.4% of the overall InCHIANTI study population had LBP-related functional limitation; LBP participants were significantly more likely to report difficulty in heavy household chores, carrying a shopping bag, cutting toenails, and using public transportation.[16] Continuing this line of investigation, the aim of our analysis was twofold:

1. Study the relationship of self-reported difficulty/inability to perform basic and instrumental activity of daily living (BADL, IADL) with self-report of LBP and performance based measures of lower extremity function and axial mobility;
2. Verify the hypothesis that the relationship between LBP and self-report disability in specific tasks is confounded by physical performance.

Materials and Methods

Subjects

Data are from the population-based InCHIANTI Study, an epidemiological survey conducted in the Chianti geographic area (Tuscany, Italy), and aimed at studying factors affecting mobility in late life. The characteristics of the study population and assessment methods are reported in details else-where.[17] In 1998, a representative cohort of 1270 persons aged 65 or more was randomly selected from the registries of Greve in Chianti (rural area) and Bagno a Ripoli (urban area near Florence). Study participants responded to a structured home interview and underwent a full medical, neurological, and functional examination.

The final study population included 958 persons (531 women and 427 men), who had complete information for the variables considered in this analysis. Participants who were unable to complete the performance-based tests of mobility, and those with severe cognitive impairment (MMSE ≤20) were excluded from the analysis.

LBP Assessment and Characteristics

Participants were asked whether they had any BP episodes and how often over the last 12 months. For the purpose of this study, BP was defined as the presence of frequent pain (quite often–almost every day).[16] Moreover, participants who reported frequent BP were asked to estimate the pain severity on a visuo-analogic scale from 0 to 10, and to provide information on the location of pain, use of painkillers (past 2 weeks), activities that triggered BP, and functional limitation due to BP over the last month.

Self-reported Functional Assessment

Six BADLs and 12 IADLs were collected by means of a self-reported questionnaire.[18]

Subjects who reported difficulty, but not need for help, and those who reported needing another person's help in performing BADLs and IADLs were classified, respectively, as “having a difficulty” and “having a clinical disability” for that specific activity.

Objective Based Functional Assessment

Lower extremity function was evaluated administering the Short Physical Performance Battery (SPPB), which includes tests of walking speed, standing balance, and ability to rise from a chair. The results of each test were scored on a 5-level categorical scale, with 0 representing inability to complete the test and 4 representing the highest level of performance. Adding the scores of the 3 performance tests produced a summary score ranging from 0 to 12.[19]

Mobility was assessed using the 7-m walking test, while collecting an object from the ground. To evaluate the trunk range of motion (ROM), the subjects were invited to stay upright, in a relaxed position, knees straight, arms hanging by the side; the trunk flexion–extension were estimated by means of the excursion of the distance between C7 and S2.[20]

Clinical Conditions

The diagnosis of major medical condition was ascertained according to preestablished criteria that combined information from medical history, physical examination, blood tests, and medical records. Disease ascertained and used as confounders in this analysis included hypertension, peripheral artery diseases, diabetes, stroke, cancer, and cardiovascular disease.[25] Joint pain in the hip, knee, or foot was evaluated by self-report. Depressive symptoms were assessed using the Center for Epidemiologic Studies Depression Scale (CES-D).[26]

Objectively measured height and weight were used to calculate body mass index (kg/m^2).

Statistical Analysis

Continuous variables were reported as mean values ± standard error, and ordinal/categorical variables as percentages. Differences among groups (according to LBP presence and to self-reported disability level) were evaluated by generalized linear model for continuous variables and with χ^2 test for dichotomous or categorical variables. *P*-values for descriptive analysis and for the association between LBP, and difficulty or need for help performing in BADL and/or IADL were adjusted for age and sex.

Differences in physical performance tests (SPPB score, walking bending down, trunk flexion–extension) and in CES-D depressive symptoms score, according to disability level (difficulty or need for help in performing activities of daily living) were tested in age and sex adjusted linear model.

Differences in SPPB subscores between participants who reported and did not reported LBP were tested in linear models. Separate models were fitted for each of the lower extremity performance subtests (rising from the chair 5 times, balance, and walking). After the preliminary unadjusted regression model, analyses were adjusted for age and sex and then also for depressive symptoms, comorbidity, nonsteroidal antiinflammatory drugs (NSAIDs) use and hip–knee–foot pain.

The confounding effect of physical performance (SPPB score and speed in walking bending down), trunk ROM (flexion and extension), hip–knee–foot pain, and CES-D score, on the association of LBP and self-reported disability, was tested in 5 different logistic models.

In all the 5 models the association between LBP and self-reported disability was corrected for age and sex, because these 2 variables strongly affected the risk of disability.

Additionally, a different set of covariates was introduced in each model, to assess their confounding effect. Specifically the SPPB score was introduced in model 2, the speed on 7-m walk bending down was introduced in model 3, the flexion–extension trunk ROM was introduced in the hip–knee–foot pain, and CES-D score was introduced in model 5.

All analyses were performed using the SAS statistical package version 8.2 (SAS Institute, Inc., Cary, NC).

Results

Overall, 306 of 958 participants (31.9%) considered in this study reported LBP. The prevalence of LBP was significantly higher in women (LBP presence: 209/306, 68.3%; 322/652, 49.4%) than in men (LBP presence: 97/306, 31.7%; 330/652, 50.6%) ($P < 0.001$). The likelihood of reporting frequent LBP was independent of age.

The prevalence of heart disease, peripheral artery disease, hypertension, diabetes, stroke, and cancer was similar in participants with and without LBP. As previously reported in this same population, hip, knee, and foot pain were substantially and significantly more prevalent in participants with LBP than in those without LBP (Table 1). Analogously, NSAIDs were more extensively used by participants with LBP than in those without LBP (14.4% *vs.* 4.9%, $P < 0.001$).

Both in men and women, those who reported LBP had statistically more severe symptomatic depression scores than those who did not report LBP (no LBP, M 9.2 ± 7.1; F 13.5 ± 8.4; $P < 0.001$; LBP, M 10.6 ± 7.2; F 17.5 ± 9.5; $P < 0.001$).

Participants with and without LBP reported similar disability levels in both BADLs and IADLs. Subjects with LBP, compared with controls, reported a higher prevalence of difficulty in performing almost all explored ADL and IADL with the exclusion of washing hands and face, eating, cooking, using the toilet, lying down and raising from bed, and performing light household chores (Table 2).

Prevalence of self-reported "clinical disability" in selected BADLs and IADLs, including indoor mobility, outdoor mobility, climbing/descending stairs, walking 400 m, washing hands and face, dressing/undressing, eating, cooking, using the toilet, going to/rising from bed, light household chores, and using public transportation, were similar in those who did and did not reported LBP (Table 2).

Participants who reported difficulty and those who reported disability in performing BADLs had significantly lower scores in the performance tests and a higher CES-D score, compared with those who reported no difficulty (Table 3) although the difference between mean values was small. No significant interaction between disability level and presence of LBP could be found in physical performance tests score. On the contrary, in the relationship between LBP and disability level we found a significant interaction between CES-D score and LBP ($P < 0.001$), independent from age and sex (data not shown).

Analyzing separately the SPPB subscores (Table 4), participants with LBP compared with those without LBP had worse performance only in the 5 chair stand test and the difference remained significant also after adjustment for age and sex (model 2) and after adjustment for age, sex, CES-D score, comorbidities, NSAID chronic treatment, and hip–knee–foot pain (model 3).

In an additional analysis, we tested the hypothesis that the relationship between LBP and disability could be mediated by the impact of LBP on specific lower extremity performances (Table 5). Independent of age and sex, self-report of LBP was associated with needing another person's help in performing several activities of daily living. However, when the scores of the performance tests, trunk flexion–extension ROM, hip–knee–foot pain, and depression were introduced as covariates in the models, the association of LBP with disability was substantially reduced and no longer statistically significant, with the exception of the activity of "carrying a shopping bag," which remained independently associated with LBP.

Discussion

Using data collected in a large population-based sample of persons over a wide age range, we found that LBP was associated with difficulty in performing almost all instrumental activities of daily living. Moreover, subjects who reported frequent LBP also reported more often disability in shopping, taking a bath, doing the laundry, doing heavy household chores, cutting toenails, and carrying a shopping bag compared with participants who did not report frequent LBP.

As expected, the performance in objective tests of physical function (SPPB score, speed in 7 m walk bending down, trunk extension, and trunk flexion) was substantially lower according to the level of self-reported disability, independent from age and sex.

The data reported in this study are comparable with those already reported by other investigators. In the Women's Health and Aging Study, a prospective population-based study of moderately to severely disabled older women in the East Baltimore area, Leveille *et al*[2] found that severe LBP was independently associated with difficulty in doing light housework, shopping, performing mobility tasks, and basic ADLs. Moreover, severity of LBP was associated with poorer performance in several physical performance measures: adjusted for age, weight, and height, usual-paced gait speed, and chair stand times were lower in LBP women than in their counterparts. The association was independent of multiple factors related to disability, such as chronic arthritis, performance measures of strength and function, and musculoskeletal pain.

Weiner *et al*[14] studied well-functioning older adults, aged 70 to 79 years, who did not reported difficulty walking 1/4 miles, climbing 10 steps, and performing BADL. LBP frequency/intensity was significantly associated with self-reported difficulty with most functional tasks (pulling/pushing, heavy housework, and walking a mile), but not with SPPB score, after adjusting for age, race, body mass index, CES-D score, knee and hip pain, and other comorbidities.

The participants of the InCHIANTI study were 65 or older, selected from the registries of 2 areas (rural and urban) in Tuscany region. The sample, therefore, enrolled a large cohort of males and females elderly subjects, living in the community, some healthy and others suffering of different diseases. Our sample, therefore, including subjects of both sexes and in different health status, somewhat overcomes the limitations of previous reports.

The mutual relationship between LBP, disability and physical performance is complex, and the confounding effect of performance on the LBP-disability relationship seems to be task and performance specific. The results of our study substantially confirm those of Leveille *et al*,[2] showing that the association between LBP and need for help in mobility to perform activities of daily living is almost fully attributable to the detrimental effect of LBP on physical performance.

The association between LBP and disability was substantially weakened and no longer statistically significant when the results of performance-based tests are introduced in the models. Similarly, the association was completely removed when hip–knee–foot pain and depression were introduced as covariates in the models, suggesting that limitations in other weight-bearing joints or psychological factors may play a role in the pathway between LBP and disability.

Only one activity of daily living, “carrying a shopping bag” remained independently associated to LBP after the inclusion of the covariates considered in the multivariate models. The task of “carrying a shopping bag” implies prevalently the use of muscles and joints of the upper extremity, especially when the mobility is not primarily impaired and this may explain our findings. LBP could be considered as a local expression of a systemic disease, which may be widespread to the muscloskeletal system, it is probable that a more generalized functional impairment may occur in LBP patients, as proved by the higher prevalence of lower limbs joints pain.

An alternative hypothesis could be that carrying a shopping bag imposes an higher stress on the spine; so the pathway from LBP to disability, in this case, could be mediated from the weakness and reduction of the trunk's muscles function, which stabilize the spine during the every day life task.

Successful mobility is influenced by 3 elements: the skills of the subject, the nature of the task, and the level of challenging in the environment.[23] Chronic LBP leads to a restriction in physical activity and deranges the interaction with the environment. The subtle chronic impairment related to LBP may be masked by the utilization of functional reserve and compensatory strategies, but, when patients are asked to perform particularly difficult tasks, their impending disability becomes evident. A functional limitation may become clear when a specific impairment such as reduced weight bearing capability, because of LBP cannot be counterbalanced. Through this mechanism, older adults affected by LBP may reduce their activity and over time lose progressively their functional status and their independence.

It may be discussed whether the variables taken into account must be considered as mediators or confounders. A confounder could be defined as a variable that is related both to the cause (determinant) and the effect, and a mediator as a variable that could modulate the pathway from cause to effect.[24,25] Independent from a statistical and epidemiological definition, in our analyses, the performance based tests, exploring the function of lower limbs and trunk ROM flexion–extension, hip–knee–foot pain, and depression were considered explaining the relationship between LBP and disability.

Some limitations of our study must be acknowledged. First, the assessment of pain and performance tests were referenced to different time-period, with question on LBP focused on the past year, not the day of the clinic visit when performance tests were administered. Second, we selected participants reporting LBP quite often–almost always in the 12 past months, therefore, probably including most persons affected by chronic pain. Moreover, the low prevalence of analgesic use, even if it could not be considered a good surrogate marker of pain intensity, and the relatively high functional status in our patients suggest that they had minor functional limitations. In addition, the data analyzed were cross-sectional in nature. Finally, the InCHIANTI study was not designed to evaluate specifically the LBP and the definition used could misclassify subjects potentially affected by LBP in the control group. This approach in any case was conservative, and in a worse scenario leads to a misclassification that reduces the differences between the two groups.

Our results underline the need that future studies on the functional consequences of LBP in healthy elder subjects use more complex assessment of functional capacity, which include several different types of physical challenges, including tests that directly and properly assess spine mobility.

Key Points

- To evaluate the confounding effect of performance measures of lower extremity function in the association of low back pain (LBP) with self-report disability in specific basic (BADLs) and instrumental activities of daily living (IADLs).
- LBP was defined as a self-report of back pain “quite often-almost every day” in the past 12 months.
- The association between LBP and disability in selected ADLs and IADLs was no longer statistically significant, after adjustment for physical performance, with exception of the activity of “carrying a shopping bag.”
- The mediating effect of performance measures on the association between LBP and disability was task and performance-specific.

Acknowledgments

Federal funds were received in support of this work. No benefits in any form have been or will be received from a commercial party related directly or indirectly to the subject of this manuscript.

Supported, in part, by the Intramural Research Program, National Institute on Aging, NIH, USA. Federal funds were received in support of this work.

The InCHIANTI Study is supported as a “target project” (ICS 110.1/RS97.71) by the Italian Ministry of Health and in part by the U.S. National Institute on Aging (Contracts 263_MD_9164_13 and 263_MD_821336).

References

1. Reid MC, Williams CS, Gill TM. Back pain and decline in lower extremity physical function among community-dwelling older persons. J Gerontol A Biol Sci Med Sci 2005;60:793–7. [PubMed: 15983185]
2. Leveille SG, Zhang Y, McMullen W, et al. Sex differences in musculoskeletal pain in older adults. Pain 2005;116:332–8. [PubMed: 15982814]
3. Ensrud KE, Nevitt MC, Yunis C, et al. Correlates of impaired function in older women. J Am Geriatr Soc 1994;42:481–9. [PubMed: 8176141]
4. Lavsky-Shulan M, Wallace RB, Kohout FJ, et al. Prevalence and functional correlates of low back pain in the elderly: the Iowa 65+ Rural Health Study. J Am Geriatr Soc 1985;33:23–8. [PubMed: 3155530]
5. Scudds RJ, Robertson JM. Pain factors associated with physical disability in a sample of community-dwelling senior citizens. J Gerontol A Biol Sci Med Sci 2000;55:M393–M399. [PubMed: 10898256]
6. Goubert L, Crombez G, De BI. Low back pain, disability and back pain myths in a community sample: prevalence and interrelationships. Eur J Pain 2004;8:385–94. [PubMed: 15207520]
7. Linton SJ. Occupational psychological factors increase the risk for back pain: a systematic review. J Occup Rehabil 2001;11:53–66. [PubMed: 11706777]
8. Brox JI, Storheim K, Holm I, et al. Disability, pain, psychological factors and physical performance in healthy controls, patients with sub-acute and chronic low back pain: a case-control study. J Rehabil Med 2005;37:95–9. [PubMed: 15788344]
9. Reuben DB, Valle LA, Hays RD, et al. Measuring physical function in community-dwelling older persons: a comparison of self-administered, interviewer-administered, and performance-based measures. J Am Geriatr Soc 1995;43:17–23. [PubMed: 7806733]
10. Cox ME, Asselin S, Gracovetsky SA, et al. Relationship between functional evaluation measures and self-assessment in nonacute low back pain. Spine 2000;25:1817–26. [PubMed: 10888951]
11. Fried LP, Young Y, Rubin G, et al. Self-reported preclinical disability identifies older women with early declines in performance and early disease. J Clin Epidemiol 2001;54:889–901. [PubMed: 11520648]
12. Guralnik JM, Ferrucci L. Assessing the building blocks of function: utilizing measures of functional limitation. Am J Prev Med 2003;25:112–21. [PubMed: 14552934]
13. Leveille SG, Guralnik JM, Hochberg M, et al. Low back pain and disability in older women: independent association with difficulty but not inability to perform daily activities. J Gerontol A Biol Sci Med Sci 1999;54:M487–M493. [PubMed: 10568530]
14. Weiner DK, Haggerty CL, Kritchevsky SB, et al. How does low back pain impact physical function in independent, well-functioning older adults? Evidence from the Health ABC Cohort and implications for the future. Pain Med 2003;4:311–20. [PubMed: 14750907]
15. Hicks GE, Simonsick EM, Harris TB, et al. Trunk muscle composition as a predictor of reduced functional capacity in the health, aging and body composition study: the moderating role of back pain. J Gerontol A Biol Sci Med Sci 2005;60:1420–4. [PubMed: 16339328]
16. Cecchi F, Debolini P, Lova RM, et al. Epidemiology of back pain in a representative cohort of Italian persons 65 years of age and older: the InCHIANTI study. Spine 2006;31:1149–55. [PubMed: 16648752]

17. Ferrucci L, Bandinelli S, Benvenuti E, et al. Subsystems contributing to the decline in ability to walk: bridging the gap between epidemiology and geriatric practice in the InCHIANTI study. J Am Geriatr Soc 2000;48:1618–25. [PubMed: 11129752]
18. Ferrucci L, Guralnik JM, Cecchi F, et al. Constant hierarchic patterns of physical functioning across seven populations in five countries. Gerontologist 1998;38:286–94. [PubMed: 9640848]
19. Guralnik JM, Ferrucci L, Pieper CF, et al. Lower extremity function and subsequent disability: consistency across studies, predictive models, and value of gait speed alone compared with the short physical performance battery. J Gerontol A Biol Sci Med Sci 2000;55:M221–M231. [PubMed: 10811152]
20. Sullivan MS, Dickinson CE, Troup JD. The influence of age and gender on lumbar spine sagittal plane range of motion. A study of 1126 healthy subjects. Spine 1994;19:682–6. [PubMed: 8009333]
21. Simonsick EM, Maffeo CE, Rogers SK, et al. Methodology and feasibility of a home-based examination in disabled older women: the Women's Health and Aging Study. J Gerontol A Biol Sci Med Sci 1997;52:M264–M274. [PubMed: 9310080]
22. Roberts RE, Vernon SW. The Center for Epidemiologic Studies Depression Scale: its use in a community sample. Am J Psychiatry 1983;140:41–6. [PubMed: 6847983]
23. Frank JS, Patla AE. Balance and mobility challenges in older adults: implications for preserving community mobility. Am J Prev Med 2003;25:157–63. [PubMed: 14552940]
24. Flanders WD, Khoury MJ. Indirect assessment of confounding: graphic description and limits on effect of adjusting for covariates. Epidemiology 1990;1:239–46. [PubMed: 2081259]
25. Robins J. The control of confounding by intermediate variables. Stat Med 1989;8:679–701. [PubMed: 2749074]

Table 1

Lifestyle, Psychosocial Features and Comorbidity According to Presence *Versus* Absence of Frequent Back Pain in InCHIANTI Participants

	Presence of Back Pain (n = 306)	Absence of Back Pain (n = 652)	*P*	*P**
Female sex (%)	68.3	49.4	<0.001	
Age (years) (mean ± SD)	74.5 ± 6.6	74.1 ± 7.1	0.44	
Body Mass Index (kg/m^2) (mean ± SE)	27.7 ± 0.2	27.3 ± 0.2	0.09	0.17
Heart disease (%)	11.4	10.9	0.80	0.47
Peripheral arteriopathy (%)	6.2	5.8	0.82	0.42
Hypertension (%)	63.4	62.1	0.70	0.84
Diabetes (%)	11.1	12.9	0.44	0.72
Stroke (%)	4.6	4.9	0.82	0.96
Cancer (%)	6.5	6.3	0.88	0.85
Hip pain (%)	20.3	4.5	<0.001	<0.001
Knee pain (%)	28.4	12.4	<0.001	<0.001
Foot pain (%)	32.4	16.6	<0.001	<0.001
Current use of NSAID (%)	14.4	4.9	<0.001	<0.001
MMSE (mean ± SD)	25.7 ± 2.9	25.6 ± 2.9	0.55	0.27
Depression (CES-D score) (mean ± SD)	15.3 ± 9.4	11.3 ± 8.1	<0.001	<0.001
No. ADL disabilities (mean ± SD)	0.2 ± 0.7	0.1 ± 0.5	0.19	0.17
No. IADL disabilities (mean ± SD)	0.8 ± 1.6	0.6 ± 1.6	0.04	0.10

Percentage are calculated on the total number of participants in the respective column.

*From age- and sex-adjusted linear or logistic regression models.

Table 2

Disability in Activities of Daily Living According to Presence *Versus* Absence of Frequent Back Pain Among InCHIANTI Participants Aged 65 Years and Older

	Presence of Back Pain (n = 306)		Absence of Back Pain (n = 652)			
	Difficulty	Disability	Difficulty	Disability	*P**	*P*†
Indoor mobility	8.1	2.3	4.3	1.7	0.02	0.46
Outdoor mobility	9.4	5.9	5.5	3.8	0.02	0.21
Climbing/descending stairs	27.3	5.6	13.9	3.2	<0.001	0.06
Walking 400 m	14.0	8.2	6.7	6.0	<0.001	0.25
Shopping	6.2	11.1	2.9	6.9	0.006	0.04
Washing hands and face	5.5	2.0	2.8	0.5	0.06	0.07
Bathing	6.8	10.5	3.4	7.1	0.03	0.04
Dressing/undressing	8.1	4.3	3.1	3.0	0.001	0.16
Eating	2.6	1.0	1.6	2.2	0.53	0.79
Cooking	3.6	4.3	1.1	4.1	0.07	0.91
Using the toilet	3.3	3.0	2.3	1.5	0.55	0.17
Laying down/rising from bed	5.8	2.3	3.1	2.0	0.10	0.65
Light household chores	6.5	6.9	3.8	4.5	0.21	0.07
Heavy household chores	12.7	20.0	6.7	11.7	0.004	0.001
Cutting toe nails	22.7	23.2	12.7	15.3	<0.001	<0.001
Carrying shopping bag	20.8	21.2	13.2	8.7	<0.001	<0.001
Laundry	10.1	9.5	4.3	6.1	0.004	0.01
Using public transportation	10.1	16.7	5.2	11.5	0.009	0.06

Subjects who reported difficulty, but not need for help, and those who reported needing another person's help in performing basic and instrumental activities of daily living were classified, respectively, as having a "difficulty" and having a clinical "disability" for that specific activity.

All results are expressed as percentage and are calculated on the total number of person in the respective column.

All *P* values were age and sex adjusted.

* For the comparison between participants who referred difficulty and those who were fully autonomous.

† For the comparison between participants who referred disability and those who were fully autonomous.

Table 3

Differences in Performance Test and Trunk Flexion According to Disability Level Only in Subjects Reporting Low Back Pain

	No Disability (110)	Difficulty (76)	Disability (120)	*P* (1 *vs.* 2)	*P* (1 *vs.* 3)	*P* (2 *vs.* 3)
SPPB score	11.2 ± 0.1	10.5 ± 0.2	7.3 ± 0.4	0.41	<0.001	<0.001
Speed on 7 m walk bending down (m/s)	1.0 ± 0.1	0.9 ± 0.1	0.5 ± 0.1	0.002	<0.001	<0.001
Trunk extension (cm)	3.1 ± 0.2	2.8 ± 0.1	2.2 ± 0.1	0.73	0.10	0.12
Trunk flexion (cm)	6.3 ± 0.2	5.8 ± 0.1	4.9 ± 0.1	0.57	0.15	0.41
CES-D score	10.8 ± 0.7	15.4 ± 1.1	19.6 ± 0.9	0.005	<0.001	0.05

Subjects who reported difficulty, but not need for help, and those who reported needing another person's help in performing basic and instrumental activities of daily living were classified, respectively, as having a “difficulty” and having a clinical “disability” for that specific activity.

P values were adjusted for age and sex.

Table 4

Score in Single Items of the SPPB According to Back Pain in All Study Participants and Separately in Men and Women

			P		
	Presence of Back Pain	**Absence of Back Pain**	**Model 1**	**Model 2**	**Model 3**
5 Chair stands (all)	0.49 ± 0.21	0.56 ± 0.18	<0.001	<0.001	0.003
Male	0.54 ± 0.20	0.60 ± 0.16	0.005	0.009	0.04
Female	0.46 ± 0.22	0.53 ± 0.19	<0.001	<0.001	0.02
Balance test (all)	0.86 ± 0.27	0.89 ± 0.23	0.03	0.14	0.72
Male	0.89 ± 0.25	0.92 ± 0.21	0.32	0.51	0.87
Female	0.83 ± 0.28	0.87 ± 0.25	0.25	0.13	0.59
Walking speed (all)	0.81 ± 0.14	0.83 ± 0.12	0.05	0.19	0.97
Male	0.83 ± 0.12	0.84 ± 0.11	0.45	0.59	0.96
Female	0.80 ± 0.15	0.81 ± 0.13	0.29	0.19	0.94

P value for the null-hypothesis that performance is similar in subjects with and without LBP; model 1 is unadjusted; model 2 is adjusted for age and sex; model 3 is also adjusted for CES-D score, NSAID use and feet, knee, and hip pain.

NIH-PA Author Manuscript
NIH-PA Author Manuscript

Table 5

Disability in Activities of Daily Living According to Presence *Versus* Absence of Frequent Back Pain Among InCHIANTI Participants Aged 65 Years and Older

			OR (95%CI)				
	Presence	**Absence**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Walk 400 m	8.2	6.0	1.5 (0.8–2.6)	0.8 (0.4–1.7)	1.6 (0.6–4.3)	1.4 (0.6–2.9)	1.1 (0.6–2.1)
Shopping	11.1	6.9	1.8 (1.1–3.0)	0.9 (0.4–1.8)	1.9 (0.8–4.5)	1.7 (0.9–3.3)	1.4 (0.8–2.4)
Washing hands and face	2.0	0.5	3.7 (0.9–15)	3.0 (0.5–16)	1.9 (0.3–17)	3.0 (0.4–15)	4.7 (0.5–47)
Laundry	9.5	6.1	2.0 (1.2–3.4)	1.3 (0.7–2.6)	2.0 (0.8–4.6)	2.2 (1.1–4.3)	1.5 (0.9–2.8)
Using public transportation	16.7	11.5	1.6 (1.1–2.6)	0.8 (0.4–2.4)	1.0 (0.6–1.9)	1.4 (0.8–2.3)	1.2 (0.7–1.9)
Climbing/descending stairs	5.6	3.2	2.6 (1.1–4.6)	1.8 (0.7–4.6)	2.7 (0.1–7.1)	2.5 (0.8–7.9)	1.5 (0.7–3.3)
Bathing	10.5	7.1	1.7 (0.9–2.8)	0.9 (0.5–1.9)	1.8 (0.8–4.3)	1.6 (0.8–3.1)	1.5 (0.9–2.7)
Dressing/undressing	4.3	3.0	1.7 (0.8–3.7)	0.9 (0.4–2.5)	0.6 (0.1–6.0)	1.1 (0.3–4.7)	1.2 (0.5–2.9)
Heavy household chores	20.0	11.7	2.2 (1.4–3.3)	1.6 (0.9–2.7)	1.9 (1.1–3.3)	2.3 (1.4–3.7)	1.6 (1.1–2.6)
Cutting toe nails	23.2	15.3	2.0 (1.4–4.0)	1.4 (0.9–2.2)	1.6 (0.9–2.6)	1.9 (1.2–3.0)	1.4 (0.9–2.2)
Carrying shopping bag	21.2	8.7	3.6 (2.3–5.6)	3.0 (1.7–5.1)	3.2 (1.7–5.9)	4.0 (2.3–6.8)	2.5 (1.5–4.1)

Model 1: adjusted for age and sex; Model 2: corrected for age, sex and SPPB; Model 3: corrected for age, sex and speed on 7 m walk bending down; Model 4: corrected for age, sex, and for trunk flexion; Model 5 corrected for age, sex, and for presence of feet–knee–hip pain and CES-D score.