

Supplementary Material

A. Search Strategies Among the Different Databases

Table A.1 Search strategies (keywords and filters) related to the different databases used. In bold: MeSH Terms; * for terms with end-truncation; TS = topic; TITLE-ABS-KEY = document title-abstract-keyword.

Database	Keywords & filters - <i>Gait</i>	Keywords & filters - <i>Gait initiation</i>	Keywords & filters - <i>Posture</i>	Keywords & filters - <i>Turning</i>
Pubmed/Cochrane CENTRAL	(locomotion OR walking OR gait) AND (accidental falls OR faller) AND (aged OR aging) AND (dual task* OR dual-task* OR cognition OR attention), Filters: English, Humans, from 2013 - 2020	(gait initiation OR step initiation) AND (accidental falls OR faller) AND (aged OR aging) AND (dual task* OR dual-task* OR cognition OR attention), Filters: English, Humans, from 2013 - 2020	(posture OR postural balance OR standing position) AND (accidental falls OR faller) AND (aged OR aging) AND (dual task* OR dual-task* OR cognition OR attention), Filters: English, Humans, from 2013 - 2020	(turns) AND (accidental falls OR faller) AND (aged OR aging) AND (dual task* OR dual-task* OR cognition OR attention), Filters: English, Humans, from 2013 - 2020
Scopus	(TITLE-ABS-KEY("accidental falls") OR TITLE-ABS-KEY("faller")) AND (TITLE-ABS-KEY("aged") OR TITLE-ABS-KEY("aging")) AND (TITLE-ABS-KEY("cognition") OR TITLE-ABS-KEY("attention") OR TITLE-ABS-KEY("dual task*") OR TITLE-ABS-KEY("dual-task*")) AND (TITLE-ABS-KEY("locomotion") OR TITLE-ABS-KEY("walking") OR TITLE-ABS-KEY("gait")) AND NOT (TITLE-ABS-KEY("Parkinson") OR TITLE-ABS-KEY("Alzheimer") OR TITLE-ABS-KEY("stroke") OR TITLE-ABS-KEY("multiple sclerosis") OR TITLE-ABS-KEY("diabet*") OR TITLE-ABS-KEY("training")) AND (LIMIT-TO (SRCTYPE,"j")) AND (LIMIT-TO (DOCTYPE,"ar")) AND (LIMIT-TO (SUBJAREA,"MEDI") OR LIMIT-TO (SUBJAREA,"HEAL") OR LIMIT-TO (SUBJAREA,"NEUR") OR LIMIT-TO (SUBJAREA,"MULT")) AND (LIMIT-TO (PUBYEAR,2020) OR LIMIT-TO (PUBYEAR,2019) OR LIMIT-TO (PUBYEAR,2018) OR LIMIT-TO (PUBYEAR,2017) OR LIMIT-TO (PUBYEAR,2016) OR LIMIT-TO (PUBYEAR,2015) OR LIMIT-TO (PUBYEAR,2014) OR LIMIT-TO (PUBYEAR,2013)) AND (LIMIT-TO (LANGUAGE,"English"))	(TITLE-ABS-KEY("accidental falls") OR TITLE-ABS-KEY("faller")) AND (TITLE-ABS-KEY("aged") OR TITLE-ABS-KEY("aging")) AND (TITLE-ABS-KEY("cognition") OR TITLE-ABS-KEY("attention") OR TITLE-ABS-KEY("dual task*") OR TITLE-ABS-KEY("dual-task*")) AND (TITLE-ABS-KEY("gait initiation") OR TITLE-ABS-KEY("step initiation")) AND NOT (TITLE-ABS-KEY("Parkinson") OR TITLE-ABS-KEY("Alzheimer") OR TITLE-ABS-KEY("stroke") OR TITLE-ABS-KEY("multiple sclerosis") OR TITLE-ABS-KEY("diabet*") OR TITLE-ABS-KEY("training")) AND (LIMIT-TO (SRCTYPE,"j")) AND (LIMIT-TO (DOCTYPE,"ar")) AND (LIMIT-TO (SUBJAREA,"MEDI") OR LIMIT-TO (SUBJAREA,"HEAL") OR LIMIT-TO (SUBJAREA,"NEUR") OR LIMIT-TO (SUBJAREA,"MULT")) AND (LIMIT-TO (PUBYEAR,2020) OR LIMIT-TO (PUBYEAR,2019) OR LIMIT-TO (PUBYEAR,2018) OR LIMIT-TO (PUBYEAR,2017) OR LIMIT-TO (PUBYEAR,2016) OR LIMIT-TO (PUBYEAR,2015) OR LIMIT-TO (PUBYEAR,2014) OR LIMIT-TO (PUBYEAR,2013)) AND (LIMIT-TO (LANGUAGE,"English"))	(TITLE-ABS-KEY ("accidental falls") OR TITLE-ABS-KEY ("faller")) AND (TITLE-ABS-KEY ("aged") OR TITLE-ABS-KEY ("aging")) AND (TITLE-ABS-KEY ("cognition") OR TITLE-ABS-KEY ("attention") OR TITLE-ABS-KEY ("dual task*") OR TITLE-ABS-KEY ("dual-task*")) AND (TITLE-ABS-KEY ("posture") OR TITLE-ABS-KEY ("postural balance") OR TITLE-ABS-KEY("standing position")) AND NOT (TITLE-ABS-KEY ("Parkinson") OR TITLE-ABS-KEY ("Alzheimer") OR TITLE-ABS-KEY ("stroke") OR TITLE-ABS-KEY ("multiple sclerosis") OR TITLE-ABS-KEY ("diabet*") OR TITLE-ABS-KEY ("training")) AND (LIMIT-TO (SRCTYPE,"j")) AND (LIMIT-TO (DOCTYPE,"ar")) AND (LIMIT-TO (SUBJAREA,"MEDI") OR LIMIT-TO (SUBJAREA,"HEAL") OR LIMIT-TO (SUBJAREA,"NEUR") OR LIMIT-TO (SUBJAREA,"MULT")) AND (LIMIT-TO (PUBYEAR,2020) OR LIMIT-TO (PUBYEAR,2019) OR LIMIT-TO (PUBYEAR,2018) OR LIMIT-TO (PUBYEAR,2017) OR LIMIT-TO (PUBYEAR,2016) OR LIMIT-TO (PUBYEAR,2015) OR LIMIT-TO (PUBYEAR,2014) OR LIMIT-TO (PUBYEAR,2013)) AND (LIMIT-TO (LANGUAGE,"English"))	(TITLE-ABS-KEY ("accidental falls") OR TITLE-ABS-KEY ("faller")) AND (TITLE-ABS-KEY ("aged") OR TITLE-ABS-KEY ("aging")) AND (TITLE-ABS-KEY ("cognition") OR TITLE-ABS-KEY ("attention") OR TITLE-ABS-KEY ("dual task*") OR TITLE-ABS-KEY ("dual-task*")) AND (TITLE-ABS-KEY ("turns")) AND NOT (TITLE-ABS-KEY ("Parkinson") OR TITLE-ABS-KEY ("Alzheimer") OR TITLE-ABS-KEY ("stroke") OR TITLE-ABS-KEY ("multiple sclerosis") OR TITLE-ABS-KEY ("diabet*") OR TITLE-ABS-KEY ("training")) AND (LIMIT-TO (SRCTYPE,"j")) AND (LIMIT-TO (DOCTYPE,"ar")) AND (LIMIT-TO (SUBJAREA,"MEDI") OR LIMIT-TO (SUBJAREA,"HEAL") OR LIMIT-TO (SUBJAREA,"NEUR") OR LIMIT-TO (SUBJAREA,"MULT")) AND (LIMIT-TO (PUBYEAR,2020) OR LIMIT-TO (PUBYEAR,2019) OR LIMIT-TO (PUBYEAR,2018) OR LIMIT-TO (PUBYEAR,2017) OR LIMIT-TO (PUBYEAR,2016) OR LIMIT-TO (PUBYEAR,2015) OR LIMIT-TO (PUBYEAR,2014) OR LIMIT-TO (PUBYEAR,2013)) AND (LIMIT-TO (LANGUAGE,"English"))
Web of Science	TS=(gait OR walking OR locomotion) AND	TS=(gait initiation OR step initiation) AND	TS=(posture OR postural balance OR	TS=(turns) AND TS=(accidental falls OR

	TS=(accidental falls OR faller) AND TS=(aged OR aging) AND TS=(dual-task* OR dual task* OR cognition OR attention) AND LANGUAGE: (English) - <i>Indexes=SCI-EXPANDED, CPCI-S, BKCI-S, ESCI</i> <i>Timespan=2013-2020</i>	TS=(accidental falls OR faller) AND TS=(aged OR aging) AND TS=(dual-task* OR dual task* OR cognition OR attention) AND LANGUAGE: (English) - <i>Indexes=SCI-EXPANDED, CPCI-S, BKCI-S, ESCI</i> <i>Timespan=2013-2020</i>	standing position) AND TS=(accidental falls OR faller) AND TS=(aged OR aging) AND TS=(dual-task* OR dual task* OR cognition OR attention) AND LANGUAGE: (English) - <i>Indexes=SCI-EXPANDED, CPCI-S, BKCI-S, ESCI</i> <i>Timespan=2013-2020</i>	faller) AND TS=(aged OR aging) AND TS=(dual-task* OR dual task* OR cognition OR attention) AND LANGUAGE: (English) - <i>Indexes=SCI-EXPANDED, CPCI-S, BKCI-S, ESCI</i> <i>Timespan=2013-2020</i>
Google Scholar	Anywhere in the article, with all of the words: (locomotion walking gait) (accidental falls faller) (aged aging) (cognition attention dual task dual-task) and without the words: -training; articles in English and dated between 2013 and 2020	Anywhere in the article, with all of the words: (gait initiation step initiation) (accidental falls faller) (aged aging) (cognition attention dual task dual-task) and without the words: -training; articles in English and dated between 2013 and 2020	Anywhere in the article, with all of the words: (posture postural balance standing position) (accidental falls faller) (aged aging) (cognition attention dual task dual-task) and without the words: -training; articles in English and dated between 2013 and 2020	Anywhere in the article, with all of the words: (turns) (accidental falls faller) (aged aging) (cognition attention dual task dual-task) and without the words: -training; articles in English and dated between 2013 and 2020

B. Detailed Table of Systematic Reviews

Table B.1 Systematic reviews that have assessed in the last 12 years the power of dual-task walking in predicting risk of falls in healthy older adults.

Authors	Description of the systematic review	Electronic databases & Search terms used for literature search	Inclusion and exclusion criteria	Involved population	Motor & Concurrent cognitive tasks	(1) Is DT performance/DT-related change predictor (or discriminator) of falling? (2) Is the DT-related predictive strength superior compared to the ST-related one? (Yes/No/Inconclusive/Not addressed)
Zijlstra et al., 2008 [80]	<p>7 prospective and 9 retrospective data collection of falls; Retrospective study periods: from 6 to 12 months, prospective follow-up periods: from 3 to 12 months.</p> <p>Studies in common with the other reviews: 6 ([12,36,43,62,71,72]) with [9], 5 ([12,43,63,64,72]) with [35], 4 ([12,43,62,72]) with [17], 2 ([64,72]) with [49], 1 ([12]) with [53], 2 ([12,64]) with [75].</p>	<p><u>Search terms:</u> (MeSH key terms are the bold ones): (1) (gait OR walking OR locomotion OR musculoskeletal equilibrium OR posture) (2) #1 AND (aged OR aged, 80 and over OR aging) (3) (cognition OR attention OR cognitive task(s) OR attention task(s) OR DT(s) OR double task paradigm OR second task(s) OR secondary task(s)) (4) #2 AND #3 (5) #4 AND humans</p> <p><u>Databases:</u> PubMed, EMBASE, CINALHL, AMED, PsycINFO and Cochrane</p>	<p><u>Inclusion criteria:</u> (1) population: older adults (mean age ≥ 65 years); (2) assessment tool: DT combining gait or other balance task with a cognitive task; (3) design: prospective or retrospective data collection of falls; (4) papers focusing on measures of the ability to predict future falls or to discriminate between fallers and non-fallers for both tasks during DT performance as well as for the single balance and cognitive task; (5) classification of fallers and non-fallers based on actual fall events.</p> <p><u>Exclusion criteria:</u> Individual abstracts, review articles, studies evaluating sitting balance performance, case studies, letters to the editor and studies with subjective scoring system for the assessment of DT performance.</p> <p><i>Dates of publication: up to 2006</i></p>	<p>Only 6 retrospective studies and 2 prospective studies include from 30 to 380 healthy older people (mean age ≥ 65 years) without a specific pathology or medical condition.</p>	<p><u>Motor task:</u> Straight walking, quiet stance with different surface and sensory conditions, walking tasks including transfers and turns (e.g., TUG). <u>Measures:</u> postural sway, speed, gait measures. <u>Cognitive task:</u> - Verbal fluency tasks: sentence completion, animals or professions naming; - Discrimination and decision-making tasks: Judgment of Line Orientation, phoneme monitoring, Stroop's colored words test, auditory choice reaction time task; - Mental tracking/working memory tasks: backward counting, serial subtractions/additions, remembering a shopping list, listening to a text and answering multiple-choices questions; - Reaction time task: simple auditory reaction time. <u>Measures:</u> speed and accuracy.</p>	<p><u>(1) Yes & (2) Inconclusive:</u> In most cases, specificity and predictive values of the DT were moderate or high whereas sensitivity was low. Moreover, while one retrospective [19] and one prospective [4] study reported similar odds ratios for DT compared to ST and an additional retrospective study [62] showed that ST and DT have similar value for discriminating between fallers and non-fallers, two other prospective studies [11,72] suggested an added value of DT conditions over ST regarding prediction of falls. However, any conclusion could not be made because of incomplete comparisons of single and dual walking/balance tasks, and due to the global heterogeneity of the studies.</p>

<p>Beauchet et al., 2009 [9]</p>	<p>Systematic review including 15 studies: 3 retrospective studies and 12 prospective ones;</p> <p>Retrospective study periods: from 6 to 12 months, prospective follow-up periods: from 50 days to 12 months.</p> <p>Studies in common with the other reviews: 6 ([12,36,43,62,71,72]) with [80], 8 ([7,8,10,12,21,40,43,72]) with [35], 12 ([7,8,10,12,21,40,43-45,62,65,72]) with [17], 4 ([7,8,40,72]) with [49], 4 ([7,8,10,12]) with [53], 2 ([8,12]) with [75].</p>	<p>Search terms: MeSH terms: “accidental fall” and “aged” or “aged, 80 and over” combined with the terms “DT”, “dual tasking”, “gait”, “walking”, “fall” and “falling”</p> <p>Databases: English and French Medline and Cochrane library</p>	<p>Inclusion criteria: observational studies, retrospective or prospective data collection of falls, number of falls and motor performance under ST and DT as outcomes measures, subjects with mean age of 65 and older, and provided enrolment methods, exact procedures of dual tasking and discriminative or predictive values of falls.</p> <p><i>Dates of publication: from March 1997 to April 2008</i></p>	<p>From 30 to 380 subjects per study;</p> <p>Older adults and frail older adults with mean age of 65 and older.</p> <p>Note: In some studies, some subjects exhibit cognitive impairment, dementia, stroke or previous stroke, lower limb neuropathy, depression, or pain in lower limb.</p>	<p>Motor task: Various DT conditions with walking as main task, some walking tasks including transfers and turns (e.g., TUG).</p> <p>Measures: walking time, stop walking, coefficient of variation of stride time variability, walking speed.</p> <p>Concurrent task: - Mental tracking/working memory tasks: backward counting, reciting alternate letters from the alphabet, simple calculations; - Verbal fluency tasks: conversation, recitation of names of animals and professions, or alphabet; - Discrimination and decision-making tasks: visuospatial decision task; - Motor tasks: carrying a glass of water.</p> <p>Measures: increase backward counting performance.</p>	<p>(1) Yet & (2) Not addressed: Despite few conflicting reports probably because of limited sample sizes, study samples heterogeneity, too short follow-up periods or lack of standardization in DT paradigms and outcomes measures, most involved studies (and the pooled odds ratio) showed that DT-related changes are significantly associated with an increased risk of falling in older adults.</p>
<p>Hsu et al., 2012 [35]</p>	<p>Systematic review including 25 studies, with 16 DT studies: 7 prospective studies and 9 cross-sectional ones;</p> <p>Prospective follow-up periods: from 6 months to 2 years.</p> <p>Studies in common with the other reviews: 5 ([12,43,63,64,72]) with [80], 8 ([7,8,10,12,21,40,43,72]) with [9], 9 ([7,8,10,12,21,29,40,43,72]) with [17], 7 [7,8,29,40,42,64,72]) with</p>	<p>Search terms: Search and MeSH terms: cognition, executive functions, DT, and falls</p> <p>Databases: MEDLINE, Pubmed, and EMBASE</p>	<p>Exclusion criteria: studies that did not examine specific cognitive processes (e.g., only measured global cognitive function), intervention studies that focused on improving cognitive function or reducing falls, protocol studies, studies that did not include falls or falls risk, any case report or case series studies, and samples which included those with significant neurodegenerative disease (e.g., Alzheimer’s disease).</p> <p><i>Dates of publication: from 1948</i></p>	<p>From 27 to 380 subjects per DT study;</p> <p>Adults aged 60 years or older from community-dwelling, senior housing facility, residential care, and geriatric rehabilitation hospital.</p> <p>Note: In some studies, some subjects exhibit mild/moderate cognitive</p>	<p>Motor task: Physical performance task, such as walking (including sometimes transfers and turns), maintaining stability under various conditions, or lower limb maximal strength test.</p> <p>Measures: walking speed, mean walking time, swing time average, gait variability, stride time variability, swing time variability, postural recovery, postural stability, maximal isometric leg strength.</p> <p>Cognitive task: - Mental tracking/working</p>	<p>(1) Yes & (2) Inconclusive: Most studies found a strong association between DT performance on the one hand, and falls or falls risk on the other hand. However, over 16 DT studies, one study [10] found a positive association between better DT performance and falls, whereas another study [7] did not find any predictive power of DT performance regarding falls (based on a multiple logistic regression model) unlike ST performance, and a third study [12] observed a similar predictive strength for DT performance as for ST performance.</p>

	[49], 5 ([7,8,10,12,29]) with [53], 3 ([8,12,64]) with [75].		to May 3, 2011	impairment, dementia, stroke or previous stroke, lower limb neuropathy, depression, or pain in lower limb.	memory tasks: counting backwards, serial subtraction, reciting alternate letters of the alphabet, simple and complex calculations; -Verbal fluency tasks: conversation, sentence completion, recitation of names of animals and professions, or alphabet; - Discrimination and decision- making tasks: auditory choice reaction time task, visuospatial decision task, perceptual matching/judgment of line orientation, listen to a text and phoneme monitoring; - Reaction time task: reaction time on push-button task. <u>Measures:</u> auditory choice reaction time, accuracy in backward counting, number of correct calculations.	
Chu et al., 2013 [17]	Systematic review including 2 retrospective studies and 13 articles using a prospective design; Retrospective study periods: from 6 to 12 months, prospective follow-up periods: from 29.6 ± 25.9 days to 2 years. Studies in common with the other reviews: 4 ([12,43,62,72]) with [80], 12 ([7,8,10,12,21,40,43– 45,62,65,72]) with [9], 9 ([7,8,10,12,21,29,40,43,72]) with [35], 7 ([7,8,29,40,54,72,77]) with	Search terms: (MeSH key terms are the bold ones): (aged OR aged 80 and over OR elderly OR frail elderly) and (gait[s] OR walking OR ambulation OR locomotion) and (accidental fall[s] OR fall[s]) and (attention OR cognition OR DT[s] OR attention task[s] OR cognitive task[s] OR secondary task[s] OR double task paradigm) Databases: Medline, PubMed, CINAHL, Cochrane Central Register of Controlled Trials and	Inclusion criteria: DT paradigm used to discriminate fallers and non- fallers or to predict falls; ground walking as the postural task of the DT paradigm; and mean age of 60 years or older for the sample. Exclusion criteria: dissertation theses, review articles or conference abstracts; articles that focused on a single population with a specific diagnosis, such as stroke or arthritis; intervention studies; and articles that did not report discriminative or relative values of falls. <i>Dates of publication: up to May 2011</i>	From 30 to 380 subjects per DT study; Adults aged 60 years or older from senior housing facilities, inpatients, and community- dwelling elderly. Note: In some studies, some subjects exhibit cognitive impairment, dementia, stroke or previous stroke, lower limb neuropathy, depression, or pain in lower limb.	Motor task: Straight walking tasks, turn walking and TUG. <u>Measures:</u> walking time, walking speed, coefficient of strike time variation, swing time variability, mean step width, number of stop walking. Concurrent task: - Mental tracking/working memory tasks: counting backwards, serial subtraction, reciting alternate letters of the alphabet, simple calculations; - Verbal fluency tasks: conversation, recitation of names of animals and professions, or alphabet; - Discrimination and decision- making task: visuospatial decision	(1) Yes & (2) Not addressed: Contrary to verbal fluency tasks and manual tasks, mental tracking tasks were the only type of concurrent tasks related to a significant odds ratio, thus to a significant predictive strength for falls. Besides, the complexity of a specific concurrent task needs to be appropriately chosen for the studied population in order to obtain similar odds ratio independently from the subjects. Finally, the biggest limitation of the review is the substantial heterogeneity between studies.

	[49], 7 [[7,8,10,12,29,54,77]] with [53], 3 [[8,12,54]] with [75].	PsycINFO			task; - Reaction time task: reaction time on push-button task; - Motor tasks: carrying a glass of water/coffee cup and saucer/tray with a ball. <u>Measures:</u> reaction time, accuracy, speed.	
Menant et al., 2014 [49]	Systematic review and meta-analysis; 30 articles (11 prospective studies and 19 retrospective studies) and 33 samples; Follow-up periods: from 4 to 24 months. Studies in common with the other reviews: 2 [[64,72]] with [80], 4 [[7,8,40,72]] with [9], 7 [[7,8,29,40,42,64,72]] with [35], 7 [[7,8,29,40,54,72,77]] with [17], 5 [[7,8,29,54,77]] with [53], 8 [[6,8,20,54,57,58,64,78]] with [75].	<u>Search terms:</u> (MeSH key terms are the bold ones): 1. gait OR walking OR locomotion 2. falls OR accidental falls OR falling OR faller 3. aged OR aged, 80 and over OR aging OR ageing 4. DT* OR D-T* OR cognition OR attention 5. #1 AND #2 AND #3 AND #4 <u>Databases:</u> PubMed, Ovid MEDLINE, EMBASE, PsycINFO, CINAHL, Scopus and Cochrane Central Register of Controlled Trials	<u>Inclusion criteria:</u> studies which evaluated gait at self-selected speed under ST and DT conditions in older people to either: (1) predict falls, or (2) discriminate between fallers and non-fallers based on retrospective data collection. <u>Exclusion criteria:</u> exclusion if: (1) individual abstracts, case studies or reviews; (2) focus on patient groups (e.g., PD, stroke, etc.) other than cognitive impairment; (3) participants' mean age less than 65 years or all participants younger than 60 years old; (4) the walking task not involving time or gait speed as an outcome; (5) not a cognitive task as the secondary task; (6) subjective scoring systems to assess DT performance; (7) publications in languages other than Dutch, English, French or German. <i>Dates of publication: from 2008 to February 2013</i>	From 11 to 1308 participants per sample; Mean age ≥ 65 years or participants older than 60 years; Community-dwellers, outpatients from a geriatrics department, participants from senior housing facilities or intermediate care hostels, and geriatrics and Alzheimer's care unit inpatients; 12 studies with a small percentage or all of the subjects having cognitive impairments; 16 studies with slow walkers (< 1 m/s).	<u>Motor task:</u> Straight line walking including sometimes a turn . <u>Measures:</u> walking speed. <u>Cognitive task:</u> Each study comprised one, two or more types of secondary cognitive tasks: mainly mental tracking/working memory tasks (counting backwards, reciting alternate letters from the alphabet, serial subtraction, addition/subtraction) and verbal fluency tasks (enumeration of animal names, enumeration of words starting with a specific letter) and, to a lesser extent, discrimination and decision-making tasks (auditory Stroop task, listening to a randomized audio sequence for "X" and repeating the letter aloud).	<u>(1) Yes & (2) No*:</u> Gait speed did not have a significantly better predictive value for falls in a DT compared to a ST paradigm, but both paradigms were equivalent in discriminating fallers from non-fallers based on gait speed assessments. Moreover, the latter results stayed invariant when only prospective falls studies/ subgroups of people with fast gait speed, slow gait speed or with cognitive impairment/ a specific type of concurrent task (mental tracking tasks vs. verbal fluency tasks)/ studies with straight line walking were taken into account. *This answer needs to be taken into account with caution. Indeed, due to a majority of retrospective designs for the reporting of fall history and the analysis of mean difference (an appropriate statistical measure for discriminative ability), it is rather the discriminative power of DT performance (compared to the one of ST) that has been assessed, instead of its predictive value.
Muir-Hunter and Wittwer, 2016 [53]	10 articles with prospective cohort studies that lasted at least 1 year and were based on 7 independent samples.	<u>Search terms:</u> MeSH subject terms and keywords: "accidental falls, falling, prospective studies,	<u>Inclusion criteria:</u> (1) sample participants aged ≥ 60 years; (2) prospective cohort design with a duration of at least 1 year; (3) samples	From 100 (with 98% of subjects available for assessment at the end of the study) to	<u>Motor task:</u> Main tasks included walking (combining sometimes transfers and turns), quiet stance and stepping reaction responses in	<u>(1) Yes & (2) Inconclusive:</u> Although most studies reported DT performance related to falls, 3 of them [8,29,51] showed a stronger association between DT performance and future fall risk

	<p>Studies in common with the other reviews:</p> <p>1 ([12]) with [80], 4 ([7,8,10,12]) with [9], 5 ([7,8,10,12,29]) with [35], 7 ([7,8,10,12,29,54,77]) with [17], 5 ([7,8,29,54,77]) with [49], 4 ([8,12,51,54]) with [75].</p>	<p>aged, aged80 and over, elderly, aging, gait, postural balance, DT, cognition and attention”</p> <p>Databases: MEDLINE, Pubmed and EMBASE</p>	<p>comprised community-dwelling individuals alone; (4) “falls” as the primary study outcome, including “any fall”, “recurrent falls” and “injurious falls”, and the association between the DT test and future fall risk evaluated in statistical analysis; (5) DT assessment detailed explicitly in the methods section ; (6) reported inclusion and exclusion criteria and demographic information; and (7) confounding factors reported and used in multi-variable regression analysis to generate adjusted risk estimates.</p> <p><i>Dates of publication: from January 1998 to September 2013</i></p>	<p>1038 participants included in each study; Community-dwelling participants aged ≥ 60 years.</p>	<p>standing.</p> <p>Measures: number of steps, number of complete stops, mean velocity, mean and variability of walking time, swing time, step length, step width and double support time, amplitude and time of COP during step initiation, amplitude of COP during quiet stance.</p> <p>Concurrent task:</p> <ul style="list-style-type: none"> - Mental tracking/working memory tasks: counting backwards, serial subtraction; - Verbal fluency tasks: recitation of names of animals or professions; - Discrimination and decision-making task: Stroop test; - Motor tasks: carrying a cup and saucer/tray/tray with a cup and saucer/tray with a ball. <p>Measures: accuracy, speed (e.g., number of names per minute, number of enumerated figures).</p>	<p>than with ST, while 2 additional studies [12,48] did not find any added predictive value for falls in a DT compared to a ST paradigm and 2 others [7,66] even assigned a better predictive power to ST performance. All the studies in favor of the superiority of the DT included a straight (or up and down a hall) walking task. The ones that rather highlighted the use of ST for fall prediction involved respectively a straight walking task, a fast walking and returning task, measures of maximal postural sway during quiet standing under DT conditions and the assessment of stepping reaction responses in standing during a DT situation.</p>
<p>Wollesen et al., 2019 [75]</p>	<p>Systematic review and meta-analysis including 15 and 11 studies respectively, 6 of the 15 studies presenting a prospective design; Retrospective study periods: from 1 to 24 months, prospective follow-up periods: from 12 to 66 months.</p> <p>Studies in common with the other reviews:</p> <p>2 ([12,64]) with [80] 2 ([8,12]) with [9], 3 ([8,12,64]) with [35], 3 ([8,12,54]) with [17],</p>	<p>Search terms:</p> <ol style="list-style-type: none"> 1. "Age" or "old\$" or "elder\$" or "aged" or "advanced age" or "senior\$" or "geriatric\$" or "eldest" or "aging" or "gerontic" or "faller\$" or "fear of falling" 2. "corresponding task\$" or "coupled task\$" or "dual task\$" or "dual task paradigm\$" or "secondary task" or "conflicting task" or "task prioritisation" or "inattentional" 	<p>Inclusion criteria:</p> <p>(1) population: older adults (mean age ≥ 60 years) with a previous fall; (2) DT paradigm used to discriminate fallers from non-fallers; (3) primary motor task: straight over ground walking at self-selected speed; (4) outcome measures: gait measurements during both ST- and DT-performance or the DT effect on gait performance (more than one gait cycle); (5) clear description of the DT situation; (6) report of adequate data to calculate effect sizes either from descriptive or inferential</p>	<p>From 16 to 1350 healthy older people (mean age between 67 and 87 years) included in each study.</p>	<p>Motor task:</p> <p>Straight over ground walking at self-selected speed.</p> <p>Measures: cadence, walking speed, gait variability, walking time, stride length, step length, stride length CV, stride time, step time, stride time CV, single-support time/phase, double-support time/phase, stride width, step width, stride width CV, number of strides, number of steps, stance time, swing time, average swing time, swing time variability CV, STV, ML RMS, AP RMS, standardized ML RMS, standardized AP RMS, COP path, min COP velocity, mean COP velocity, median COP velocity,</p>	<p>(1) Yes & (2) No*:</p> <p>The meta-analysis revealed significant mean difference between fallers and non-fallers for both ST and DT gait speed, with a reduced performance for fallers. However, no significant mean difference in DTC on gait speed or on the cognitive task performance (considering or not the cognitive task domain) was observed between fallers and non-fallers. Only trends for higher decrements in gait speed for fallers compared to non-fallers under DT conditions, as well as increased DTC in fallers for verbal fluency and motor DT were showed.</p> <p>*This answer needs to be taken into account with caution. Indeed, due to a majority of retrospective designs for the reporting of fall</p>

	<p>8 ([6,8,20,54,57,58,64,78]) with [49], 4 ([8,12,51,54]) with [53].</p>	<p>blindness" 3. "gait" or "step length" or "cadence" or "step count" or "step width" or "stance time" or "swing time" or "single support time" or "stride time" or "stride width" or "stride length" or "gait line" or "maximum force forefoot" or "maximum force midfoot" or "maximum force heel" or "double support time" or "gait speed" or "stride speed" or "motion" or "movement\$" or "motor\$" or "locomotion" or "walking" or "balance" or "posture" not "slipping" (not "perturbation") 4. "cognitive" or "neurocognitive" or "cognition\$" or "executive" or "processing" or "spatial" or "visuospatial" or "memory" or "reaction\$" or "speed" or "decision-making" or "mental" or "attention" or "cognitive-motor" or "motor-cognitive" or "reaction\$" or "planning" or inhibition 5. Combination of 1 and 2 and 3 and 4 <u>Databases:</u></p>	<p>statistics; (7) inclusion of interventional studies if the DT effect on gait at baseline if reported. <u>Exclusion criteria:</u> (1) population with brain injuries or diagnosed cognitive decline, physical impairments (e.g., using a cane or walker) or chronic diseases such as multiple sclerosis or PD; (2) studies with a secondary analysis of previous reported results; (3) publications in languages other than English and German. <i>Dates of publication: from 1946 (MEDLINE)/1806 (PsycINFO)/1974 (EMBASE) to 2019 (Week 20)</i></p>		<p>symmetry index, impulse (foot strike to first peak, min to second peak, second peak to foot off, foot strike), stride frequency, stride regularity, number of complete stops. <u>Cognitive task:</u> - Verbal fluency tasks: recitation of letters of the alphabet, animals or professions (starting or not with a specific letter), enumeration of words starting with a specific letter; - Discrimination and decision-making tasks: Stroop task, clock task; - Mental tracking/working memory tasks: backward counting, listening and answering questions; - Motor tasks: carrying a cup/glass/tray.</p>	<p>history and the analysis of mean difference (an appropriate statistical measure for discriminative ability), it is rather the discriminative power of DT performance (compared to the one of ST) that has been assessed, instead of its predictive value. Here, there is no additional benefit of DT walking as a measurement to discriminate fallers from non-fallers compared to ST walking.</p>
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		MEDLINE, PsycINFO and EMBASE				
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C. Detailed Table of Results from the Systematic Literature Review Regarding Walking Dual Tasks

Table C.1 Articles regarding walking dual tasks that were included in the systematic literature review. Abbreviations: y. = years; F = females; M = males; # = number; GDS = Geriatric Depression Scale; HR = hazard ratio; OR = odds ratio; CI = confidence interval; MMSE = Minimal Mental State Examination; SPPB = Short Physical Performance Battery; POMA = Performance Oriented Mobility Assessment; PPV = Positive Predictive Value; NPV = Negative Predictive Value; 6MWT = Six Minute Walk Test; BESTest = Balance Evaluation Systems Test; CT = cognitive task; MT = motor task; AP = anteroposterior; ML = mediolateral; PCA = Principal Component Analysis; AUC = Area Under the Curve; CoV = coefficient of variation; PFC = prefrontal cortex; RBANS = Repeatable Battery for the Assessment of Neuropsychological Status; PPA = Physiological Profile Assessment; TMT = Trail Making Test; IconFES = Iconographical-Fall Efficacy Scale; MSIT = Multi-Source Interference Task; EF = executive function.

Authors	Population	Falls	Dual-task paradigm & discriminative/predictive analysis	(1) Do DT-related changes or DT performance discriminate fallers from non-fallers? (2) Are DT-related changes or DT performance predictors of falling? (3) Is the DT-related predictive strength superior compared to the ST-related one? (Yes/No/Inconclusive/Not addressed)	Risk of bias via QUIPS tool (High H, Moderate M, Low L risk of bias)
Ayers et al., 2014 [5]	646 community-dwelling older adults: 337 fallers (80.5 ± 5.4 y.; 219 F; Blessed score: 1.7 ± 1.5; normal walking velocity: 94.3 ± 22.7 cm/s) and 309 non-fallers (79.2 ± 5.5 y.; 176 F; Blessed Score: 1.7 ± 1.6; normal walking velocity: 95.8 ± 22.6 cm/s); <u>Inclusion criteria:</u> aged 70 years-old and older, living in the community; <u>Exclusion criteria:</u> severe auditory or visual loss, inability to ambulate, institutionalization, people with significant cognitive impairment (Blessed Score > 6).	Prospective study; Mean follow-up of 2.6 years with annual clinical, cognitive and mobility assessments and telephone interviews at baseline and every 2-3 months to assess function and falls; → Fallers = (# of falls ≥ 1) during the follow-up period; Definition of a fall: “unintentionally coming down to the floor or a lower level not due to a major intrinsic or extrinsic event” [67].	<u>Motor task:</u> walking 4.6 m at normal pace (+ 0.914 m from either end of the walkway edge) <u>Concurrent cognitive task:</u> mental tracking/working memory task: reciting alternate letters of the alphabet <u>Instructions:</u> “pay equal attention to walking and talking” <u>Independent variables & analysis:</u> gait variables at baseline: velocity, cadence, step length, swing, stance, double support, step time variability, swing time variability; (PCA &) Cox proportional hazards models → HR (95% CI)	<u>(1) Not addressed, (2) Yes & (3) Yes:</u> In a Cox proportional hazard model adjusted for gender, age and education, step length in DT condition was the only individual gait parameter that predicted falls, being shorter in fallers compared to non-fallers (HR = 0.989, 95% CI = 0.98-0.99, p = 0.034). In Cox proportional hazard models adjusted for gender, age, education, illness index, prescription medicines, GDS, Blessed Score, chair rise test, clinical gait abnormalities, baseline prevalence of previous falls, normal velocity during ST and normal stride length variability during ST, poorer performance in the DT “pace” domain (including DT velocity and step length) remained a significant predictor of falls (HR = 1.312, 95% CI = 1.11-1.55, p = 0.002). The inclusion of the two last confounding variables allowed concluding for an incremental validity of DT over ST walking assessment in the prediction of falls. However, DTC measured as change in gait velocity between DT and ST conditions did not predict falls. <u>Limitations:</u> difficult generalization to older adults who are institutionalized or with cognitive impairments.	1) M (exclusion criteria missed neurological diseases) 2) L 3) L 4) L 5) L 6) L → Low risk of bias
Hirashima et al., 2015 [30]	92 volunteers from a community senior club: 16 fallers (78.1 ± 5.6 y.; 13 F; MMSE: 28.1 ± 1.6; TUG: 8.3 ± 1.1 s) and 76 non-fallers (74.9 ±	Prospective cohort study; Over a follow-up period of 12 months using monthly postal surveys and	<u>Motor task:</u> walking 60 m (10 m walkway with 3 returns) at usual speed <u>Concurrent cognitive task:</u>	<u>(1) Yes, (2) Yes & (3) Not addressed:</u> Fallers and non-fallers were not significantly different in terms of walking time during ST and DT. There is no significant influence of age on the incidence of injurious	1) L 2) L 3) L

	<p>5.3 y.; 65 F; MMSE: 28.1 ± 1.7; TUG: 8.4 ± 1.5 s);</p> <p><u>Inclusion criteria:</u> aged 65 years-old and older, living independently in the community, ability to walk approximately 500 m without a cane;</p> <p><u>Exclusion criteria:</u> MMSE < 25, neurological and/or orthopedic disorders, previous operations on the spine and/or lower extremities.</p>	<p>telephone calls;</p> <p>→ Fallers = (injured because of falls or # of falls ≥ 2);</p> <p>Definition of a fall: “accidental contact of any body part, except for the plantar, with a low area such as the floor or the ground”[23].</p>	<p>discrimination and decision-making task: not stepping on the unequal lines</p> <p><u>Independent variables & analysis:</u></p> <p>time and number of missteps recorded every 20, 40 and 60 m;</p> <p>for group (fallers vs. non-fallers) comparisons at baseline: unpaired t-tests or Mann-Whitney U tests + for comparison between misstep and non-misstep groups and between age groups: Kaplan-Meier survival curves and log-rank tests</p>	<p>falls or more or equal to 2 falls.</p> <p>However, fallers and non-fallers significantly differed in terms of the presence of missteps at 40 m and 60 m (p = 0.041 and 0.035, respectively). Subjects who had made missteps during the DT test with an extended walking distance of ≥ 40 m were significantly more likely to be fallers (p = 0.042 at 40 m and p = 0.038 at 60 m, as results of the log-rank tests).</p> <p><u>Limitations:</u> No direct comparison between ST and DT concerning sensitivity and specificity of predicting falls, unclear inter-rater reliability of the DT test.</p>	<p>4) L 5) L 6) L → Low risk of bias</p>
<p>MacAulay et al., 2015 [46]</p>	<p>416 relatively healthy and cognitively intact older adults, 67.5% female, primarily Caucasian, with normal or corrected vision: 81 fallers (69.6 ± 6.81 y.; initial MMSE: 29.47 ± 0.87; initial SPPB: 11.04 ± 1.4) and 312 non-fallers (70.13 ± 6.62 y.; initial MMSE: 29.25 ± 1.02; initial SPPB: 11.02 ± 1.19);</p> <p><u>Inclusion criteria:</u> aged 60 years-old and older;</p> <p><u>Exclusion criteria:</u> GDS ≥ 6; a history of neurological or untreated health conditions that might cause cognitive impairment.</p>	<p>Longitudinal (prospective) study;</p> <p>Structured clinical interview after 1 year in order to obtain participant’s fall history for the past year;</p> <p>→ Fallers = (# of falls ≥ 1);</p> <p>Definition of a fall: “times that individuals unexpectedly lost their balance and unintentionally came unto rest on the ground, floor or other object; events in which participants were able to regain their balance did not count as a fall (e.g., tripping but catching oneself before falling onto the floor)” [41].</p>	<p><u>Motor task:</u></p> <p>straight walking at normal everyday walking speed</p> <p><u>Concurrent cognitive task:</u></p> <p>mental tracking/working memory task: spelling a word of 5 letters in length backwards aloud</p> <p><u>Independent variables & analysis:</u></p> <p>stride length, step time → average stride length and step time scores;</p> <p>mixed-design repeated measures ANCOVAs for group differences during ST and DT at both time points + partial correlations</p>	<p><u>(1) Yes, (2) Not addressed & (3) Not addressed:</u></p> <p>Fallers exhibited shorter stride length than non-fallers within both walking task conditions (ST and DT), even when sex, age and height were controlled (F(1,405) = 15.8, p < 0.001).</p> <p>There was no significant interaction between group and task conditions on gait stride length.</p> <p>Shorter strides during DT at follow-up were predicted by worse executive attention/processing speed performance 1 year before (r = 0.24, p < 0.001).</p> <p><u>Limitations:</u> too specific sample (generally college educated participants, predominantly white, with a higher proportion of females), time frame limited to 1-year, potential unreliability of retrospective clinical interview after one year.</p>	<p>1) L 2) L 3) L 4) L 5) L 6) L → Low risk of bias</p>
<p>Gimmon et al., 2016 [26]</p>	<p>160 older adults: 61 fallers (79.4 ± 5.7 y.; 49 F; MMSE: 28.19 ± 1.53; POMA total score: 26.09 ± 2.15) and 99 non-fallers (81.5 ± 5 y.; 69 F; MMSE: 27.9 ± 1.65; POMA total score: 26.69 ± 1.69);</p> <p><u>Inclusion criteria:</u> aged 65</p>	<p>Participants asked to retrospectively recall fall events during the past year;</p> <p>→ Fallers = (# of falls ≥ 1);</p> <p>Definition of a fall: “an event which results in a</p>	<p><u>Motor task:</u></p> <p>narrow path walking test = walking at a comfortable pace within a 6 m long narrow path</p> <p><u>Concurrent cognitive tasks:</u></p> <p>3 mental tracking/working memory tasks: reciting the days of the week backwards, reciting the months of the year backwards, serial-5 subtraction loudly</p>	<p><u>(1) Yes, (2) No & (3) No:</u></p> <p>Trial velocity during ST remained significantly slower in fallers compared to non-fallers, even after the gait parameter was adjusted for age, sex and fear of falling (F = 11.498, p < 0.001). Therefore, trial velocity during ST was identified as a potential identifier of falls.</p> <p>There was no significant interaction between group and task. Indeed, among both groups, gait speed decreased during DT. However, no</p>	<p>1) L 2) L 3) L 4) L 5) L 6) L</p>

	<p>years-old and older, ability to walk independently, MMSE > 24;</p> <p><u>Exclusion criteria:</u> serious visual impairment, severe cardio-vascular disease, terminal diseases, Menier and substantial pain, and severe gait impairment due to focal lower limb muscle weakness or palsy, lower limb amputation or joint arthrodesis, or neurological diseases.</p>	<p>person coming to rest inadvertently on the ground or other lower level, regardless of whether an injury was sustained" [68].</p>	<p>from 100 to 50</p> <p><u>Instructions:</u></p> <p>"to walk at their comfortable pace without stepping outside the narrow path" and "to perform both tasks as best as they can"</p> <p><u>Independent variables & analysis:</u></p> <p>number of steps during each trial, trial time, trial velocity, ML instability (i.e., number of step errors), and number of cognitive task errors during ST (sitting) and DT;</p> <p>2-way ANOVA (with group as between-subjects factor and with repeated measures on the within-subject factor that is task) + 2-way ANCOVA (group as between-subjects factor and adjustment by age, sex and fear of falling) + AUC/validity, sensitivity, specificity and PPV related to ROC curve in ST and DT</p>	<p>added value of DT condition over ST condition in identification of fallers has been showed.</p> <p>Predictive abilities: ST trial velocity ≥ 0.78 m/s vs. DT trial velocity ≥ 0.46 m/s: sensitivity: 77.5% vs. 70.2%; specificity: 57.4% vs. 55%; AUC/validity: 0.69 (p = 0.002) vs. 0.62 (p = 0.067); PPV: 53.9% for ST gait speed.</p> <p><u>Limitations:</u> small sample size, retrospective study, cognitive task not reflecting a realistic life performance, ST condition can be perceived as a motor-motor DT.</p>	<p>→ Low risk of bias</p>
<p>Howcroft et al., 2016 [32,33]</p>	<p>100 community-dwelling older adults: 24 fallers (76.3 \pm 7 y.; 11 F; 6MWT distance: 446.6 \pm 101.4 m) and 76 non-fallers (75.5 \pm 6.6; 45 F; 6MWT distance: 455.8 \pm 102.4 m);</p> <p><u>Inclusion criteria:</u> aged 65 years-old and older, living in the community;</p> <p><u>Exclusion criteria:</u> cognitive disorder, inability to walk for 6 minutes without an assistive device.</p>	<p>Retrospective study;</p> <p>Classification of fallers and non-fallers based on 6-month retrospective fall occurrences;</p> <p>→ Fallers = (# of falls ≥ 1);</p> <p>Definition of a fall: [68].</p>	<p><u>Motor task:</u></p> <p>walking 7.62 m</p> <p><u>Concurrent cognitive task:</u></p> <p>verbal fluency task: saying words starting with A, F or S</p> <p><u>Independent variables & analysis:</u></p> <p>gait velocities for ST and DT trials; temporal, impulse and COP path-related variables from measurements performed via pressure-sensing insoles; descriptive statistics, temporal features, FFT quartile, ratio of even to odd harmonics (REOH) and maximum Lyapunov exponent (MLE) as accelerometer-derived parameters;</p> <p>a) for each variable: mixed-design ANOVA test, with a 2-factor within-subject walking condition (ST,DT) and a 2-factor between-subjects faller status condition (faller, non-faller); post-hoc tests for comparing walking conditions: Wilcoxon Signed-Rank test or paired t-test; post-hoc tests for comparing faller status conditions: Mann-Whitney U test, independent t-test or Welch's t-test;</p> <p>b) 3 classifier models: multi-layer perceptron neural network, naive Bayesian, support vector machine; model evaluation → accuracy, specificity, sensitivity, PPV, NPV, F1 score, Matthew's Correlation</p>	<p>(1) Yes, (2) Yes & (3) No:</p> <p>a) Regarding pressure-sensing insole measures, for both DT and ST gait data, no significant differences were found between fallers and non-fallers. Concerning accelerometer-derived parameters, fallers showed significantly greater head posterior standard deviation (p = 0.025) and decreased posterior pelvis AP REOH (p = 0.023) during ST, and greater posterior pelvis vertical MLE (p = 0.017) during DT gait.</p> <p>b) In the context of models of wearable-sensor based fall-risk classification in older adults, ST sensor-based gait assessment models outperformed models based on DT walking or clinical assessment data.</p> <p><u>Limitations:</u> retrospective fall occurrence as the criterion for classification → potential inaccurate recall of falls + potential changes to gait patterns.</p>	<p>1) H (no reporting of global cognitive function - even if self-reported cognitive disorder was an exclusion criterion - or potential neurological disorders, and no baseline comparison of demographic data between fallers and non-fallers)</p> <p>2) L</p> <p>3) L</p> <p>4) L</p> <p>5) L</p> <p>6) L</p> <p>→ Moderate risk of bias</p>

			Coefficient → ranking method		
Johansson et al., 2016 [37]	<p>1390 fairly healthy community-dwelling older adults aged 70 years (684 F; MMSE: F → 28.5 ± 1.6 vs. M → 28.3 ± 1.7; no significant differences between F and M when objectively measured 7-day total physical activity): over 1350 → 148 fallers (88 F);</p> <p><u>Inclusion criteria:</u> sample representing the general population → residence in the Umea municipal area and age of exactly 70 years-old at the time of testing.</p>	<p>Prospective study; Self-reported fall data by telephone 6 and 12 months after examination; → Fallers = (# of falls ≥ 1); Definition of an incident low-energy fall: “unexpected event in which participants came to rest on the ground” [28].</p>	<p><u>Motor task:</u> walking 8.6 m at preferred pace (+ 1 m ahead of the walkway) (+ walking at fast speed only under ST condition) <u>Concurrent cognitive task:</u> mental tracking/working memory task: counting backward from 100 in increments of 1 <u>Independent variables & analysis:</u> in ST and DT, CoV for: step/stride width, step/stride length, step/stride time, stance time, swing time, stride velocity, double support time; Student’s t-tests, multiple logistic regression models</p>	<p>(1) Yes, (2) Yes & (3) Yes: During the normal-speed trial, no differences in gait variability were detected between fallers and non-fallers, whereas step width, step length, step time and stance time variability were significantly greater in fallers during the fast-speed trial (p = 0.01, 0.02, 0.03 and 0.01, respectively). Nevertheless, during DT, fallers exhibited significantly increased variability for step width, step length, stride length, step time, stance time, stride time, stride velocity and swing time in comparison with non-fallers (p = 0.002, 0.004, 0.01, 0.005, 0.02, 0.02, 0.002 and 0.007, respectively). Moreover, in an adjusted logistic regression model (covariates: sex, physical activity, education level, smoking, cardiovascular disease, diabetes, MMSE, gait speed), step width variance from the DT trial represented an independent predictor of incident falls (OR = 1.09, 95% CI = 1.02-1.17, p = 0.01), as well as other gait parameters under DT. <u>Limitations:</u> limited generalization of the findings to other age groups, potential familiarization with the gait measurement system, difficulties of asking to recall falls.</p>	<p>1) M (no demographic characteristics directly related to fallers and non-fallers, but to females and males, and poor inclusion and exclusion criteria, even if population’s description was quite exhaustive) 2) L 3) L 4) L 5) L 6) L → Low risk of bias</p>
Pelosi et al., 2016 [55]	<p>31 older adults: 17 fallers (73.4 ± 4.2 y., 10 F, MoCA score: 26.4 ± 1.6) and 14 age-matched non-fallers (72.1 ± 4.9 y., 5 F, MoCA: 28.3 ± 2);</p> <p><u>Inclusion criteria:</u> age between 60 and 85 years, ability to walk for 5 min unassisted;</p> <p><u>Exclusion criteria:</u> clinical diagnosis of dementia or other severe cognitive impairment (MMSE < 24), psychiatric co-morbidity, history of stroke or other neurologic disorders.</p>	<p>Cross-sectional (retrospective) study; Self-reported falls over the previous 6 months; → Fallers = (# of falls ≥ 2).</p>	<p><u>Motor task:</u> walking in a corridor at a comfortable speed for 1 min <u>Concurrent cognitive task:</u> verbal fluency task: talking <u>Independent variables & analysis:</u> for ST, DT and proportionate difference (DTC in %): gait speed; repeated measures ANOVA with group as between-subjects factor and task (ST and DT) as within-subject factor + post-hoc t-tests with Bonferroni correction for multiple comparisons</p>	<p>(1) Yes, (2) Not addressed & (3) Not addressed: Gait speed was significantly lower in fallers than in non-fallers during ST and DT (p = 0.003 and 0.005). Unlike non-fallers, fallers significantly reduced their gait speed under DT gait with respect to normal gait (p = 0.022). <u>Limitations:</u> cholinergic activity was evaluated at rest (sitting position) and SAI is reduced in muscles involved in a specific motor task during movement, no plan to test whether anticholinergic drugs may improve cholinergic activity in the faller population.</p>	<p>1) L 2) L 3) M (no clear description of the concurrent cognitive task) 4) M (no formal definition of falls) 5) L 6) L → Moderate risk of bias</p>
Freire Júnior et al., 2017 [22]	<p>62 community-dwelling older adults: 27 fallers (67.96 ± 5.7 y.; 26 F; MMSE: 25, 95% CI 23.5-26.5; BESTest: 84.07 ± 9.43) and 35 non-fallers (67.97 ± 4.82 y.; 24 F; MMSE: 26.57, 95% CI 25.63-27.52; BESTest: 88.77 ± 7);</p>	<p>Retrospective study; Questionnaire about the history of falls in the 6 months preceding the assessment day; → Fallers = (# of falls = 1); Definition of a fall: [28].</p>	<p><u>Motor task:</u> walking 8 m at self-selected speed (+ 1 m before the electronic carpet and 1 m after) <u>Concurrent tasks:</u> - verbal fluency task: naming animals without repeating names - motor task: transferring a coin from one pocket</p>	<p>(1) No, (2) Not addressed & (3) Not addressed: There were significant effects of the task (increased stride time and reduced gait speed, cadence and single support time under both DT conditions compared to ST, decreased step length under both DT conditions compared to ST but with a larger reduction for CT, increased stride time variability in CT compared to MT and ST), but neither significant main effects of the faller status nor significant interaction effects between group and walking condition.</p>	<p>1) M (exclusion criteria missed neurological diseases) 2) L 3) L 4) L 5) M (no covariates)</p>

	<p><u>Exclusion criteria:</u> inability to walk without help from others, severe impairment of balance, presence of cognitive impairment identified by MMSE (exclusion if MMSE score: ≤ 13 for illiterate elderly, ≤ 18 for people with 1-7 years of education, ≤ 26 for people with 8 years or more of education).</p>		<p>to the other</p> <p><u>Instructions:</u> “do not prioritize either task”</p> <p><u>Independent variables & analysis:</u> for ST, DT and proportionate DTC ($([DT_{walking} - ST_{walking}]/ST_{walking}) \times 100$): gait speed, cadence, stride time, step length, single support time, stride time CoV;</p> <p>2-way repeated-measure ANOVAs (group as between-subjects factor and task as repeated measure, Bonferroni post-hoc tests); Mann-Whitney tests or independent Student’s t-tests for comparing DTC between groups</p>	<p>Regarding DTC, no significant differences between groups were observed, whereas significant differences in step length were found between tasks: CT > MT, $p = 0.0003$ in non-fallers and 0.036 in fallers (the same for stride time variability in non-fallers, $p = 0.016$).</p> <p><u>Limitations:</u> fallers had experienced only one fall over the past 6 months, performance on the concurrent cognitive and motor tasks were not measured → no information concerning strategy of task prioritization that might discriminate fallers from non-fallers.</p>	<p>taken in to account in the statistical analyses)</p> <p>6) L → Moderate risk of bias</p>
<p>Vergheze et al., 2017 [73]</p>	<p>166 high-functioning older adults (74.5 ± 6.07 y.; 85 F; RBANS: 91.56 ± 12): 71 fallers (34 with # of falls > 1) and 85 non-fallers;</p> <p><u>Inclusion criteria:</u> community-residing adults, aged 65 years-old and older;</p> <p><u>Exclusion criteria:</u> presence of dementia, inability to walk, active neurologic or psychiatric disorders severe enough to interfere with study assessments, presence of major visual or hearing loss, recent or planned surgical procedures restricting walking, disability, need for assistance or assistive devices to walk, presence of clinical gait abnormalities.</p>	<p>Prospective cohort study; 50-month follow-up period (mean follow-up: 33.9 ± 11.9 months), annual interviews based on a standardized questionnaire during in-person visits and phone calls every 2 to 3 months;</p> <p>Definition of a fall: “unintentionally coming down on the floor or to a lower level not as a result of a major intrinsic or extrinsic event” [39].</p>	<p><u>Motor task:</u> walking at normal pace on an electronic walkway (for 3 continuous loops consisting of 6 straight segments and 5 turns)</p> <p><u>Concurrent cognitive task:</u> mental tracking/working memory task: recitation of alternate letters of the alphabet (under ST: for 30 seconds while standing)</p> <p><u>Instructions:</u> “to pay equal attention to both tasks to minimize task prioritization”</p> <p><u>Independent variables & analysis:</u> gait stride velocity, correct letter rate per minute; Andersen-Gil extension of the Cox model (hazard ratios), adjusted for age, sex, education, comorbidity count, RBANS score, HbO_2 levels during normal walking and cognitive ST conditions, Digit Symbol Substitution test score, walking velocity and correct letter rate during DT (+ models where subjects with slow gait, with instrumental activity limitations, with fall history before baseline were excluded)</p>	<p>(1) Not addressed, (2) Yes & (3) Yes:</p> <p>Higher PFC activation levels on fNIRS during DT predicted falls (HR = 1.32, 95% CI = 1.01-1.7) and this association remained significant when controlling for all the covariates.</p> <p>However, PFC activation during both motor and cognitive ST, as well as gait velocity and letter rate during DT were not significantly associated with risk of falls.</p> <p><u>Limitations:</u> focus limited to PFC analysis, very mild clinical signs and possibility that this compensatory brain activity do not occur in later clinical stages (associated with gait abnormalities), negotiating turns might be more cognitively demanding, observational study does not allow to report real causality.</p>	<p>1) M (no demographic characteristics directly related to fallers and non-fallers)</p> <p>2) L 3) L 4) L 5) L 6) M (no p-values reported) → Moderate risk of bias</p>
<p>Caetano et al., 2018 [13]</p>	<p>50 healthy community-dwelling older adults: high-risk of falling group ($n=22$; 77 ± 8 y.; 16 F) and low-risk of falling group ($n=28$; 72 ± 4 y.; 18 F);</p> <p><u>Inclusion criteria:</u> aged 65</p>	<p>Retrospective study; Classification as fallers and non-fallers based on falls experienced in the past 12 months and on the PPA</p>	<p><u>Motor task:</u> gait adaptability test (GAT) → walking over a 6-m path at self-selected speed under 4 conditions: while avoiding an obstacle, stepping onto close or far targets, or walking without any stimulus on the pathway</p>	<p>(1) Yes, (2) Yes & (3) No:</p> <p>In adjusted logistic regression models, at least one stepping error in the single GAT and reduced GAT velocity in both ST and DT conditions were found to discriminate low- from high-risk of falling groups ($\chi^2 = 5.966$, $p = 0.015$; $t_{48} = 3.552$, $p = 0.001$; $t_{48} = 3.88$, $p < 0.001$) and to be independent predictors of high risk of falling.</p>	<p>1) H (no reporting of a global cognitive score, even if dementia was an exclusion criterion)</p> <p>2) L 3) L</p>

	<p>years-old and older, living independently in the community, cognitive ability to follow instructions, relatively healthy;</p> <p><u>Exclusion criteria:</u> dementia, acute or terminate illness, progressive neurodegenerative diseases, major psychiatric illnesses, color-blindness or untreatable visual impairment, inability to walk independently, recent surgery affecting mobility.</p>	<p>score;</p> <p>→ High fall-risk group = (history of multiple falls and/or PPA score ≥ 1.5);</p> <p>Definition of a fall: [41].</p>	<p><u>Concurrent cognitive task:</u></p> <p>mental tracking/working memory task: serial-3 subtraction from a two-digit number</p> <p><u>Independent variables & analysis:</u></p> <p>GAT errors, velocity of the stride preceding the target/obstacle;</p> <p>independent sample t-tests, Mann-Whitney-U tests or Chi-square tests + binary logistic regression (with covariates such as TMT, IconFES, quadriceps strength and age) + AUC of ROC curves</p>	<p>The association between ST GAT errors and fall risk (OR 3.54, 95% CI 0.67-18.65) was mediated by impaired EF, while the association between GAT velocity and fall risk in ST (OR = 1.69, 95% CI = 0.62-4.62) and DT (OR = 2.01, 95% CI = 0.75-5.37) situations was mediated by high concern about falling, weak quadriceps strength and impaired EF.</p> <p>However, GAT under DT condition did not provide greater predictive power of fall risk over ST GAT ($\chi^2 = 0.09$, $p = 0.76$, for ROC curves comparison).</p> <p><u>Limitations:</u> GAT might be perceived as a DT in itself, the performance of the cognitive task was not measured → no information about strategy of task prioritization that might discriminate fallers from non-fallers, retrospective aspect of the study.</p>	<p>4) L</p> <p>5) L</p> <p>6) L</p> <p>→ Moderate risk of bias</p>
<p>Callisaya et al., 2018 [15]</p>	<p>424 older adults (77.8 \pm 6.4 y.; 234 F; RBANS: 93.5 \pm 12.6; mean normal gait speed: 98.3 \pm 23 cm/s);</p> <p><u>Inclusion criteria:</u> aged 65 years-old and older, participation in the longitudinal Central Control of Mobility in Aging (CCMA) study;</p> <p><u>Exclusion criteria:</u> dementia, inability to walk, severe neurological or psychiatric conditions, major visual or auditory loss, receiving hemodialysis, recent or planned surgery that would interfere with assessments or restrict walking.</p>	<p>Retrospective study;</p> <p>Participants were asked if they had fallen in the past year;</p> <p>→ Fallers = (# of falls ≥ 1).</p>	<p><u>Motor task:</u></p> <p>walking on a computerized mat (457.2 cm long) at normal walking speed</p> <p><u>Concurrent cognitive task:</u></p> <p>mental tracking/working memory task: recitation of alternate letters of the alphabet starting with the letter 'A'</p> <p><u>Instructions:</u></p> <p>“to pay equal attention to both the walking and talking tasks to avoid task prioritization effects”</p> <p><u>Independent variables & analysis:</u></p> <p>ST and DT normal walking speed;</p> <p>Spearman’s correlation coefficients related to relationships between mobility measures and prior falls + multivariable linear regression, adjusting for age and gender, between clinic-based mobility measure and each community risk factors (including prior falls) in separate models + final models including each significant mobility measures in the same model</p>	<p>(1) Not addressed, (2) Yes & (3) No:</p> <p>Prior falls were significantly correlated with ST normal walking speed ($r = -0.19$, $p < 0.001$), DT walking speed ($r = -0.13$, $p < 0.01$), maze delay ($r = 0.12$, $p < 0.05$), time for ascending stairs ($r = 0.21$, $p < 0.001$) and time for descending stairs ($r = 0.16$, $p < 0.001$).</p> <p>In separate regression models, falls in previous year were significantly associated with slower DT walking speed (OR = 0.99, 95% CI = 0.98-0.99, $p < 0.5$), ascending (OR = 1.49, 95% CI = 1.21-1.84, $p < 0.05$) and descending stairs (OR = 1.25, 95% CI = 1.07-1.45, $p = 0.002$).</p> <p>However, in the final model, only time for ascending stairs (OR = 1.33, 95% CI = 1.05-1.68, $p = 0.02$) remained significant, the pseudo R^2 for the model being 5 %, with ascending stairs contributing 81.7% of 5%.</p> <p><u>Limitations:</u> no objective measurements of community performance, self-reported measures were subject to recall or reporting bias, cross-sectional study → inability to make causal inferences, other gait parameters to be included (e.g., gait variability), small explained variance for some outcomes.</p>	<p>1) M (no demographic characteristics directly related to fallers and non-fallers)</p> <p>2) L</p> <p>3) H (no formal definition of fall and, number of falls and subjects who had fallen were not reported)</p> <p>4) L</p> <p>5) L</p> <p>6) M (no complete reporting of the statistical analyses)</p> <p>→ Moderate risk of bias</p>
<p>Commandeur et al., 2018 [18]</p>	<p>42 community-dwelling older adults: 27 fallers (75.9 \pm 3.3 y.; 19 F; MMSE: 28.5 \pm 1.6) and 15 non-fallers (75.8 \pm 3.4 y.; 6 F; MMSE: 28.5 \pm 1.1);</p> <p><u>Exclusion criteria:</u> physician-diagnosed dementia, recent</p>	<p>Retrospective study;</p> <p>Self-reported falls over the previous 12 months;</p> <p>→ Fallers = (# of falls ≥ 1);</p> <p>Definition of a fall: “if the participant came to rest on a lower surface as a result</p>	<p><u>Motor task:</u></p> <p>walking there and back (10 ST and 10 DT walking passes) at a self-selected preferred speed along a 6.4 m instrumented walkway (+ 1.5 m prior to and beyond the end of the mat)</p> <p><u>Concurrent cognitive task:</u></p> <p>mental tracking/working memory task: serial-7</p>	<p>(1) Not addressed, (2) Yes & (3) Not addressed:</p> <p>Among the 11 measures kept after PCA, 5 gait measures were sufficient for retrospectively classifying fallers and non-fallers with 92.3% sensitivity, 66.7% specificity and a total model classification of 82.9%: stride time difference, stride width difference, stride length difference, stride width variability difference and stride velocity variability difference. Larger stride length difference and stride time</p>	<p>1) L</p> <p>2) L</p> <p>3) L</p> <p>4) L</p> <p>5) L</p> <p>6) L</p>

	major illness or a neurological, sensory, or mobility impairment that would impede participation, MMSE \leq 24, non-fluent in English.	of a loss of balance”.	subtraction aloud from a randomly generated three-digit number <u>Independent variables & analysis:</u> mean and variability (SD) of DT scores and DTC (difference scores between ST and DT gait trials) for variables included in 4 sub-domains: length, width, timing and velocity; remove of highly collinear and theoretically redundant measures within each domain + PCA + backward stepwise binary logistic regression + Hosmer-Lemeshow test	difference significantly and uniquely contributed to the increase of fall risk ($p = 0.042$ and 0.047 , respectively, within the logistic regression model). These DTC gait measures outperformed traditional clinical tests of strength, mobility and balance, and physiological assessments. <u>Limitations:</u> retrospective study.	→ Low risk of bias
Halliday et al., 2018 [27]	27 older adults: 12 fallers (76.25 ± 3.19 y.; 8 F) and 15 non-fallers (75.93 ± 3.41 y.; 7 F); <u>Inclusion criteria:</u> healthy, living in the community; <u>Exclusion criteria:</u> self-report of a physician-diagnosed major medical illness with residual motor or sensory deficits (e.g., PD, stroke, heart disease, dementia, cancer, brain tumor), severe sensory impairment, drug or alcohol abuse, history of inpatient psychiatric treatment, significant cognitive impairment (MMSE < 24), English as a second language.	Retrospective study; Follow-up period: the two-years leading up to the first study visit; → Fallers = (# of falls \geq 1); Definition of a fall: “any instance in which the participant came to rest involuntarily on a lower surface (e.g., ground or floor).	<u>Motor task:</u> walking at self-selected, normal walking speed along a 6.4 m instrumented walkway (+ 1.5 m before and after the mat ended) → 10 passes * total recorded walking distance of about 6.1 m <u>Concurrent cognitive task:</u> mental tracking/working memory task: serial-7 subtraction from a given three-digit starting number <u>Independent variables & analysis:</u> mean and CoV: swing time, step length; Student’s t-tests (measures of effect size) + logistic regression analysis	<u>(1) Yes, (2) Yes & (3) Yes:</u> Mean step length, step length CoV and swing time CoV were significantly larger in fallers compared to non-fallers in DT ($t(23) = 1.95, 3.05$ and $2.1, p < 0.05, < 0.01$ and $< 0.05, d = 0.758, 1.178$ and 0.786 , respectively), and not in ST. Step length variability in DT showed a significant effect within the logistic regression model (OR = 1.163, 90% CI = 1.019-1.328, $p = 0.03$, on tailed). <u>Limitations:</u> optical array limited to coverage of a portion of the frontal cortex, MSIT with fNIRS relatively unprecedented in the literature, relatively liberal definition of fall status, participants did not undergo clinical assessment for MCI, small sample size, retrospective study.	1) M (existing exclusion criterion MMSE < 24, but no reporting of MMSE scores or other measure of global cognitive functions) 2) L 3) L 4) L 5) L 6) M (no description of methodology concerning statistical analyses within a dedicated section) → Moderate risk of bias
Howcroft et al., 2018 [31,34]	75 community-dwelling older adults: 28 fallers (75 ± 8.2 y.; 14 F) and 47 non-fallers (75.3 ± 5.5 y.; 30 F); <u>Inclusion criteria:</u> aged 65 years-old and older, without a fall in the 6 months before evaluation, living in the community; <u>Exclusion criteria:</u> self-reported cognitive disorder, inability to walk for 6 min without an	Prospective study (and comparison with retrospective studies from the same group [32,33]); → Fallers = (# of falls \geq 1 during the 6-month follow-up period); Definition of a fall: [68].	<u>Motor task:</u> walking 7.62 m <u>Concurrent cognitive task:</u> verbal fluency task: saying words starting with A, F or S <u>Independent variables & analysis:</u> as in [32,33]: gait velocities for ST and DT trials; temporal, impulse and COP path-related variables from measurements performed via pressure-sensing insoles; descriptive statistics, temporal features, FFT quartile, REOH and MLE as accelerometer-derived	<u>(1) Yes, (2) Yes & (3) No:</u> a) During both ST and DT, gait velocity was not shown to be significantly different between fallers and non-fallers. On the contrary, for DT gait , fallers had significantly lower stance AP COP path CoV ($p = 0.046$) and AP FFT first quartile for the head accelerometer ($p = 0.011$) compared to non-fallers, whereas, during ST , fallers showed significantly lower ML FFT first quartile for the left shank accelerometer ($p = 0.045$) as well as lower superior maximum acceleration for the right shank accelerometer ($p = 0.041$). Gait differences between fallers and non-fallers were dependent on retrospective or prospective faller identification → more interest of using data based on prospective fall occurrence to be part of a	1) H (no reporting of global cognitive function - even if self-reported cognitive disorder was an exclusion criterion - or potential neurological disorders, and no baseline comparison of demographic data between fallers and non-fallers)

	assistive device.		parameters; a) as in [32]; b) as in [33] + predictive accuracy of the top 10 ST and top 10 DT models → repeated random sampling	successful clinical fall risk assessment protocol compared to measures based on retrospective fall occurrence. b) Although the best overall models were based on DT walking (for the best one: accuracy = 57%, sensitivity = 43%, specificity = 65%), the comparison between ST- and DT-gait-based models did not reveal a clearly superior gait assessment for fall-risk prediction (similar accuracies for the top ST- and DT-gait-based models). <u>Limitations:</u> performance of cognitive task not measured → no information about task prioritization → potential masking of faller and non-faller gait differences, 7.62 m walking trial may be not enough reflective of everyday walking, larger number of variables in the analysis increases the potential Type 1 errors.	2) L 3) L 4) L 5) M (no covariates taken in to account in the statistical analyses) 6) L → Moderate risk of bias
Minet et al., 2018 [50]	322 older women: 117 fallers from the falls clinic, 99 fallers (79 [76-85] y.; MMSE: 27 [25-29]) and 106 non-fallers (80 [75-86] y.; MMSE: 28 [26-29]) from the community; <u>Inclusion criteria:</u> women, aged 65 years-old and older; <u>Exclusion criteria:</u> not mobile enough to transfer from bed to chair with or without help.	Observational case-control (retrospective) study; Self-reported questionnaire to assess falls history over 1 year; → Once only faller and recurrent fallers (> 1 fall); Definition of a fall: [41].	<u>Motor task:</u> 4-meter walking test at preferred walking speed <u>Concurrent cognitive task:</u> mental tracking/working memory task: serial-3 subtractions <u>Independent variables & analysis:</u> for ST and DT: gait speed; for differences between groups: 1-way ANOVAs or Kruskal-Wallis tests, and then post-hoc independent t-tests or Mann-Whitney tests	<u>(1) Yes, (2) Not addressed & (3) Not addressed:</u> Under both ST and DT, gait speed was significantly slower in fallers compared to non-fallers from the community (p < 0.001). However, gait speed was not significantly different between community-dwelling once only fallers and recurrent fallers. <u>Limitations:</u> self-reported falls questionnaires.	1) M (poor inclusion and exclusion criteria such as cognitive impairment and neurological diseases) 2) L 3) L 4) L 5) M (no covariates taken in to account in the statistical analyses) 6) L → Moderate risk of bias
Gillain et al., 2019b [24,25]	96 community-dwelling older adults: 35 fallers (69 [67-76] y.; 17 F; MoCA: 27 [26-29]; SPPB: 10 [9-11]) and 61 non-fallers (70 [67-74] y.; 31 F; MoCA: 28 [26-29]; SPPB: 11 [10-12]); <u>Inclusion criteria:</u> aged 65 years-old and older, living independently at home, ability to understand French and to provide written informed consent; <u>Exclusion criteria:</u> history of fall(s) in the previous year, use	Longitudinal (prospective), observational study; 2-year follow-up, using personal falls diaries and phone calls every 3 months; → Fallers = (# of falls ≥ 1); Definition of a fall: [41].	<u>Motor task:</u> walking at self-selected comfortable speed (+ walking at self-selected fast speed) <u>Concurrent cognitive task:</u> mental tracking/working memory task: serial-7 subtraction from 100 <u>Independent variables & analysis:</u> for both ST, DT, proportionate differences (DTC and fast walking improvement): gait speed, stride length, stride frequency, stride symmetry, stride regularity, and minimum toe clearance MTC (mean, median, minimum, SD, variance, CoV, delta1 = max - mean, delta2 = mean - min);	<u>(1) Yes, (2) Yes & (3) Inconclusive:</u> Compared to non-fallers, fallers had lower gait speed during fast walking ST (p = 0.035), shorter stride length during normal speed and fast walking ST (p = 0.035 and 0.01, respectively) and higher symmetry DTC (p = 0.022). Among the discriminative variables, symmetry DTC was the only one significantly related to the risk of falls (OR = 1.018, 95% CI = 1.002-1.033, p = 0.027). The obtained model included symmetry DTC, stride length in fast walking ST, stiffness, mean MTC in normal speed walking ST, MTC CoV DTC, MTC variance and mean MTC in fast walking ST, delta1 MTC in DT and gender. Regarding its performances, this model was related to an accuracy of 84%, a sensitivity of 80%, a specificity of 87%, a PPV of 78%, a NPV of 88%, an AUC related to ROC curve of 0.84, and an area	1) L 2) L 3) L 4) L 5) L 6) L → Low risk of bias

	<p>of a walking aid, gait disorders and/or increased fall risk related to neurological or osteoarticular disease, dementia, hip or knee prosthesis in the previous year, pain when walking, acute respiratory or cardiac illness (< 6 months), recent hospitalization (< 3 months), untreated or uncontrolled comorbidities, use of neuroleptic and sedative drugs (except sleeping pills), and presence of a cardiac pacing device.</p>		<p>1-way ANOVAs or Kruskal-Wallis tests + binary logistic regression analysis + supervised machine learning algorithm (J48 classifier) → accuracy and sensitivity</p>	<p>under the Precision Recall Curve of 0.83. <u>Limitations:</u> small sample size, with non-fallers that were more numerous than fallers → it led to a first classification node of the model that identified non-fallers (because chosen as the attribute that allows the classification of higher number of people), while the aim of the present study was to identify fallers → the results obtained were limited by the volume of available data associated with prospective fall risk, as it was the case for the last classification node; no external validation of the classification model in an independent sample that was different from the one used to develop the model.</p>	
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D. Detailed Table of Results from the Systematic Literature Review About Dual Tasks Involving Gait Initiation

Table D.1 Articles about dual tasks involving gait initiation that were included in the systematic literature review. Abbreviations: y. = years; F = females; M = males; # = number; OR = odds ratio; RR = risk ratio; CI = confidence interval; MMSE = Minimal Mental State Examination; RDST = Rapid Dementia Screening Test; EF = executive function; RT = reaction time.

Authors	Population	Falls	Dual-task paradigm & discriminative/predictive analysis	<p>(1) Do DT-related changes or DT performance discriminate fallers from non-fallers?</p> <p>(2) Are DT-related changes or DT performance predictors of falling?</p> <p>(3) Is the DT-related predictive strength superior compared to the ST-related one?</p> <p>(Yes/No/Inconclusive/Not addressed)</p>	Risk of bias via QUIPS tool (High H, Moderate M, Low L risk of bias)
Callisaya et al., 2016 [14]	<p>124 older adults: 27 single fallers (71.3 ± 5.3 y.; 13 F), 20 multiple fallers (73.5 ± 9 y.; 11 F) and 77 non-fallers (70.2 ± 6.6 y.; 29 F);</p> <p><u>Inclusion criteria:</u> aged between 60-85 years-old, randomly selected from the Southern Tasmanian electoral roll;</p> <p><u>Exclusion criteria:</u> resident of a nurse home, inability to walk without the use of gait aid, any contraindications to having an MRI scan, suffering from PD or dementia.</p>	<p>Prospective study;</p> <p>Falls questionnaire sent every 2 months for 12 months + falls calendar + follow-up with a phone call;</p> <p>→ Fallers = (# of falls ≥ 1) (single fallers or multiple fallers);</p> <p>Definition of a fall: [41].</p>	<p><u>Motor task:</u> starting walking in response to a buzzer activated at random times</p> <p><u>Concurrent cognitive task:</u> mental tracking/working memory task: 3-serial subtraction</p> <p><u>Independent variables & analysis:</u> time from stimulus to first lateral movement, transfer time (from first lateral movement to toe off of the leading foot), swing time (from toe off to foot contact), overall GI time from stimulus to leading foot contact;</p> <p>log multinomial regression with adjustment for age and sex, and then also for physiological and cognitive fall risk factors</p>	<p>(1) Not addressed, (2) Yes & (3) No:</p> <p>There was no association between GI time (or any of its components) and single falls over 12 months.</p> <p>Slower overall GI time under ST and DT (ST: RR = 1.28, 95% CI = 1.03-1.58; DT: RR = 1.14, 95% CI = 1.02-1.27), swing time under DT (RR = 1.44, 95% CI = 1.08-1.94) and slower time to first lateral movement under ST (RR = 1.9, 95% CI = 1.23-2.94) increased the risk of multiple falls.</p> <p>However, GI under DT did not increase the discrimination of multiple fallers over ST condition: slower time to first lateral movement under ST showed the strongest association with multiple falls.</p> <p><u>Limitations:</u> performance of the concurrent cognitive task was not recorded, which did not provide any information concerning strategy of task prioritization and did not allow comparing sensitivity with other types of DT; heels spaced by 6 cm may have influenced stability for some subjects.</p>	<p>1) H (no global cognition score reported even if dementia was an exclusion criterion, and no statistical comparisons on demographic characteristics at baseline)</p> <p>2) L</p> <p>3) L</p> <p>4) L</p> <p>5) L</p> <p>6) M (no p-values reported)</p> <p>→ Moderate risk of bias</p>

E. Detailed Table of Results from the Systematic Literature Review About Dual Tasks Involving Postural Control

Table E.1 Articles about dual tasks involving postural control that were included in the systematic literature review. Abbreviations: y. = years; F = females; M = males; # = number; IRR = incidence rate ratio; CI = confidence interval; MMSE = Minimal Mental State Examination; SPPB = Short Physical Performance Battery; POMA = Performance Oriented Mobility Assessment; BESTest = Balance Evaluation Systems Test; AP = anteroposterior; ML = mediolateral; PCA = Principal Component Analysis; RMS = root mean square; RT = reaction time.

Authors	Population	Falls	Dual-task paradigm & discriminative/predictive analysis	(1) Do DT-related changes or DT performance discriminate fallers from non-fallers? (2) Are DT-related changes or DT performance predictors of falling? (3) Is the DT-related predictive strength superior compared to the ST-related one? (Yes/No/Inconclusive/Not addressed)	Risk of bias via QUIPS tool (High H, Moderate M, Low L risk of bias)
Kang et al., 2013 [38]	717 relatively healthy community-dwelling older adults (77.9 ± 5.3 y.; 458 F; MMSE: 27.1 ± 2.6; 90 subjects with BBS ≤ 45); 131 outdoor fallers, 137 indoor fallers, 129 fallers with both outdoor and indoor falls and 320 non-fallers; <u>Inclusion criteria:</u> aged 70 years-old and older, from the Boston area, living in the community, ability to walk 6 m and to communicate in English; <u>Exclusion criteria:</u> cognitive impairment (MMSE ≤ 18), terminal disease, severe hearing or vision loss.	Prospective study; Falls monitored using a monthly mail-in calendar over 6-36 months and telephone interviews; → Fallers = (# of falls ≥ 1); Definition of a fall: [39]; Characterization into indoor (i.e., falls in one's own home, someone else's home, other buildings and other enclosed spaces like transportation vehicles) and outdoor falls (i.e., falls in outside stairs, gardens, yards, sidewalks, streets, curbs, parking lots, etc).	<u>Motor task:</u> quiet standing barefoot with eyes open for 30 s <u>Concurrent cognitive task:</u> mental tracking/working memory task: serial-3 subtraction from 500 (individual adaptation of the task in case of difficulty) <u>Instructions:</u> "to prioritize standing and look forward" <u>Independent variables & analysis:</u> In AP and ML directions, during ST and DT: COM RMS, postural stiffness, postural damping; negative binomial regression models, with the number of falls for a given period as dependent variable and model adjustments by the time spent either indoor or outdoor and clinical variables that were associated with both prospective falls and the biomechanical variable	(1) Not addressed, (2) Yes & (3) No: Only AP COM RMS was significantly smaller in non-fallers compared to fallers (p = 0.015). Greater postural stiffness and damping were associated with lower outdoor fall risks. Furthermore, greater COM RMS was associated with higher indoor falls (IRR ranges = 1.4-1.66, p < 0.05), whereas greater damping in the AP direction was related to lower rates of indoor falls (IRR = 0.65, 95% CI = 0.42-0.99, p = 0.044). Except for the last predictor, the associations of postural measures with indoor and outdoor fall rates were invariant by direction (AP vs. ML) and by condition (ST vs. DT). Therefore, measuring postural control under DT did not improve fall prediction. <u>Limitations:</u> lack of a feedback mechanism in the inverted pendulum model used, instruction of prioritization of the standing task while looking forward.	1) M (no demographic characteristics directly related to fallers and non-fallers, and a neurological disorder was not an exclusion criteria) 2) L 3) L 4) L 5) L 6) M (p-values and statistical variables are plotted but not all clearly reported) → Moderate risk of bias
Maranesi et al., 2015 [47]	130 older adults: 45 infrequent fallers (79 ± 6 y.; 26 F; MMSE: 25 ± 3; POMA, gait score = 11; POMA, balance score = 13), 18 frequent fallers (81 ± 6 y.; 16 F; MMSE: 25 ± 3; POMA, gait score = 10; POMA, balance score = 14) and 67 non-fallers	Retrospective study; Last year fall history; → Infrequent fallers = 1 or 2 falls, frequent fallers ≥ 2 falls.	<u>Motor task:</u> quiet standing with eyes open and closed on both a firm and a compliant surface during 30 s <u>Concurrent cognitive task:</u> mental tracking/working memory task: serial-7 subtraction (performed while standing with eyes open on a firm surface)	(1) Yes but..., (2) Not addressed & (3) Not addressed: Postural DT on a firm surface and related posturographic parameters (RANGE-AP, MVELO-AP and MVELO-ML) were significantly different between non-fallers and frequent fallers , while RANGE-AP was also found to be significantly different between infrequent and frequent fallers. However, performing postural ST with eyes open on a compliant	1) M (poor inclusion and exclusion criteria) 2) L 3) L 4) M (no formal definition of a fall) 5) M (covariates not

	<p>(79 ± 5 y.; 38 F; MMSE: 26 ± 3; POMA, gait score = 11; POMA, balance score = 14);</p> <p><u>Inclusion criteria:</u> cognitive ability;</p> <p><u>Exclusion criteria:</u> diagnosed dementia.</p>		<p><u>Independent variables & analysis:</u></p> <p>MDIST-AP (mean distance-AP, average AP distance from the mean COP) , MDIST-ML, RDIST-AP (RMS distance-AP), RDIST-ML, RANGE-AP (maximum distance between 2 points of the AP time series), RANGE-ML, MVELO-AP (average velocity of the COP in the AP direction), MVELO-ML, AREA-SW (estimation of the area enclosed by the COP path per unit of time), MFREQ-AP (frequency of a sinusoidal oscillation with an average value of MDIST-AP and a total path length of total excursions-AP), MFREQ-ML, pfap-50 (frequency below which 50% of the power spectral density of the AP times series is found), pfml-50, pfap-95, pfml-95, MD (mean distance fixed radius = mean spatial distance between 2 consecutive peaks of the sway density curve calculated with relative radius), MP (mean duration of the peaks of the sway density curve calculated with relative radius);</p> <p>for group differences: Kruskal-Wallis tests and post-hoc comparisons with Wilcoxon Rank Sum tests + PCA for each task → Kruskal-Wallis test</p>	<p>surface and using PCA-derived parameters allowed to discriminate between non-fallers and (infrequent and frequent) fallers and between infrequent fallers and frequent fallers. Indeed, the parameter derived from the first principal component (PC1) was significantly different between all pairs of groups ($p < 0.01$). For this task, PC1 involved posturographic parameters concerning the AP variation in COP displacement: MDIST-AP, RDIST-AP, RANGE-AP.</p> <p><u>Limitations:</u> retrospective study, acquisition of only a single trial for each test condition, use of only one force platform instead of two.</p>	<p>taken in to account in the statistical analyses)</p> <p>6) M (no reporting of exact p-values) → Moderate risk of bias</p>
<p>Westlake et al., 2016 [74]</p>	<p>23 older adults: 12 fallers (70 ± 5 y.; MMSE = 29) and 11 non-fallers (69 ± 4 y.; MMSE = 30);</p> <p><u>Exclusion criteria:</u> significant musculoskeletal, vestibular or neurological impairments, MMSE score < 24 (suggestive of dementia).</p>	<p>Retrospective study;</p> <p>Falls history over the last year;</p> <p>→ Fallers = (# of falls ≥ 1);</p> <p>Definition of a fall: [39].</p>	<p><u>Motor task:</u></p> <p>maintaining postural stability under 2 different perturbation conditions (“quickly grab one handrail and do not take a step”): predictable and unpredictable</p> <p><u>Concurrent cognitive tasks:</u></p> <p>- verbal fluency task: associated verb generation as quickly as possible after having heard a noun that was read by a staff member</p> <p>- mental tracking/working memory task: 1-back verb generation task</p> <p><u>Instructions:</u></p> <p>“not to prioritize one task over the other (i.e., balance vs. cognitive) once the perturbation occurred”</p> <p><u>Independent variables & analysis:</u></p> <p>RT (time from the onset of platform perturbation to initial arm response), movement time (time from initial arm response to handrail contact), grasp error frequency, direction of grasp, errors in verb</p>	<p>(1) Yes, (2) Not addressed & (3) Not addressed:</p> <p>The only significant difference between older adult fallers and non-fallers concerned grasp errors under both DT conditions, with a higher amount of errors in fallers compared to non-fallers (verb generation: $t(21) = 9.31$, $p = 0.03$; 1-back verb generation: $t(21) = 9.64$, $p = 0.013$). A longer movement time under both DT conditions was observed in fallers in comparison with non-fallers, but this difference was not significant.</p> <p><u>Limitations:</u> retrospective fall data, only a lateral reach response induced from stationary standing while perturbations occur from multiple directions during dynamic walking.</p>	<p>1) M (some missing information like gender, and no statistical comparisons on demographic characteristics at baseline)</p> <p>2) L</p> <p>3) L</p> <p>4) L</p> <p>5) M (covariates not taken in to account in the statistical analyses)</p> <p>6) L</p> <p>→ Moderate risk of bias</p>

			generation; 2-way (3 groups x 4 conditions) repeated measures ANOVA with condition as the repeated factor and Tukey-Kramer post-hoc tests, or Kruskal-Wallis tests and Dunn's multiple comparison post-hoc tests		
Rinaldi et al., 2017 [59,60]	30 older adults: 15 fallers (70.1 ± 5.1 y.; 15 F; MMSE: 27 ± 3.2; Mini-BESTest: 19 ± 2.6) and 15 non-fallers (71.8 ± 5.8 y.; 15 F; MMSE: 28 ± 1.3; Mini-BESTest: 27.3 ± 1.6); <u>Inclusion criteria:</u> right-handed, normal or corrected-to-normal vision, no neurological /musculoskeletal disorder that would affect task performance; <u>Exclusion criteria:</u> cognitive impairment (MMSE < 24), ability to walk without assistance.	<u>Retrospective study;</u> 12-month follow-up period prior to data collection; → Fallers = (# of falls ≥ 1); Definition of a fall: [39].	<u>Motor task:</u> walking at self-selected speed (also perform as ST) (or postural control: performing the concurrent task while staying stationary → in [60]) <u>Concurrent task:</u> motor task: to reach and grasp a dowel with the right hand and without contacting the obstacles and knocking down the support, under different difficulty levels: stable (SB) and unstable (UB) bases without obstacles, stable base with obstacles at short (SSD) and long (SLD) distances, and unstable base with obstacles at short (USD) and long (ULD) distances <u>Instructions:</u> "to walk at their self-selected speed and to continue walking when grasping the dowel" <u>Independent variables & analysis:</u> frequency of occurrence of: different joint couplings: right-left shoulder and right shoulder-right hip, different movement directions: flexion/extension and adduction/abduction, different patterns of coordination: in-phase, anti-phase, left and right shoulder phase and right hip phase; for group differences: 1-way ANOVAs + repeated measures 3-way ANOVAs (groups x conditions [grasping conditions or ST versus DT] x strides [stride at the moment of dowel contact and one stride before contact]) + ANCOVA for differences in gait phases (double or single support, ipsilateral or contralateral) used according to grasping difficulty, with walking speed as covariate + post-hoc tests with Bonferroni adjustments	<u>(1) Yes, (2) Not addressed & (3) Not addressed:</u> In a previous study from the group using the same dataset but other sort of analyses [60], step width (p = 0.003) and step duration (p = 0.03) were greater in fallers than in non-fallers. Furthermore, step velocity was lower in fallers compared to non-fallers, in step at dowel contact (p ≤ 0.0001). Moreover, fallers exhibited a greater reduction in AP COM velocity than non-fallers (p ≤ 0.0001), while they presented a minimum AP COM velocity significantly earlier than non-fallers before dowel contact (p = 0.004). AP and ML margins of dynamic stability were greater for fallers than for non-fallers (p = 0.022 and ≤ 0.001, respectively). Finally, concerning the prehension task, in comparison with non-fallers, fallers showed a greater movement time (p = 0.046) and temporal difference between right heel contact and reaching onset (p = 0.002), and lower peak wrist velocity (p = 0.0001), time-to-peak grip aperture (p = 0.002) only during walking DT, peak grip aperture velocity during postural DT (p = 0.042) and time-to-peak grip aperture velocity (p = 0.007). → Generalized slowing down in movement performance in fallers. Here (in [59]), mean walking speed during both ST and DT was significantly lower in fallers compared to non-fallers (p = 0.014 and 0.001, respectively). Fallers presented a higher frequency of grasping the dowel in double support in comparison with non-fallers, whereas non-fallers showed a greater frequency of dowel grasping using a contralateral single support. → Greater decoupling between walking and prehension in fallers. <u>Limitations:</u> level of difficulty of the manual task potentially not high enough to elicit modifications in interlimb coordination, subjects that were free to choose their walking speed.	1) L 2) L 3) L 4) L 5) L 6) M (all the p-values related to post-hoc tests were not clearly reported) → Low risk of bias
Zhou et al., 2017 [79]	738 older adults: 460 fallers (78.1 ± 5.5 y.; 292 F; SPPB: 9.3 ± 2.6) and 278 non-fallers (77.9 ± 5.3 y.; 178 F; SPPB: 9.4 ± 2.4); <u>Inclusion criteria:</u> aged 70	<u>Prospective study;</u> Over a follow-up period of 48 months using monthly falls calendar and follow-up interviews;	<u>Motor task:</u> quiet standing barefoot with eyes open for 30 s <u>Concurrent cognitive task:</u> mental tracking/working memory task: serial-3	<u>(1) Yes, (2) Yes & (3) Yes:</u> Fallers exhibited lower AP postural sway complexity (measured by multiscale entropy) under both ST and DT in comparison with non-fallers (p = 0.007 and 0.002, respectively), while there were no differences in terms of sway speed, sway area, AP path length and	1) H (existing exclusion criterion MMSE ≤ 18, but no reporting of MMSE scores or other

	<p>years-old and older, ability to walk 6 m without personal assistance (walking aids permitted);</p> <p><u>Exclusion criteria:</u> cognitive impairment (MMSE \leq 18), terminal disease, severe hearing or vision loss.</p>	<p>→ Fallers = (# of falls \geq 1);</p> <p>Definition of a fall: “unintentionally coming to rest on the ground or other lower level, not as a result of an overwhelming external hazard or a major intrinsic event”.</p>	<p>subtraction from 500 (individual adaptation of the task in case of difficulty)</p> <p><u>Independent variables & analysis:</u></p> <p>AP postural sway complexity metric, sway speed, sway area, AP path length;</p> <p>for differences between fallers and non-fallers as well as between quintiles of the continuous postural sway complexity: ANOVAs and Student’s t-tests + negative binomial regression with involvement of covariates → IRR</p>	<p>SPPB score.</p> <p>In negative binomial analyses with covariate adjustments, AP complexity of postural sway during ST and DT was independently negatively associated with the incidence of future falls (ST: IRR = 0.98, 95% CI = 0.96-0.99, $p = 0.02$; DT: IRR = 0.98, 95% CI = 0.97-0.99, $p = 0.02$). Unlikely, sway speed, sway area, AP path length and SPPB score did not significantly predict future falls rate.</p> <p>During ST, older adults in the quintile 1 had a significantly higher falls rate than those in quintiles 4 and 5 ($p < 0.01$), whereas, during DT, those in quintiles 1,2 and 3 of complexity presented higher fall rates than those in quintiles 4 and 5 ($p < 0.04$).</p> <p>In the DT condition, older adults in the lower quintiles of complexity (quintiles 1, 2 and 3) experienced significantly more falls during the follow-up (IRRs = 1.48, 1.42 and 1.44, 95% CI = 1.04-1.99, $p < 0.03$) compared to those in the highest quintile of complexity (quintile 5).</p> <p>DT postural sway complexity, with its particular sensitivity, was a better predictor of future falls risk than ST postural sway complexity.</p> <p><u>Limitations:</u> postural sway complexity only analyzed in AP direction.</p>	<p>measure of global cognitive functions, and no exclusion criterion such as neurological disease)</p> <p>2) L</p> <p>3) L</p> <p>4) L</p> <p>5) L</p> <p>6) L</p> <p>→ Moderate risk of bias</p>
<p>Santos et al., 2018 [61]</p>	<p>30 older women: 15 fallers (79 \pm 6 y.; 26 F; MMSE : 25 \pm 3; POMA, gait score = 11; POMA, balance score = 13) and 15 non-fallers (81 \pm 6 y.; 16 F; MMSE : 25 \pm 3; POMA, gait score = 10; POMA, balance score = 14) ;</p> <p><u>Inclusion criteria:</u> 65 years-old and older, ability to walk without the help of others or walking aids, (gender was not an inclusion criterion);</p> <p><u>Exclusion criteria:</u> visual impairments not corrected by eyeglasses or contact lenses, severe neuromuscular, musculoskeletal or cardiopulmonary disorders, dysfunction of the dominant upper limb, low cognition (MMSE < 24).</p>	<p>Retrospective study;</p> <p>6-month follow-up period;</p> <p>→ Fallers = (# of falls \geq 1).</p>	<p><u>Motor task:</u></p> <p>walking (also perform as ST) or postural control (performing the concurrent task while staying stationary)</p> <p><u>Concurrent task:</u></p> <p>manual task: grasping, transporting and placing the dowel as close as possible to the center of the target, with 4 different levels of difficulty according to target distance (short versus long distance) and target size (target of either 8 or 12 cm)</p> <p><u>Independent variables & analysis:</u></p> <p>variables related to the analysis of dowel position relative to target center: radial error, constant error (target center position - dowel center) in AP and ML directions; variables related to the analysis of dowel transport: duration of transport, peak wrist velocity during dowel transport, time to peak wrist velocity adjusted to the duration of transport; variables related to gait analysis: AP and ML margin of dynamic stability at dowel contact and release;</p> <p>Student’s t tests for independent samples + for dowel position and transport: 4-way (group x task x distance x diameter) ANOVAs with repeated measures; for gait variables: 2 4-way (group x task x</p>	<p><u>(1) Yes, (2) Not addressed & (3) Not addressed:</u></p> <p>During ST walking, step length was significantly smaller in fallers compared to non-fallers ($p = 0.004$).</p> <p>Addition of a manual task did not affect gait stability of fallers but they underperformed in this manual task of grasping, transporting and placing a dowel. Indeed, fallers were less accurate (significantly larger AP constant error, particularly for the walking DT combined with the 8-cm target; $F(1,28) = 6.395$, $p = 0.017$) and slower (during the postural DT and for the long distance in comparison with the walking DT and short distance, respectively; $p \leq 0.0001$) in the dowel-positioning task than were non-fallers.</p> <p><u>Limitations:</u> sample composed only of women, task that is not as close to everyday activities as others could be, force applied on the dowel not quantified, different simple manual tasks not assessed.</p>	<p>1) M (only women)</p> <p>2) L</p> <p>3) L</p> <p>4) M (no formal definition of a fall)</p> <p>5) M (covariates not taken in to account in the statistical analyses)</p> <p>6) L</p> <p>→ Moderate risk of bias</p>

			distance x diameter) MANOVAs with repeated measures + post-hoc analysis with Bonferroni adjustment		
Uiga et al., 2018 [70]	<p>78 older adults: 34 fallers (69 ± 3.52 y.; 29 F; MMSE: 29.03 ± 0.98) and 36 non-fallers (68.89 ± 3.7 y.; 28 F; MMSE: 29.23 ± 1.11);</p> <p><u>Exclusion criteria:</u> physical or neurological impairment, static visual acuity worse than 20/40, use of walking aids, Cantonese version of MMSE < 24/30 that would not reflect normal cognition.</p>	<p>Retrospective study;</p> <p>Falls history over the last 2 years;</p> <p>→ Fallers = (# of falls ≥ 1);</p> <p>Definition of a fall: “any fall for which a participant was clearly able to identify a timeframe, venue and mechanism”.</p>	<p><u>Motor task:</u></p> <p>1-minute quiet standing</p> <p><u>Concurrent cognitive task:</u></p> <p>discrimination and decision-making task: tone-counting task → monitoring and subsequently reporting the number of high-pitched tones presented via computer speakers</p> <p><u>Instructions:</u></p> <p>“to prioritize the balancing task”</p> <p><u>Independent variables & analysis:</u></p> <p>COP measures of postural stability: ellipsoidal area (85.35%), average velocity, SD of ML axis (SD-ML), SD-AP, ML sample entropy (SampEn-ML), SampEn-AP, ML detrended fluctuation analysis (DFA-ML), DFA-AP, tone-counting accuracy;</p> <p>for group differences: 2 (task) x 3 (group, which also included a group of young adults) multivariate repeated measures ANOVAs separately for traditional COP variables and for complexity-based COP variables + univariate ANOVA for group differences in tone-counting accuracy + Bonferroni corrected pairwise comparisons</p>	<p>(1) Yes, (2) Not addressed & (3) Not addressed:</p> <p>Regarding traditional COP sway variables, there was a significant effect of group on balance performance (F(8,228) = 4.02, p < 0.001), with greater area of sway (p < 0.001), SD-ML (p= 0.006) and SD-AP (p = 0.007) in fallers compared to non-fallers. Particularly, under DT condition, group difference was particularly significant for area of sway. A significant effect of task condition on balance performance was also found (F(4,114) = 4.06, p = 0.004), with less average sway velocity (p < 0.001) and less SD-AP (p = 0.043) under DT in comparison with ST. However, no significant interaction between task condition and group was observed.</p> <p>Concerning complexity-based COP sway variables, there was no significant group effect (older adults fallers versus non-fallers) on such kind of variables, a significant effect of task condition but with non-significant results to post-hoc tests, and no interaction between group and task condition.</p> <p>Moreover, no significant difference between older adult fallers and non-fallers was found for mean tone-counting accuracy.</p> <p><u>Limitations:</u> quiet standing is a relatively easy task, healthy and active older adults → lack of generalization in the old population.</p>	<p>1) M (no statistical comparisons on demographic characteristics at baseline)</p> <p>2) L</p> <p>3) L</p> <p>4) L</p> <p>5) L</p> <p>6) L</p> <p>→ Low risk of bias</p>

F. Detailed Table of Results from the Systematic Literature Review About Dual Tasks Involving Turns

Table F.1 Articles about dual tasks involving turns that were included in the systematic literature review. Abbreviations: y. = years; F = females; M = males; # = number; OR = odds ratio; CI = confidence interval; MMSE = Minimal Mental State Examination; POMA = Performance Oriented Mobility Assessment; RDST = Rapid Dementia Screening Test; AUC = Area Under the Curve.

Authors	Population	Falls	Dual-task paradigm & discriminative/predictive analysis	<p>(1) Do DT-related changes or DT performance discriminate fallers from non-fallers?</p> <p>(2) Are DT-related changes or DT performance predictors of falling?</p> <p>(3) Is the DT-related predictive strength superior compared to the ST-related one?</p> <p>(Yes/No/Inconclusive/Not addressed)</p>	Risk of bias via QUIPS tool (High H, Moderate M, Low L risk of bias)
<p>Muhaidat et al., 2014 [52]</p>	<p>62 independently ambulant community-dwelling older adults: 13 fallers (82 ± 12 y.; 9 F; MMSE: 29 ± 3; POMA: 26 ± 7) and 49 non-fallers (75 ± 11.5 y.; 32 F; MMSE: 29 ± 2; POMA: 28 ± 2);</p> <p><u>Inclusion criteria:</u> aged 65 years-old and older, living in the community, able to speak and understand English, able to travel to the assessment laboratory, MMSE ≥ 24, able to maintain their feet together and adopt the semi-tandem stance of the 4-test balance scale for 10 s</p> <p><u>Exclusion criteria:</u> use of walking frames and uncorrected visual or hearing impairments.</p>	<p>Prospective study;</p> <p>6-month follow-up validation cohort study, with monthly falls' diaries and telephone interviews;</p> <p>→ Fallers = (# of falls ≥ 1); + falls in the previous year.</p>	<p>8 dual-task tests and 1 triple-task test, with straight walking with or without obstacles, walking with turns and stair descent as motor tasks and motor, verbal fluency, mental tracking/working memory, and discrimination and decision-making tasks as concurrent tasks:</p> <ul style="list-style-type: none"> - straight walking and visuospatial clock task; - walking with turns and naming animals; - walking with turns and counting backwards in 3s; - avoiding stationary obstacles and naming animals; - avoiding a moving obstacle and carrying a cup; - timed Up & Go (TUG) and carrying a cup; - stair descent and naming animals; - walking while talking complex; - straight walking, visuospatial clock task, and carrying a cup <p><u>Instructions:</u></p> <p>“to walk at their preferred speed and to perform both tasks as well as they could”</p> <p><u>Independent variables & analysis:</u></p> <p>for ST, DT, proportionate and absolute differences: walking time, performance speed (total answers/second), accuracy (errors/total answers); random forest classification analysis (mean decrease in accuracy, mean decrease in Gini impurity, out-of-bag error rate) + binary logistic regression for the top 5 variables</p>	<p>(1) Not addressed, (2) Yes & (3) Inconclusive:</p> <p>18 (36.7%) of the non-fallers and 10 (76.9%) of the fallers had an history of falls in the previous year (p = 0.01).</p> <p>This multivariate analysis failed to identify a useful predictive tool, but gave an indication regarding the most useful variables in predicting falls in a multivariate analysis; that is, time for avoiding a moving obstacle in ST and DT while carrying a cup, time required to perform the walking task in the triple-task test, time for TUG in DT, and absolute difference for TUG time between ST and DT.</p> <p>For these 5 variables, the ORs obtained with binary logistic regression were all statistically significant (OR = 1.29, 1.22, 1.12, 1.23, 0.61; 95% CI = 1.11-1.54, 1.07-1.41, 1.03-1.24, 1.1-1.41, 0.43-0.81; p = 0.002, 0.004, 0.01, 0.001, 0.002).</p> <p>Moreover, in terms of the form of DT outcomes, absolute difference could be a better predictor of falls than the proportionate difference.</p> <p><u>Limitations:</u> small sample size while large number of variables, short follow-up period, and participation of subjects in exercise classes.</p>	<p>1) M (no information regarding comorbidities; e.g., a neurological disorder)</p> <p>2) L</p> <p>3) L</p> <p>4) M (no formal definition of a fall)</p> <p>5) L</p> <p>6) L</p> <p>→ Moderate risk of bias</p>

<p>Ansai et al., 2016 [1]</p>	<p>67 community-dwelling older adults: 24 fallers (80-85 y.; 18 F; MMSE = 24) and 43 non-fallers (80-83 y.; 27 F; MMSE = 27);</p> <p><u>Inclusion criteria:</u> aged 80 years-old and older, living in the community (non-institutionalized), sedentary, ability to walk alone either with or without a cane;</p> <p><u>Exclusion criteria:</u> walking with a walker, cognitive, neurological and skeletal muscle disorders that prevent walking correctly, MMSE score below the designated educational level cut-off minus one standard deviation.</p>	<p>Cross-sectional (retrospective) study;</p> <p>Self-report of falls over the past 3 months;</p> <p>→ Fallers = (# of falls ≥ 1);</p> <p>Definition of a fall: “an event which results in a person coming to rest inadvertently on the ground or floor or other lower level and other than as a consequence of the following: sustaining a violent blow; loss of consciousness; sudden onset of paralysis; or an epileptic seizure” [16].</p>	<p><u>Motor task:</u></p> <p>TUG test (walking, turning and transfers)</p> <p><u>Concurrent tasks:</u></p> <ul style="list-style-type: none"> - mental tracking task/working memory task: repeating days of the week in reverse order; - motor task: grasping a drinking filled with water <p><u>Independent variables & analysis:</u></p> <p>for both cognitive and motor DT-TUG tests: completion time, number of steps, occurrence of poured water, number of correct and incorrect answers, number of correct answers to time spent ratio, number of total answers to time spent ratio; Spearman product-moment correlation coefficient + Mann-Whitney tests or Chi-square tests</p>	<p><u>(1) Yes, (2) Not addressed & (3) Not addressed:</u></p> <p>Most balance and DT variables were significantly correlated.</p> <p>While fallers did not show differences on balance tests in comparison with non-fallers, they took significantly more time and steps during both TUG tests with cognitive (p = 0.013 and 0.057, respectively) or motor concurrent task (p = 0.037 and 0.039).</p> <p><u>Limitations:</u> small sample size, absence of a random sampling, non-prospective analysis of falls, lack of certain gait variables such as step variability.</p>	<p>1) L 2) L 3) L 4) L 5) L 6) L → Low risk of bias</p>
<p>Ponti et al., 2017 [56]</p>	<p>36 community-dwelling healthy older adults: 18 fallers (75.25 ± 8.2 y.; 15 F; MMSE: 23.75 ± 3.93) and 18 non-fallers (70.94 ± 6.69 y.; 10 F; MMSE: 26.46 ± 4.35);</p> <p><u>Inclusion criteria:</u> aged 60 years-old and older, ability to stand up from a chair with arms without other person’s help and to walk independently without aid device, eutrophic;</p> <p><u>Exclusion criteria:</u> amputation and/or use of lower limb prosthesis or other device that modifies the gait pattern, neurological or muscular disease, any condition listed it Charlson Comorbidity Index, obesity, presence of any important risk factor that compromises safety, according to the evaluator.</p>	<p>Retrospective study;</p> <p>Participants questioned about their history of falls over the past year;</p> <p>Definition of a fall: “come to inadvertently get in the soil or in other lower level, excluding intentional position changes to lean on furniture, walls or other objects” [76].</p>	<p><u>Motor task:</u></p> <p>TUG test</p> <p><u>Concurrent tasks:</u></p> <ul style="list-style-type: none"> - motor task: carrying a cup filled with water (TUG-M) - mental tracking/working memory task: continuous simple subtraction questions (TUG-C) <p><u>Independent variables & analysis:</u></p> <p>completion time, mean completion time among tasks, number of steps; for the whole signal (containing the 3 TUG tasks), TUG ST, TUG-M and TUG-C: Power Spectral Entropy (PSE), Power Spectrum Peak Frequency (PSPF), Power Spectrum Peak (PSP), Weighted Power Spectrum Peak (WPSP); distance-based features, features fusion;</p> <p>t-tests for group comparisons on traditional TUG parameters + Mann-Whitney U-tests for group comparisons on frequency domain features, and fusion of relevant features + ROC analysis (sensitivity, specificity, AUC, f1-Score)</p>	<p><u>(1) Yes, (2) Yes & (3) Yes:</u></p> <p>Traditional features such as (mean) completion time and number of steps were not significantly different between fallers and non-fallers in any of the versions of TUG test (ST and both DT).</p> <p>Regarding frequency domain features, only lower PSE (p = 0.014), WPSP2 (p = 0.022) and WPSP3 (p = 0.009) related to TUG-C as well as lower features fusion (p = 0.001), lower PSE (p = 0.029) and PSP (p = 0.014) differences between the whole signal and the TUG-C, lower PSPF difference between TUG and TUG-M (p = 0.049), and lower WPSP difference between TUG-M and TUG-C (p = 0.034) as well as lower distances fusion (p = 0.001) were significantly able to identify fallers from non-fallers.</p> <p>Outcomes from the ROC analysis were consistent with the previously reported results: the extracted frequency and distance-based features had higher values of AUC, f1-Scores, sensitivity and specificity compared to the traditional parameters (e.g., completion times) related to TUG tests. However, the best results were allocated to the fusion of distance-based features, with AUC = 0.84, f1-Score = 0.83, sensitivity = specificity = 0.83 for the probability cut-off point 0.5 with a 95% CI 0.62-0.91.</p> <p>Therefore, both distance-based features and fusion have shown to be interesting methods to improve the results.</p> <p><u>Limitations:</u> sample size, intraclass variability of the data.</p>	<p>1) M (no criterion about global cognitive functions, even if MMSE scores were relatively high) 2) L 3) L 4) L 5) L 6) L → Low risk of bias</p>

<p>Asai et al., 2018 [3]</p>	<p>537 community-dwelling older adults: 103 fallers (77.5 ± 6 y.; 68 F; RDST: 9.5 ± 3.1) and 434 non-fallers (76.5 ± 6.4 y.; 278 F; RDST: 9.6 ± 2.8);</p> <p><u>Inclusion criteria:</u> aged 60 years-old and older, ability to walk independently with or without an assistive device, no physical or social care services from the local government, no self-reported neurological disorders that could affect mobility or balance;</p> <p><u>Exclusion criteria:</u> inability to perform the ST- or DT-TUG, inability to understand the DT method because of severe cognitive impairment, incomplete data on any of the measurements.</p>	<p>Retrospective study; Self-administered questionnaire; Definition of a fall: [39].</p>	<p><u>Motor task:</u> TUG test (walking at a comfortable and safe pace)</p> <p><u>Concurrent cognitive task:</u> mental tracking/working memory task: serial-1 subtraction aloud from 100</p> <p><u>Instructions:</u> no instructions given regarding which task to prioritize</p> <p><u>Independent variables & analysis:</u> completion time, last number spoken, backward counting speed ((100-last number counted)/completion time), DTC (sort of proportionate difference, with the mean completion time among ST and DT as divisor); Unpaired t-tests for group comparisons + multivariate logistic regression models with history of falls as dependent variable and with covariates (age, sex, height, weight and RDST score) + final logistic regression model with significant and uncorrelated TUG-related variables + ROC curve → AUC, cut-off value, sensitivity, specificity → classification into 4 fall risk groups and ORs + final logistic regression model applied on well-functioning (ST-TUG score < 7 s), transitional-functioning (ST-TUG score = 7-16 s) and frail groups (ST-TUG score > 16 s)</p>	<p><u>(1) Yes, (2) Yes & (3) Yes – additional value:</u></p> <p>Fallers took significantly longer to complete ST-TUG (p = 0.002) and presented a lower DTC value (p = 0.13) in comparison with non-fallers.</p> <p>Either in separate regression models or in a common regression model, even after adjustment for covariates, ST-TUG score and DTC value were significantly associated with fall history (ST-TUG score: OR = 1.133, 95% CI = 1.029-1.249, p = 0.011, cut-off value = 7.98 s, AUC = 0.58, sensitivity = 46%, specificity = 71%; DTC value: OR = 0.984, 95% CI = 0.968-0.998, p = 0.032, cut-off value = 15.4%, AUC = 0.57, sensitivity = 70%, specificity = 44%). Compared to the other three fall risk groups, a higher proportion of older adults from the fall risk group characterized by a slower ST-TUG score and a lower DTC value reported a history of falls.</p> <p>Finally, both above mentioned predictors were similarly significantly associated with falls history in the transitional functioning group (ST-TUG time = 7-16 s; ST-TUG score: OR = 1.198, 95% CI = 1.019-1.408, p = 0.029; DTC: OR = 0.979, 95% CI = 0.958-0.997, p = 0.043), but not in the well-functioning group (ST-TUG score < 7 s).</p> <p><u>Limitations:</u> cross-sectional study → not possible to establish a causal relationship between TUG-related variables and the occurrence of a fall, various potential bias affecting the results (e.g., recall bias due to a fall history obtained via a questionnaire, selection bias because of the relatively healthy lives of the participants, confounding bias such as executive function that can affect both fall risk and DT performance), no assessment of the effects of different concurrent tasks on the TUG test score, no comparison between the predictive validity of the DT-TUG test and the DT gait test.</p>	<p>1) M (no exclusion criterion regarding non-severe cognitive impairment, even if RDST scores were high)</p> <p>2) L</p> <p>3) L</p> <p>4) L</p> <p>5) L</p> <p>6) L</p> <p>→ Low risk of bias</p>
<p>Toma-Carus et al., 2019 [69]</p>	<p>367 community-dwelling older adults: 96 fallers (78 F/18 M; 71.5 ± 9/73.5 ± 8 y.; Clock Drawing Test score: 19 ± 2/20 ± 1) and 271 non-fallers (179 F/92 M; 70 ± 7/73 ± 8 y.; Clock Drawing Test score: 19 ± 2/19 ± 1);</p> <p><u>Inclusion criteria:</u> aged 65 years-old and older, ability to walk and understand the study protocol by themselves;</p> <p><u>Exclusion criteria:</u> diagnosis of dementia, Parkinson's disease or vertigo, Clock Drawing Test score < 18 (associated with</p>	<p>Cross-sectional (retrospective) study; Fall history over the last year; → Fallers = (# of falls ≥ 1); Definition of a fall: "inadvertently coming to rest on the ground, floor or other lower level, excluding intentional change in position to rest in furniture, wall or other objects" [76].</p>	<p><u>Motor task:</u> TUG test</p> <p><u>Concurrent cognitive task:</u> mental tracking/working memory task: serial-1 subtraction from 100</p> <p><u>Instructions:</u> "walk as quickly and safely as possible (...), and count as quickly and surely as possible"</p> <p><u>Independent variables & analysis:</u> for TUG-ST and TUG-DT: time spent on the test task accomplishment; for TUG-DT: number of cognitive errors, cognitive stops and motor stops; DTC being a kind of proportionate difference (difference in time spent between TUG-ST and TUG-DT, divided by the</p>	<p><u>(1) Yes, (2) Yes & (3) Yes:</u></p> <p>History of falls was significantly positively correlated to mean TUG-ST and TUG-DT time spent, mean cognitive errors, mean cognitive stops and mean motor stops.</p> <p>Among men, mean TUG-DT time spent (p = 0.014), mean cognitive stops (p = 0.049), mean motor stops (p = 0.023), DTC (p < 0.001), [TUG-DT time + cognitive stops] (p = 0.006) and [TUG-DT time + cognitive stops + cognitive errors] (p = 0.021) were significantly higher in fallers compared to non-fallers. Regarding women, only significantly greater [TUG-DT time + cognitive stops + cognitive errors] (p = 0.045) and mean motor stops (p = 0.024) were found in fallers in comparison with non-fallers.</p> <p>In men, a significant AUC for predicting risk of falls was found for mean TUG-DT time spent (p = 0.014), [TUG-DT time + cognitive stops] (p = 0.006), [TUG-DT time + cognitive stops + cognitive errors] (p = 0.021) and DTC (p < 0.001), whereas it was only for [TUG-DT time +</p>	<p>1) L</p> <p>2) L</p> <p>3) L</p> <p>4) L</p> <p>5) L</p> <p>6) L</p> <p>→ Low risk of bias</p>

	cognitive impairment and different types of dementia).		average score between both tasks); [TUG-DT time + cognitive stops], [TUG-DT time + cognitive stops + cognitive errors]; non-parametric Spearman's correlations + Mann-Whitney U tests in both sexes + AUC of ROC curve, cut-off values, sensibility and specificity	cognitive stops (p = 0.046) and [TUG-DT time + cognitive stops + cognitive errors] (p = 0.036) in women. The best predictor (in terms of AUC) was DTC in men (0.764) and [TUG-DT time + cognitive stops + cognitive errors] in women (0.583). <u>Limitations:</u> cross-sectional design limiting the extraction of conclusions about the predictive value of the TUG, small sample size, reliability of the new variables [TUG-DT time + cognitive stops] and [TUG-DT time + cognitive stops + cognitive errors] not tested yet.	
Asai et al., 2020 [4]	649 community-dwelling older adults: 331 young-older adults (60–74 y.), with 78 fallers (72.1 ± 2.9 y.; 53 F; RDST: 10.6 ± 2.5) and 253 non-fallers (71.7 ± 2.8 y.; 164 F; RDST: 11 ± 1.7), and 318 old-older adults (≥ 75 y.), with 97 fallers (80.4 ± 3.6 y.; 69 F; RDST: 9.3 ± 2.9) and 221 non-fallers (80.8 ± 3.9 y.; 139 F; RDST: 9.1 ± 2.9) <u>Inclusion criteria:</u> aged 60 years-old and older, ability to walk independently with or without an assistive device; <u>Exclusion criteria:</u> inability to perform the ST- or DT-TUG, incomplete data on any of the measurements, self-reported neurological disorders that could affect mobility or balance.	Longitudinal observation study (prospective) study; 1-year follow-up; Definition of a fall: [39].	<u>Motor task:</u> TUG test (walking at a comfortable and safe pace) <u>Concurrent cognitive task:</u> mental tracking/working memory task: serial-1 subtraction aloud from 100 <u>Instructions:</u> no instructions given regarding which task to prioritize <u>Independent variables & analysis:</u> completion time, last number spoken, backward counting speed ((100-last number counted)/completion time), DTC (sort of proportionate difference, with the mean completion time among ST and DT as divisor); Mann-Whitney U tests + unpaired t-tests + multivariate logistic regression models with covariates (age, sex, height, weight, RDST score at baseline, change in RDST score and comorbidities)	<u>(1) Yes, (2) Yes & (3) Yes – additional value:</u> In young-older adults , fallers took longer to perform ST-TUG in comparison with non-fallers (p = 0.02). Old-older adult fallers , for their part, showed lower DTC than non-fallers (p = 0.005). Regarding predictive power for risk of falls , ST-TUG time was not significantly associated with the occurrence of falls in the follow-up year in young older adults anymore, after controlling for covariates such as RDST and backward counting speed during DT-TUG. However, in old older adults , a longer ST-TUG time (OR = 1.143, 95% CI = 1.018-1.285, p = 0.024) and lower DTC value (OR = 0.981, 95% CI = 0.963-0.999, p = 0.049) were significantly associated with falls occurrence, even after adding RDST at baseline, change in RDST score, backward counting speed during DT-TUG and comorbidities as covariates into the regression model. Therefore, DT may provide an additional value in TUG for predicting falls among old-older adults . <u>Limitations:</u> relatively low follow-up rate (649/987, 66%), potential selection bias, some data regarding falls were not obtained, potential additional confounders, quite easy cognitive task, no other concurrent task tested.	1) M (no exclusion criterion regarding cognitive impairment, even if RDST scores were high) 2) M (relatively low follow-up rate) 3) L 4) L 5) L 6) L → Moderate risk of bias

References

- [1] Ansai JH, Aurichio TR, Rebelatto JR. Relationship between balance and dual task walking in the very elderly. *Geriatr Gerontol Int* 2016;16: 89–94.
- [2] Asai T, Oshima K, Fukumoto Y, Yonezawa Y, Matsuo A, Misu S. Association of fall history with the Timed Up and Go test score and the dual task cost: A cross-sectional study among independent community-dwelling older adults. *Geriatr Gerontol Int* 2018;18: 1189–93.
- [3] Asai T, Oshima K, Fukumoto Y, Yonezawa Y, Matsuo A, Misu S.. Does dual-tasking provide additional value in timed “up and go” test for predicting the occurrence of falls? A longitudinal observation study by age group (young-older or old-older adults). *Aging Clin Exp Res* 2020; online ahead of print.
- [4] Ashburn A, Stack E, Pickering RM, Ward CD. Predicting fallers in a community-based sample of people with Parkinson’s disease. *Gerontology* 2001;47: 277–81.
- [5] Ayers EI, Tow AC, Holtzer R, Verghese J. Walking while talking and falls in aging. *Gerontology* 2014;60: 108–13.
- [6] Bauer C, Gröger I, Glabasnia A, Bergler C, Gassmann KG. First Results of Evaluation of a Falls Clinic. *International Journal of Gerontology* 2010;4: 130–6.
- [7] Beauchet O, Allali G, Annweiler C, Berrut G, Maarouf N, et al. Does change in gait while counting backward predict the occurrence of a first fall in older adults? *Gerontology* 2008;54: 217–23.
- [8] Beauchet O, Annweiler C, Allali G, Berrut G, Herrmann FR, Dubost V. Recurrent falls and dual task-related decrease in walking speed: is there a relationship? *J Am Geriatr Soc* 2008;56: 1265–9.
- [9] Beauchet O, Annweiler C, Dubost V, Allali G, Kressig RW, et al. Stops walking when talking: a predictor of falls in older adults? *Eur J Neurol* 2009;16: 786–95.
- [10] Beauchet O, Dubost V, Allali G, Gonthier R, Herrmann FR, Kressig RW. “Faster counting while walking” as a predictor of falls in older adults. *Age Ageing* 2007;36: 418–23.
- [11] Bergland A, Wyller TB. Risk factors for serious fall related injury in elderly women living at home. *Inj Prev* 2004;10: 308–13.

- [12] Bootsma-van der Wiel A, Gussekloo J, de Craen AJM, van Exel E, Bloem BR, Westendorp RGJ. Walking and talking as predictors of falls in the general population: the Leiden 85-Plus Study. *J Am Geriatr Soc* 2003;51: 1466–71.
- [13] Caetano MJD, Lord SR, Brodie MA, Schoene D, Pelicioni PHS, et al. Executive functioning, concern about falling and quadriceps strength mediate the relationship between impaired gait adaptability and fall risk in older people. *Gait Posture* 2018;59: 188–92.
- [14] Callisaya ML, Blizzard L, Martin K, Srikanth VK. Gait initiation time is associated with the risk of multiple falls-A population-based study. *Gait Posture* 2016;49: 19–24.
- [15] Callisaya ML, Verghese J. The Association of Clinic-Based Mobility Tasks and Measures of Community Performance and Risk. *PM R* 2018;10: 704-11.
- [16] Chiu AYY, Au-Yeung SSY, Lo SK. A comparison of four functional tests in discriminating fallers from non-fallers in older people. *Disabil Rehabil* 2003;25: 45–50.
- [17] Chu Y-H, Tang P-F, Peng Y-C, Chen H-Y. Meta-analysis of type and complexity of a secondary task during walking on the prediction of elderly falls. *Geriatr Gerontol Int* 2013;13: 289–97.
- [18] Commandeur D, Klimstra MD, MacDonald S, Inouye K, Cox M, et al. Difference scores between single-task and dual-task gait measures are better than clinical measures for detection of fall-risk in community-dwelling older adults. *Gait Posture* 2018;66: 155–9.
- [19] Dibble LE, Lange M. Predicting falls in individuals with Parkinson disease: a reconsideration of clinical balance measures. *J Neurol Phys Ther* 2006;30: 60–7.
- [20] Donoghue OA, Cronin H, Savva GM, O'Regan C, Kenny RA. Effects of fear of falling and activity restriction on normal and dual task walking in community dwelling older adults. *Gait & Posture* 2013;38: 120–4.
- [21] Faulkner KA, Redfern MS, Cauley JA, Landsittel DP, Studenski SA, et al. Multitasking: association between poorer performance and a history of recurrent falls. *J Am Geriatr Soc* 2007;55: 570–6.
- [22] Freire Júnior RC, Porto JM, Marques NR, Magnani PE, Abreu DCC de. The effects of a simultaneous cognitive or motor task on the kinematics of walking in older fallers and non-fallers. *Hum Mov Sci* 2017;51: 146–52.
- [23] Gibson M. Falls in later life. Improving the health of older people. In: Kane RL, et al. *A world view*. Oxford: Oxford University Press; 1990. p. 296–315.

- [24] Gillain S, Boutaayamou M, Schwartz C, Bröls O, Bruyère O, et al. Using supervised learning machine algorithm to identify future fallers based on gait patterns: A two-year longitudinal study. *Experimental Gerontology* 2019;127: 110730.
- [25] Gillain S, Boutaayamou M, Schwartz C, Dardenne N, Bruyère O, et al. Gait symmetry in the dual task condition as a predictor of future falls among independent older adults: a 2-year longitudinal study. *Aging Clin Exp Res* 2019;31: 1057–67.
- [26] Gimmon Y, Barash A, Debi R, Snir Y, Bar David Y, et al. Application of the clinical version of the narrow path walking test to identify elderly fallers. *Arch Gerontol Geriatr* 2016;63: 108–13.
- [27] Halliday DWR, Hundza SR, Garcia-Barrera MA, Klimstra M, Commandeur D, et al. Comparing executive function, evoked hemodynamic response, and gait as predictors of variations in mobility for older adults. *J Clin Exp Neuropsychol* 2018;40: 151–60.
- [28] Hauer K, Lamb SE, Jorstad EC, Todd C, Becker C. Systematic review of definitions and methods of measuring falls in randomised controlled fall prevention trials. *Age Ageing* 2006;35: 5–10.
- [29] Herman T, Mirelman A, Giladi N, Schweiger A, Hausdorff JM. Executive control deficits as a prodrome to falls in healthy older adults: a prospective study linking thinking, walking, and falling. *J Gerontol A Biol Sci Med Sci* 2010;65: 1086–92.
- [30] Hirashima K, Higuchi Y, Imaoka M, Todo E, Kitagawa T, Ueda T. Dual-tasking over an extended walking distance is associated with falls among community-dwelling older adults. *Clin Interv Aging* 2015;10: 643–8.
- [31] Howcroft J, Kofman J, Lemaire ED. Prospective Fall-Risk Prediction Models for Older Adults Based on Wearable Sensors. *IEEE Trans Neural Syst Rehabil Eng* 2017;25: 1812–20.
- [32] Howcroft J, Kofman J, Lemaire ED, McIlroy WE. Analysis of dual-task elderly gait in fallers and non-fallers using wearable sensors. *J Biomech* 2016;49: 992–1001.
- [33] Howcroft J, Lemaire ED, Kofman J. Wearable-Sensor-Based Classification Models of Faller Status in Older Adults. *PLoS ONE* 2016;11: e0153240.
- [34] Howcroft J, Lemaire ED, Kofman J, McIlroy WE. Dual-Task Elderly Gait of Prospective Fallers and Non-Fallers: A Wearable-Sensor Based Analysis. *Sensors (Basel)* 2018;18: 1275.
- [35] Hsu CL, Nagamatsu LS, Davis JC, Liu-Ambrose T. Examining the relationship between specific cognitive processes and falls risk in older adults: a systematic review. *Osteoporos Int* 2012;23: 2409–24.

- [36] Hyndman D, Ashburn A. Stops walking when talking as a predictor of falls in people with stroke living in the community. *J Neurol Neurosurg Psychiatry* 2004;75: 994–97.
- [37] Johansson J, Nordström A, Nordström P. Greater Fall Risk in Elderly Women Than in Men Is Associated With Increased Gait Variability During Multitasking. *J Am Med Dir Assoc* 2016;17: 535–40.
- [38] Kang HG, Quach L, Li W, Lipsitz LA. Stiffness control of balance during dual task and prospective falls in older adults: the MOBILIZE Boston Study. *Gait Posture* 2013;38: 757–63.
- [39] Kellogg International Work Group on the Prevention of Falls by the Elderly, Gibson MJS, Andres RO, Kennedy TE, Coppard LC, et al. The prevention of falls in later life: a report of the Kellogg International Work Group on the Prevention of Falls by the Elderly. Copenhagen: Published for the Medical Faculties of the Universities of Copenhagen and Aarhus, and the Danish National Board of Health by Ugeskrift for Læger in cooperation with the University of Michigan and the University of Copenhagen 1987.
- [40] Kressig RW, Herrmann FR, Grandjean R, Michel J-P, Beauchet O. Gait variability while dual-tasking: fall predictor in older inpatients? *Aging Clin Exp Res* 2008;20: 123–30.
- [41] Lamb SE, Jørstad-Stein EC, Hauer K, Becker C, Prevention of Falls Network Europe and Outcomes Consensus Group. Development of a common outcome data set for fall injury prevention trials: the Prevention of Falls Network Europe consensus. *J Am Geriatr Soc* 2005;53: 1618–22.
- [42] Liu-Ambrose T, Katarynych LA, Ashe MC, Nagamatsu LS, Hsu CL. Dual-task gait performance among community-dwelling senior women: the role of balance confidence and executive functions. *J Gerontol A Biol Sci Med Sci* 2009;64: 975–82.
- [43] Lundin-Olsson L, Nyberg L, Gustafson Y. “Stops walking when talking” as a predictor of falls in elderly people. *Lancet* 1997;9052: 617.
- [44] Lundin-Olsson L, Nyberg L, Gustafson Y. Attention, frailty, and falls: the effect of a manual task on basic mobility. *J Am Geriatr Soc* 1998;46: 758–61.
- [45] Lundin-Olsson L, Nyberg L, Gustafson Y. The Mobility Interaction Fall chart. *Physiother Res Int* 2000;5: 190–201.
- [46] MacAulay RK, Allaire TD, Brouillette RM, Foil HC, Bruce-Keller AJ, et al. Longitudinal assessment of neuropsychological and temporal/spatial gait characteristics of elderly fallers: taking it all in stride. *Front Aging Neurosci* 2015;7: 34.

- [47] Maranesi E, Merlo A, Fioretti S, Zemp DD, Campanini I, Quadri P. A statistical approach to discriminate between non-fallers, rare fallers and frequent fallers in older adults based on posturographic data. *Clin Biomech (Bristol, Avon)* 2016;32: 8–13.
- [48] Melzer I, Kurz I, Shahar D, Oddsson LIE. Do voluntary step reactions in dual task conditions have an added value over single task for fall prediction? A prospective study. *Aging Clin Exp Res* 2010;22: 360–6.
- [49] Menant JC, Schoene D, Sarofim M, Lord SR. Single and dual task tests of gait speed are equivalent in the prediction of falls in older people: a systematic review and meta-analysis. *Ageing Res Rev* 2014;16: 83–104.
- [50] Minet LR, Thomsen K, Ryg J, Matzen L, Masud T, Ytterberg C. Physical, mental, and social functioning in women age 65 and above with and without a falls history: An observational case-control study. *J Frailty Sarcopenia Falls* 2018;3: 179–84.
- [51] Mirelman A, Herman T, Brozgol M, Dorfman M, Sprecher E, et al. Executive function and falls in older adults: new findings from a five-year prospective study link fall risk to cognition. *PLoS ONE* 2012;7: e40297.
- [52] Muhaidat J, Kerr A, Evans JJ, Pilling M, Skelton DA. Validity of simple gait-related dual-task tests in predicting falls in community-dwelling older adults. *Arch Phys Med Rehabil* 2014;95: 58–64.
- [53] Muir-Hunter SW, Wittwer JE. Dual-task testing to predict falls in community-dwelling older adults: a systematic review. *Physiotherapy* 2016;102: 29–40.
- [54] Nordin E, Moe-Nilssen R, Ramnemark A, Lundin-Olsson L. Changes in step-width during dual-task walking predicts falls. *Gait Posture* 2010;32: 92–7.
- [55] Pelosin E, Ogliaastro C, Lagravinese G, Bonassi G, Mirelman A, et al. Attentional Control of Gait and Falls: Is Cholinergic Dysfunction a Common Substrate in the Elderly and Parkinson's Disease? *Front Aging Neurosci* 2016;8: 104.
- [56] Ponti M, Bet P, Oliveira CL, Castro PC. Better than counting seconds: Identifying fallers among healthy elderly using fusion of accelerometer features and dual-task Timed Up and Go. *PLoS ONE* 2017;12: e0175559.
- [57] Reelick MF, Kessels RPC, Faes MC, Weerdesteijn V, Esselink RAJ, Olde Rikkert MGM. Increased intra-individual variability in stride length and reaction time in recurrent older fallers. *Aging Clin Exp Res* 2011;23: 393–9.

- [58] Reelick MF, van Iersel MB, Kessels RPC, Rikkert MGMO. The influence of fear of falling on gait and balance in older people. *Age Ageing* 2009;38: 435–40.
- [59] Rinaldi NM, Emmerik R van, Moraes R. Changes in interlimb coordination during walking and grasping task in older adult fallers and non-fallers. *Hum Mov Sci* 2017;55: 121–37.
- [60] Rinaldi NM, Moraes R. Older adults with history of falls are unable to perform walking and prehension movements simultaneously. *Neuroscience* 2016;316: 249–60.
- [61] Santos LOD, Carvalho de Abreu DC, Moraes R. Performance of Faller and Nonfaller Older Adults on a Motor-Motor Interference Task. *J Mot Behav* 2018;50: 293–306.
- [62] Shumway-Cook A, Brauer S, Woollacott M. Predicting the probability for falls in community-dwelling older adults using the Timed Up & Go Test. *Phys Ther* 2000;80: 896–903.
- [63] Shumway-Cook A, Woollacott M, Kerns KA, Baldwin M. The effects of two types of cognitive tasks on postural stability in older adults with and without a history of falls. *J Gerontol A Biol Sci Med Sci* 1997;52: 232-40.
- [64] Springer S, Giladi N, Peretz C, Yogev-Seligmann G, Simon E, Hausdorff J. Dual-tasking effects on gait variability: The role of aging, falls, and executive function. *Movement Disorders* 2006;21: 950–7.
- [65] Stalenhoef PA, Diederiks JPM, Knottnerus JA, Kester ADM, Crebolder HFJM. A risk model for the prediction of recurrent falls in community-dwelling elderly: a prospective cohort study. *J Clin Epidemiol* 2002;55: 1088–94.
- [66] Swanenburg J, de Bruin ED, Uebelhart D, Mulder T. Falls prediction in elderly people: a 1-year prospective study. *Gait Posture* 2010;31: 317–21.
- [67] Tinetti ME, Baker DI, McAvay G, Claus EB, Garrett P, et al. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. *N Engl J Med* 1994;331: 821–7.
- [68] Tinetti ME, Speechley M, Ginter SF.. Risk Factors for Falls among Elderly Persons Living in the Community. *New England Journal of Medicine* 1988;319: 1701–7.
- [69] Tomas-Carus P, Biehl-Printes C, Pereira C, Veiga G, Costa A, Collado-Mateo D. Dual task performance and history of falls in community-dwelling older adults. *Exp Gerontol* 2019;120: 35–9.

- [70] Uiga L, Capio CM, Ryu D, Wilson MR, Masters RSW. The role of conscious control in maintaining stable posture. *Human Movement Science* 2018;57: 442–50.
- [71] Vaillant J, Martigné P, Vuillerme N, Caillat-Mioussé J-L, Parisot J, et al. [Prediction of falls with performance on Timed “Up-and-Go” and one-leg-balance tests and additional cognitive tasks]. *Ann Readapt Med Phys* 2006;49: 1–7.
- [72] Verghese J, Buschke H, Viola L, Katz M, Hall C, et al. Validity of divided attention tasks in predicting falls in older individuals: a preliminary study. *J Am Geriatr Soc* 2002;50: 1572–6.
- [73] Verghese J, Wang C, Ayers E, Izzetoglu M, Holtzer R. Brain activation in high-functioning older adults and falls. *Neurology* 2017;88: 191–7.
- [74] Westlake KP, Johnson BP, Creath RA, Neff RM, Rogers MW. Influence of non-spatial working memory demands on reach-grasp responses to loss of balance: Effects of age and fall risk. *Gait Posture* 2016;45: 51–5.
- [75] Wollesen B, Wanstrath M, van Schooten KS, Delbaere K. A taxonomy of cognitive tasks to evaluate cognitive-motor interference on spatiotemporal gait parameters in older people: a systematic review and meta-analysis. *European Review of Aging and Physical Activity* 2019;16: 12.
- [76] World Health Organization, WHO global report on falls prevention in older age, Geneva : World Health Organization, 2008.
- [77] Yamada M, Aoyama T, Arai H, Nagai K, Tanaka B, et al. Dual-task walk is a reliable predictor of falls in robust elderly adults. *J Am Geriatr Soc* 2011;59: 163–4.
- [78] Yamada M, Aoyama T, Nakamura M, Tanaka B, Nagai K, et al. The Reliability and Preliminary Validity of Game-Based Fall Risk Assessment in Community-Dwelling Older Adults. *Geriatric Nursing* 2011;32: 188–94.
- [79] Zhou J, Habtemariam D, Iloputaife I, Lipsitz LA, Manor B. The Complexity of Standing Postural Sway Associates with Future Falls in Community-Dwelling Older Adults: The MOBILIZE Boston Study. *Sci Rep* 2017;7: 2924.
- [80] Zijlstra A, Ufkes T, Skelton DA, Lundin-Olsson L, Zijlstra W. Do dual tasks have an added value over single tasks for balance assessment in fall prevention programs? A mini-review. *Gerontology* 2008;54: 40–9.