

Appendix C: Risk of bias assessment for each of the studies

Abbreviations: m: male; f: female; No information on status: no assessment of the participants' physical health, mental health or fall history

Table C.1 Risk of bias assessment for the studies comparing higher and lower risk older adults

Bias domain	Total bias	1 – Confounding factors	2 – Participant selection	3 – Group allocation based on fall risk assessment	4 – Intended experiment	5 – Motion analysis outcome parameters	6 – Missing data	7 – Result reporting
Stairs								
Ackermans (2019)	Low	No information on gender.	No information on gender.	Low Retrospective fall history	Low Subjects were allowed to take breaks to avoid fatigue.	Low	Low	Low
Ackermans (2021)	Moderate	No information on gender balance within groups.	Moderate Gender is unbalanced: 28 m, 53 f	Low Prospective fall history	Low	Low	Low	Low
Brodowski (2021)	Serious	Serious Participants in the hospitalized group were significantly older than in the healthy group ($p < 0.001$, mean age difference 7 years).	Moderate Gender is unbalanced: 43 m, 70 f 3 of the 60 hospitalized subjects were excluded because they could not perform the timed-up-and-go test.	Moderate Health status (hospitalized versus healthy)	Low	Low	Moderate 4 of the 60 healthy participants were excluded because they performed the task very rapidly or very slowly. 4 of the 56 hospitalized subjects could not perform the 2 nd trial.	Moderate Significance level was not reported, but sample size was sufficient for the reported effect size.
Carli (2014)	Moderate	No information on gender balance within groups.	Moderate Gender is unbalanced: 4 m, 30 f.	Moderate Physical level	No information on fatigue prevention strategy.	Low	Low	Low

Oh-Park (2012)	Moderate	Low	Moderate Gender is unbalanced: 147 m, 224 f.	Moderate Functional decline over 1 year	Low Subjects were allowed a brief rest.	Low	Low	Moderate Significance level was not reported, but sample size was sufficient for the reported effect size.
Oh-Park (2011)	Moderate	No information on gender balance within groups	Moderate Gender is unbalanced: 204 m & 309 f.	Low Retrospective fall history	Low Subjects were allowed a brief rest.	Low	Low	Low
Zietz (2011)	Serious	Serious Higher risk participants were significantly older ($p < 0.05$, mean age difference 7 years).	Moderate Gender is unbalanced: 3 m, 19 f	Moderate Physical and mental level	Moderate 4 out of the 7 high fall risk older adults (and no other participant) used the handrail. No information on fatigue prevention strategy.	Serious No information on how the center of mass is calculated.	Low	Low
Perturbations								
Gerards (2021)	Low	Low	Low	Low Retrospective fall history	No information on randomization. No information on fatigue prevention strategy.	Low	Low One subject was excluded because of technical failure	Low
Pijnappels (2005)	Moderate	Low	No information on status.	Moderate Physical level	No information on fatigue prevention strategy. No information on randomization.	Low	Moderate Older adults (but no younger adults) sometimes performed “a lowering strategy at mid-swing”, and these trials were	Low

							removed from the analysis.	
Obstacles								
Brach (2011)	Moderate	Low	Moderate Gender is unbalanced: 20 m, 87 f Exclusion of subjects with low walking speed (36 out of the 120 recruited subjects).	Low Retrospective fall history	No information on randomization. No information on fatigue prevention strategy.	Low	Moderate 13 out of 84 subjects did not complete the follow-up.	Low
Chou (2003)	Moderate	Moderate Gender balance is different across groups Y: 7 m, 2 f O: 1 m, 5 f	Low	Low	Low	Low	Low	Low
Hansson (2021)	Moderate	Low	Moderate Gender is unbalanced: 10 m, 91 f	Low	Low	Low	Low	
Guadagnin (2020)	Moderate	Low	Moderate Exclusion of male subjects.	Low Retrospective fall history	No information on fatigue prevention strategy. No information on randomization.	Low	Low	Low
Pan (2016)	Moderate	No information on gender.	No information on gender.	Moderate Physical level	Low Subjects were allowed to rest if needed.	Low	Low	Low
Pieruccini-	Moderate	Low	Moderate Exclusion of male subjects.	Low Retrospective fall history	No information on fatigue prevention strategy.	Low	Low	Low

Faria (2019)					No information on randomization.			
Uemura (2011)	Moderate	Low	Moderate Gender is unbalanced: 26 m, 50 f.	Low Retrospective fall history	No information on fatigue prevention strategy.	Low	Low	Low

Table C.2 Risk of bias assessment for the studies comparing younger and older adults

Bias domain	Total bias	1 – Confounding factors	2 – Participant selection	4 – Intended experiment	5 – Motion analysis outcome parameters	6 – Missing data	7 – Result reporting
Stairs							
Begg (2000)	Moderate	Low	Moderate Exclusion of male subjects.	No information on fatigue prevention strategy.	Low	Low	Low
Bosse (2012)	Low	Low	No information on status.	No information on randomization. No information on fatigue prevention strategy.	Low	Low	Low
Chiu (2015)	Low	Low	No information on status.	No information on randomization. No information on fatigue prevention strategy.	Low	Low	Low
Christina (2002)	Moderate	Moderate Gender balance is different across groups Y: 5 m, 7 f O: 8 m, 4 f	Low	No information on fatigue prevention strategy.	Low	Low 1 participant slipped and was removed from the analysis.	Low

Crosbie (2003)	Low	Low	Low	Low	Low	Low	Low
Dewolf (2021)	Moderate	Moderate Gender balance is different across groups Y: 4 m, 4 f O: 9 m, 1 f	Moderate Gender is unbalanced: 13 m, 5 f	Low	Low	Low	Low
Dixona (2018)	Low	No information on gender.	Low	No information on randomization. No information on fatigue prevention strategy.	Low	Low	Low
Francksen (2022)	Low	No information on gender.	No information on status or gender.	Low	Low	Low 2 out of 27 younger adults and 1 out of 33 older adults were excluded due to technical issues.	Low
Francksen (2020)	Low	No information on gender.	No information on status or gender.	No information on randomization. No information on fatigue prevention strategy.	Low	Low	Low
Foster (2019)	Low	Low	No information on status.	No information on randomization. No information on fatigue prevention strategy.	Low	Low	Low
Hamel (2005)	Moderate	Low	Moderate Exclusion of male subjects.	No information on randomization. No information on fatigue prevention strategy.	Low	Low Only trials of a pre-specified speed were included in the analysis.	Low

Hsue (2014)	Moderate	Low	Moderate Exclusion of subjects with fall history.	Low	Low	Low	Low
Hsue (2009)	Moderate	Low	Moderate Exclusion of male subjects.	Low	Low	Low	Low
Kim (2009)	Moderate	Low	Moderate Exclusion of subjects with low physical test scores.	No information on randomization. No information on fatigue prevention strategy.	Low	Low	Low
Larsen (2008)	Moderate	No information on gender.	Moderate Exclusion of subjects who do not participate in physical activities at least once per week. No information on gender.	No information on randomization. No information on fatigue prevention strategy.	Low	Low 1 out of 19 older subjects was excluded because they could not walk up the stairs without the handrails.	Low
Mian (2007)	Moderate	Low	Moderate Exclusion of female subjects.	No information on randomization. No information on fatigue prevention strategy.	Low	Low	Low
Novak (2011)	Moderate	Low	Moderate Exclusion of subjects with fall history. Gender is unbalanced 21 m, 36 f.	No information on fatigue prevention strategy.	Low	Low 1 subject per group was excluded due to technical failure.	Low
Novak (2016)	Moderate	Low	No information on status.	Low Trials were randomized to prevent fatigue affecting the results.	Moderate Markers placed on the sacrum were used as a proxy for the	Low	Low

					center of mass.		
Reeves (2007)	Moderate	Moderate Gender balance is different across groups Y: 10 m, 7 f O: 5 m, 10 f	No information on status.	No information on randomization. No information on fatigue prevention strategy.	Low	Low	Low
Perturbations							
Afschrift (2019)	Low	No information on gender.	No information on gender.	Low	Low	Low	Low
Bosqué e (2021)	Low	No information on gender.	No information on status or gender.	Low	Low	Low	Low
Debelle (2021)	Moderate	Moderate Gender balance is different across groups Y: 8 m, 9 f O: 3 m, 14 f	Moderate Gender is unbalanced: 11 m, 23 f No information on status.	Low	Low	Low Trials for which the subjects required more than 15 recovery steps were not analyzed (9 younger adults trials and 9 older adults trials)	Low
Jeon (2022a)	Moderate	Moderate Gender balance is different across groups Y: 4 m, 6 f O: 7 m, 3 f	Low	Low	Low	Moderate 1 out of 10 young subjects was excluded because they had no arm reaction.	Low

Jeon (2022b)	Moderate	Low	No information on status	No information on randomization. No information on fatigue prevention strategy.	Low	Low	Low
Kazanski (2020)	Moderate	Low	Low	Low There was an approximately 2 minute rest between trials.	Low	Moderate 2 of the 17 older adults (and none of the younger adults) used the handrail, and were removed from the analysis.	Low
Laudani (2021)	Moderate	Low	Moderate Gender is unbalanced: 4 m, 16 f . Exclusion of highly active individuals.	Low	Low	Low	Low
Liu (2009)	Moderate	No information on gender.	No information on status or gender.	No information on randomization. No information on fatigue prevention strategy.	Low	Moderate “Participants who successfully recovered with two feet (i.e., stance foot and swing foot) on one force-plate were excluded from the current study due to the difficulty in performing inverse dynamics analyses.”	Low
Martelli (2017)	Moderate	Low	Moderate Exclusion of subjects with fall history.	Low Subjects were allowed to rest if needed. No information on randomization.	Low	Low 2 out of 24 trials (both in elderly subjects) were removed due to technical failure.	Low

McCru m (2016)	Moderate	Low	Moderate Exclusion of male subjects. No information on status	No information on randomization. No information on fatigue prevention strategy.	Low	Low	Low
McIntos h (2016)	Moderate	Low	Moderate Gender is unbalanced: 6 m, 15 f	Low	Low	Low	Low
Nachma ni (2020)	Serious	No information on gender.	No information on gender.	Low Subjects were allowed to rest if needed.	Moderate The center of mass was calculated as the midpoint between both ASIS markers.	Serious 13 of the 35 older adults (and none of the younger adults) failed to complete the task and were removed from the analysis.	Low
Qiao (2018)	Moderate	Low	Moderate Exclusion of subjects with fall history or BMI > 30.	Low	Low	Low	Low
Ren (2022)	Moderate	No information on gender.	Moderate Exclusion of subjects with fall history. No information on gender.	Low	Low	Low	Low
Roeles (2018)	Moderate	Moderate Gender balance is different across groups Y: 6 m, 3 f O: 2 m, 7 f	Low	No information on fatigue prevention strategy.	Low	Low	Low
Rum (2020)	Moderate	Low	Moderate Gender is unbalanced: 4 m, 16 f	Low	Low	Low	Low

Shulman (2018)	Low	Low	Low	No information on fatigue prevention strategy.	Low	Low	Low
Shulman (2019)	Low	Low	No information on status.	No information on fatigue prevention strategy.	Low	Low 4 of the 560 trials (all in older adults) were removed from the analysis because participants contacted the floor with the forefoot prior to heel contact.	Low
Tropea (2015)	Serious	Moderate Gender balance is different across groups Y: 4 m, 2 f O: 2 m, 4 f	Low Exclusion of participants with low physical health (as assessed by a physical therapist)	No information on fatigue prevention strategy. No information on randomization.	Low	Low	Serious Significance level was not reported, and sample size was too low for the reported effect size.
Yoo (2021)	Moderate	Moderate Gender balance is different across groups Y: 7 m, 7 f O: 4 m, 10 f	Moderate Gender is unbalanced: 11 m, 17 f	Low	Low	Low	Low
Obstacles							

Caetano (2016)	Moderate	Low	Moderate Gender is unbalanced: 25 m, 46 f.	No information on fatigue prevention strategy.	Low	Moderate 22% of the older adults (and none of the younger adults) made at least 1 mistake, and trials with a mistake were removed from the analysis.	Low
Chen (1991)	Low	Low	Low	No information on fatigue prevention strategy.	Low	Low	Low
Chen (1994)	Moderate	Low	Low	No information on fatigue prevention strategy.	Low	Moderate Trials in which participants failed to step over an obstacle were removed from the analysis. There is no information on how often this occurred.	Low
Chien (2018)	Moderate	Low	Moderate Exclusion of subjects with fall history	Low Subjects rested one minute between trials.	Low	Low	Low
Dragani ch (2004)	Low	Low	No information on status.	Low	Low	Low	Low
Eyal (2020)	Moderate	Low	Moderate Exclusion of subjects with fall history.	Low	Low	Low	Low
Hahn (2004)	Low	Low	Low	No information on randomization. No information on fatigue prevention strategy.	Low	Low 19 out of 6630 individual data points were removed because they were	Low

						“outside reasonable variability”	
Huang (2008)	Low	No information on gender.	No information on status or gender.	No information on randomization. No information on fatigue prevention strategy.	Low	Low	Low
Kim (2013)	Low	Low	Low	No information on fatigue prevention strategy.	Low	Low	Low
Kulkarni (2021)	Moderate	Low	Moderate Gender is unbalanced: 7 m, 24 f No information on status.	No information on randomization. No information on fatigue prevention strategy.	Low	Low	Low
LoJacono (2018)	Moderate	No information on gender.	No information on gender.	Low	Low	Low	Low
Lowrey (2007)	Low	Low	Low	Low	Low	Low	Low
Lu (2006)	Low	No information on gender.	No information on status or gender.	No information on fatigue prevention strategy. No information on randomization.	Low	Low	Low
Luo (2022)	Serious	Low	Serious Exclusion of: <ul style="list-style-type: none"> • subjects with fall history. • female subjects. 	Low	Low	Low	Low
Maidana (2018)	Low	Low	Low	Low	Low	Low	Low
McFadyen (2002)	Moderate	Low	Moderate Exclusion of female subjects.	Low	Low	Low	Low

Mckenzie (2004)	Moderate	Low	Moderate Gender is unbalanced: 12m, 20 f	No information on fatigue prevention strategy.	Low	Moderate 6 out of 17 older adults and 8 out of 15 younger adults were not analyzed due to technical failure.	Low
Park (2012)	Moderate	Low	Moderate Gender is unbalanced: 6 m, 12 f	Low	Low	Low	Low
Tomar (2019)	Serious	Low	Moderate Exclusion of female subjects.	No information on randomization. No information on fatigue prevention strategy.	Low	Low	Serious Significance level was not reported, and sample size was too low for the reported effect size.
Uchiyama (2012)	Low	No information on gender.	Low No information on gender.	Low	Low	Low	Low
Wang (2010)	Low	Low	Low	No information on fatigue prevention strategy. No information on randomization.	Low	Low	Low
Weerdesteijn (2005a)	Moderate	Low	Moderate Gender is unbalanced: 26 m, 98 f Exclusion of subjects without fall history.	No information on fatigue prevention strategy.	Low	Low 1% of trials were removed from the analysis because the subject performed an	Low

						“intermediate avoidance strategy”.	
Weerde steyn (2005b)	Serious	Low	Serious Exclusion of male subjects. Subjects were recruited from elderly sports groups.	Low	Low	Low	Low