

Table G1.A1. Summary of Epidemiologic Studies on Physical Activity and All-Cause Mortality

Reference	Subjects	Special Populations?	Follow-up Duration; No. of Deaths	Assessment of Physical Activity	Main Results*	Findings Independent of Body Weight? (Y/N)	Dose-Response? Volume† (Y/N)	Dose-Response? Intensity† (Y/N)	Dose-Response? Duration† (Y/N)	Dose-Response? Frequency† (Y/N)	Covariates Adjusted For	Comments
Eaton et al., 1995 (1)	8,463 men, ≥40 y (Israeli Ischemic Heart Disease Study)	–	Up to 21 y; 2,593	1 question each on sitting at work LTPA	Vs. sitting at work: standing: RR = 0.99 (0.88-1.12) walking: RR = 1.09 (0.99-1.20) physical labor: RR = 1.16 (1.03-1.30) Vs. sedentary LTPA: light: RR = 0.84 (0.74-0.94) light daily: RR = 0.81 (0.73-0.90) heavy: RR = 0.84 (0.72-0.98)	N	Apparent N	–	–	–	Age	–
Lee et al., 1995 (2)	17,321 men, mean age 46 y (Harvard Alumni Health Study)	–	22-26 y; 3,728	Reported walking, climbing stairs, sports/recreational activity	Vs. lowest non-vigorous activity (<150 kcal/wk): 150-399 kcal/wk: RR = 0.89 (0.79-1.01) 400-749 kcal/wk: RR = 1.00 (0.89-1.12) 750-1499 kcal/wk: RR = 0.98 (0.88-1.12) ≥1500 kcal/wk: RR = 0.92 (0.82-1.02) <i>P</i> for trend = 0.36 Vs. lowest vigorous activity (<150 kcal/wk): 150-399 kcal/wk: RR = 0.88 (0.82-0.96) 400-749 kcal/wk: RR = 0.92 (0.82-1.02) 750-1499 kcal/wk: RR = 0.87 (0.77-0.99) ≥1500 kcal/wk: RR = 0.87 (0.78-0.97) <i>P</i> for trend = 0.007	Y	Y	Y (vigorous activity)	–	–	Age, BMI, smoking, hypertension, diabetes, early parental death; mutually adjusted for the 2 kinds of energy expenditure	Analyses of non-vigorous and vigorous activities were mutually adjusted
Haapanen et al., 1996 (3)	1,072 men, 35-63 y	–	10.8 y; 168	23 questions on LTPA, household chores, and commuting	Vs. >2,100 kcal/wk: 1500.1-2100 kcal/wk: RR = 1.74 (0.87-3.50) 800.1-1500 kcal/wk: RR = 1.10 (0.55-2.21) <800 kcal/wk: RR = 2.74 (1.46-5.14) <i>P</i> for trend, <0.0001 Specific activities showing independent inverse associations were leisure time forestry work, gardening, and repair work	N	Y	–	–	–	Age	–
Kaplan et al., 1996 (4)	2,832 men and 3,299 women, 16-94 y (Alameda County Study)	–	28 y; 1,226	LTPA index assessed using answers to 3 questions on physical exercise, sports participation, and long walks/swimming	Vs. lowest LTPA tertile (T1), men: T2: RR = 0.46 T3: RR = 0.31 Vs. lowest LTPA tertile (T1), women: T2: RR = 0.42 T3: RR = 0.22	N	Apparent Y	–	–	–	Crude. Adjustment for age, sex, ethnicity, education, health conditions, and social isolation still yielded significant inverse associations.	Findings persisted when physical activity updated over time
LaCroix et al., 1996 (5)	615 men and 1,030 women, ≥65 y	All subjects ≥65 y	4.2 y; 128	Modified Minnesota LTPA questionnaire	Vs. walked <1 hour/week: 1-4 hours/wk: RR = 0.83 (0.53-1.29) >4 hours/wk: RR = 0.91 (0.58-1.42)	Y	Apparent N	–	–	–	Age, sex, functional status, smoking, BMI, chronic disease score, self-rated health, alcohol use	Inverse association significant for women but not men, and for ≥75 y but not 65-74 y

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Lissner et al., 1996 (6)	1,405 women, 38-60 y (Gothenburg Prospective Study of Women)	–	20 y; 424	OPA and LTPA in the 12 months prior, assessed from questionnaire in 1968-69 and 1974-75	Vs. low LTPA in 1968-69: medium: RR = 0.56 (0.39-0.82) high: RR = 0.45 (0.24-0.86) Vs. low OPA in 1968-69: medium: RR = 0.28 (0.17-0.46) high: RR = 0.24 (0.14-0.43) Vs. no change between 1968-69 and 1974-75: increased LTPA: RR = 1.11 (0.67-1.86) decreased LTPA: RR = 2.07 (1.39-3.09)	Y	Apparent Y	–	–	–	Age. Findings little changed with additional adjustment for smoking, alcohol use, education, BMI, waist-to-hip ratio, diet, blood pressure, blood lipids, peak expiratory flow.	Increased LTPA over time associated with lower mortality rates
Mensink et al., 1996 (7)	7,689 men and 7,747 women, 25-69 y (German Cardiovascular Prevention Study)	–	5-8 y; 110	Questionnaire assessed 18 leisure activities; one question on OPA	Vs. low total activity, men: moderate: RR = 0.56 (0.30-1.04) high: RR = 0.78 (0.42-1.44) Vs. low LTPA, men: moderate: RR = 0.61 (0.35-1.05) high: RR = 0.79 (0.48-1.31) Vs. no sports activity, men: <1 hour/wk: RR = 0.49 (0.26-0.95) 1-2 hours: RR = 0.57 (0.30-1.09) >2 hours: RR = 0.36 (0.16-0.79) Vs. low total activity, women: moderate: RR = 1.24 (0.60-2.58) high: RR = 1.29 (0.58-2.85) Vs. low LTPA, women: moderate: RR = 0.94 (0.51-1.75) high: RR = 0.81 (0.44-1.49) Vs. no sports activity, women: <1 hour/wk: RR = 0.38 (0.12-1.23) 1-2 hours: RR = 0.52 (0.23-1.17) >2 hours: RR = 0.28 (0.07-1.17)	Y	Apparent Y (sports activity)	–	–	–	Age, systolic blood pressure, total serum cholesterol, BMI, smoking	–
Finucane et al., 1997 (8)	970 men and 818 women, ≥70 y (Australian Longitudinal Study of Ageing)	All subjects ≥70 y	2 y; 189	4 questions on type of exercise undertaken	Vs. some exercise: no exercise: RR = 1.74 (1.29-2.34)	N	–	–	–	–	Age, sex, marital status, self-rated health, chronic medical conditions, smoking, alcohol, age at leaving school	–

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Hedblad et al., 1997 (9)	642 men, 55 y (Men Born in 1914 Study, Malmö)	–	25 y; 333	Reported LTPA and bicycling or walking to work	Vs. no LTPA: vigorous LTPA: RR = 0.7 (0.5-0.9)	Y	–	–	–	–	Smoking, smoking amount, hypertension, diabetes mellitus, history of chronic renal disease, hyperlipidemia, weight	–
Kushi et al., 1997 (10)	40,417 women, 55-69 y (Iowa Women's Health Study)	–	7 y; 2,260	Frequency of moderate and vigorous LTPA assessed by questionnaire 3-level LTPA index based on frequency and intensity of activity	Vs. rarely/never participating in moderate activity: 1/week-few/mo: RR = 0.71 (0.63-0.79) 2-4 times/wk: RR = 0.63 (0.56-0.71) >4 times/wk: RR = 0.59 (0.51-0.67) P for trend <0.001 Vs. rarely/never participating in vigorous activity: 1/week-few /mo: RR = 0.83 (0.69-0.99) 2-4 times/wk: RR = 0.74 (0.59-.093) >4 times/wk: 0.62 (0.42-0.90) P for trend = 0.009 Vs. low activity index: medium: RR = 0.77 (0.69-0.86) high: RR = 0.68 (0.60-0.77) P for trend <0.001	Y	Y	Y	–	–	Age, reproductive factors, alcohol, total energy intake, smoking, estrogen use, BMI at baseline and 18 years, waist-to-hip ratio, high blood pressure, diabetes, education level, marital status, family history of cancer	Analyses of moderate and vigorous activity not adjusted for each other Significant inverse association in subgroup ≥65 y
Leon et al., 1997 (11)	12,138 men, 35-57 y (MRFIT)	No clinical CHD, but at high risk for (upper 10-15% Framingham risk score)	16 y; 1,904	Minnesota LTPA; classified into deciles and analyzed as decile 1 (4.9 min/day), 2-4 (22.7 min/day), 5-7 (53.9 min/day), 8-10 (140.0 min/day)	Vs. decile 1: deciles 2-4: RR = 0.85 (0.73-0.99) deciles 5-7: RR = 0.87 (0.75-1.02) deciles 8-10 RR = 0.83 (0.71-0.97)	Y	Apparent Y	–	Apparent Y	–	Age, intervention, education, cigarettes/d, cholesterol, diastolic blood pressure, BMI	Analyses of duration do not address short vs. long bouts
Morgan & Clarke 1997 (12)	406 men and 635 women, ≥65 y (Nottingham Longitudinal Study of Aging and Activity)	All subjects ≥65 y	10 y; 568	Interview using detailed inventory of activities	Vs. high activity, men: intermediate: RR = 1.35 (0.96-1.89) low: RR = 1.59 (1.12-2.25) Vs. high activity, women: intermediate: RR = 1.53 (1.12-2.09) low: RR = 2.07 (1.53-2.79)	N	Apparent Y	–	–	–	Age, health index score, smoking	–

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Rosengren & Wilhelmsen 1997 (13)	7,142 men, 47-55 y (Göteborg study)	–	20 y; 684	4 levels of OPA and LTPA assessed by questionnaire. Few men fell into the highest level of LTPA so top 3 levels combined	No significant association with OPA Vs. sedentary LTPA: moderately active: RR = 0.84 (0.77-0.93) regular exercise: RR = 0.83 (0.77-0.90)	Y	Apparent Y	–	–	–	Age, diastolic blood pressure, serum cholesterol, smoking, alcohol use, BMI, diabetes, occupation	–
Sarna et al., 1997 (14)	2,613 men representing Finland in Olympic Games 1920-65, mean ages 21.3-28.5 y; 1,712 men selected from military recruits, mean age 20.1 y	–	Up to 71 y; 1,910	Olympic athletes, compared with military recruits	Life expectancies, y: military recruits: 69.9 (69.0-70.9) endurance sports: 75.6 (73.6-77.5) team sports: 73.9 (72.7-75.1) power sports: 71.5 (70.4-72.2)	N	–	–	–	–	–	–
Schroll et al., 1997 (15)	196 men and 210 women, 75 y	All subjects 75 y	5 y; 98	1 interview question with 6 levels of activity; analyzed as not active vs. active	Vs. not active: active: RR = 0.41	N	–	–	–	–	–	–
Bijnen et al., 1998 (16)	802 men, 64-84 y (Zutphen Study)	Most ≥65 y	10 y; 373	Questionnaire on walking, cycling, hobbies/gardening; odd jobs/sports; classified into tertiles and also as not active/active (walk/cycle at least 20 min 3 d/wk)	Vs. lowest tertile: middle tertile: RR = 0.80 (0.63-1.02) top tertile: RR = 0.77 (0.59-1.00) <i>P</i> for trend = 0.04 <i>P</i> for trend across vigorous activities <0.01; non-vigorous activities = 0.54 Vs. not active: active: RR = 0.71 (0.58-0.88)	N	Y	Y (vigorous activity)	–	–	Age, smoking, alcohol, CVD, cancer, diabetes, lung diseases	–

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Fried et al., 1998 (17)	5,201 men and 685 women, ≥65 y (Cardiovascular Health Study)	All subjects ≥65 y 685 African Americans in a validation cohort, NOT used for physical activity analyses.	4.8 y; 646	Reported moderate or vigorous exercise	Vs. ≤67.5 kcal/wk: 67.5-472.5 kcal/wk: RR = 0.78 (0.60-1.00) 472.5-980 kcal/wk: RR = 0.81 (0.63-1.05) 980-1890 kcal/wk: RR = 0.72 (0.55-0.93) >1890 kcal/wk: RR = 0.56 (0.43-0.74) P for trend <0.001	Y	Y	–	–	–	Age, sex, education, income, widowed, weight, smoking, alcohol, blood pressure factors, diuretic use, LDL, fasting glucose, albumin, creatinine, fibrinogen, CHF, CHD, FEV1, aortic stenosis, ECG abnormality, internal carotid artery stenosis, ADL difficulty, digit symbol substitution test score, self-assessed health	–
Hakim et al., 1998 (18)	707 men, 61-81 y (Honolulu Heart Study)	–	12 y; 208	Daily distance walked	Vs. <1 mile/day: 1.0-2.0: RR = 0.68 2.1-8.0: RR = 0.59 P for trend = 0.002	N	Y	–	–	–	Age. Subjects were all nonsmokers.	–
Kujala et al., 1998 (19)	7,925 men and 7,977 women, 25-64 y (Finnish Twin Cohort)	–	18 y; 1,253	Questionnaire on frequency, duration, and intensity of LTPA	Vs. sedentary: occasional exercisers: RR = 0.80 (0.69-0.91) conditioning exercisers: RR = 0.76 (0.59-0.98) Vs. lowest quintile (Q1, <0.58 MET-hr/day): Q2 (0.59-1.29 MET-hr/day): RR = 0.85 Q3 (1.30-2.49 MET-hr/day): RR = 0.72 Q4 (2.50-4.49 MET-hr/day): RR = 0.68 Q5 (≥4.50 MET-hr/day): RR = 0.60 P for trend = 0.04 Participation in vigorous activities, RR = 0.79 (0.56-1.10)	N	Y	–	–	–	Age, sex, smoking, occupation, alcohol	Inverse association observed for men and women. Inverse association remained after taking into account genetic factors (twin status).

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Villeneuve et al., 1998 (20)	6,246 men and 8,196 women, 20-69 y (Canada Fitness Survey)	–	7 y; 1,116	Modified Minnesota LTPA questionnaire; average daily energy expenditure (KKD) was estimated	<p>Vs. lowest KKD (<0.5), men: 0.5 to <1.5 KKD: RR = 0.81 (0.59-1.11) 1.5 to <3.0: RR = 0.79 (0.54-1.13) ≥3.0: RR = 0.86 (0.61-1.22)</p> <p>Vs. lowest KKD (<0.5), women: 0.5 to <1.5 KKD: RR = 0.94 (0.69-1.30) 1.5 to <3.0: RR = 0.92 (0.64-1.34) ≥3.0: RR = 0.71 (0.45-1.11)</p> <p>Participation in vigorous (≥6 METs) LTPA: men: RR = 0.72 (0.53-0.96) women: RR = 0.71 (0.48-1.05)</p>	N	N	Y (vigorous activity in men)	–	–	Age, smoking	No significant associations with increasing nonvigorous LTPA among subjects without vigorous LTPA.
Wannamethee et al., 1998 (21)	7,735 men, 40-59 y (British Regional Heart Study)	–	15 y; 1,064	Questionnaire on walking/cycling, recreational activity, vigorous sporting activity; physical activity score calculated based on intensity and frequency of these activities	<p>Vs. inactive: occasional: RR = 0.79 (0.64-0.96) light: RR = 0.69 (0.56-0.86) moderate: RR = 0.64 (0.50-0.81) moderately vigorous: RR = 0.63 (0.48-0.82) vigorous: RR = 0.54 (0.38-0.77)</p> <p>Vs. 0 min/day regular walking: ≤20 min/day: RR = 1.15 (0.73-1.79) 21-40 min/day: RR = 1.06 (0.75-1.50) 41-60 min/day: RR = 0.97 (0.65-1.46) > 60 min/day: RR = 0.62 (0.37-1.05)</p>	Y	Apparent Y	–	–	–	Age, smoking, alcohol use, BMI	–
Weller & Corey 1998 (22)	6,620 women, ≥30 y (Canada Fitness Survey)	–	7 y; 449	Modified Minnesota LTPA questionnaire; average daily energy expenditure (KKD) was estimated for leisure and non-leisure activity	<p>Vs. lowest KKD quartile (Q1) of leisure activity: Q2: RR = 0.91 (0.66-1.25) Q3: RR = 0.94 (0.72-1.23) Q4: RR = 0.89 (0.67-1.17)</p> <p>Vs. lowest KKD quartile (Q1) of non-leisure activity: Q2: RR = 0.66 (0.50-0.87) Q3: RR = 0.68 (0.51-0.89) Q4: RR = 0.71 (0.50-0.87)</p>	N	Apparent Y	–	–	–	Age	–

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Bijnen et al., 1999 (23)	472 men, 64-84 y (Zutphen Elderly Study)	Most ≥65 y	5 y; 118	Questionnaire on walking, cycling, hobbies/gardening; odd jobs/sports; classified into tertiles and also as not active/active (walk/cycle at least 20 min 3 d/wk) administered in 1985 and 1990	Vs. lowest tertile in 1985: middle tertile: RR = 1.25 (0.79-1.99) top tertile: RR = 1.25 (0.73-2.12) P for trend = 039 Vs. lowest tertile in 1990: middle tertile: RR = 0.56 (0.35-0.89) top tertile: RR = 0.44 (0.25-0.80) P for trend <0.01 No consistent associations with type/intensity of activity. Vs. active 1985/ active 1990: inactive/active: RR = 1.36 (0.78-2.36) active/inactive: RR = 1.72 (1.04-2.85) inactive/inactive: RR = 2.01 (1.19-3.39)	N	Y	N	–	–	Age, smoking, alcohol, CVD, cancer, diabetes, lung diseases, functional status	Increased activity over time associated with lower mortality rates
Engstrom et al., 1999 (24)	642 men, 55 y (Men Born in 1914 Study, Malmö)	–	25 y; 333	4 categories of activity, based on reported LTPA and bicycling or walking to work; collapsed to 2 levels for analyses	Vs. no vigorous activity (normotensive men): vigorous activity: RR = 0.89 (0.60-1.31) Vs. no vigorous activity (hypertensive men): vigorous activity: RR = 0.43 (0.22-0.82)	N	–	Y (vigorous activity)	–	–	Smoking, antihypertensive therapy, systolic blood pressure	–
Glass et al., 1999 (25)	1,169 men and 1,643 women, ≥65 y (Established Populations for Epidemiological Studies of the Elderly, EPESE)	All subjects ≥65 y	18 y; 1,712	Interview asking about active sports or swimming, walking, physical exercise; response options were never, sometimes, often, scored as 0, 1, and 2	Vs. most active quartile: least active quartile: RR = 0.85 (0.77-0.95)	Y	–	–	–	–	Age, sex, race, marital status, income, BMI, smoking, functional disability, history of cancer, diabetes, stroke, and MI	–
Andersen et al., 2000 (26)	17,265 men and 13,375 women, 20-93 y (Copenhagen City Heart Study, Glostrup Population Studies, Copenhagen Male Study)	–	14.5 y; 8,549	Questionnaire on LTPA and OPA, 4 response options	Vs. inactive LTPA: light: RR = 0.68 (0.64-0.71) moderate: RR = 0.61 (0.57-0.66) heavy: RR = 0.53 (0.41-0.68) Among subjects with light, moderate, and heavy LTPA, sports participation: in men: RR = 0.63 (0.51-0.79) in women: RR = 0.47 (0.34-0.66) OPA: inverse association in women, no association in men.	N	Apparent Y	Y (sports)	–	–	Age, sex	Significant inverse trends in subgroup ≥65 y

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Davey Smith et al., 2000 (27)	6,702 men, 40-64 y (Whitehall Study)	–	15 y; 2,859	Reported walking pace and types of hobbies/sports	Vs. faster pace, compared to others of same age: the same: RR = 1.21 (1.1-1.3) slower: RR = 1.87 (1.6-2.1) <i>P</i> for trend <0.001 Vs. active LTPA: moderately active: RR = 1.07 (1.0-1.2) inactive: RR = 1.20 (1.1-1.3) <i>P</i> for trend <0.001	Y	Y	–	–	–	Age, civil service grade, smoking, BMI, systolic blood pressure, cholesterol, glucose intolerance, diabetes, FEV1, ischemia	–
Hirvensalo et al., 2000 (28)	391 men and 493 women, 65-84 y (Evergreen Project)	All subjects ≥65 y; subjects with impaired mobility examined separately	8 y; 389	Interview with overall activity assessed on a 6-point scale; frequency of participation in various sports. Active defined as 3-6 points and moderate activity daily or vigorous activities once/wk. "Mobile" defined as ability to walk 2 km and climb 1 flight with no difficulty	Vs. mobile-active, men: mobile-sedentary: RR = 0.92 (0.53-1.59) impaired-active: RR = 1.69 (1.01-2.84) impaired-sedentary: RR = 2.67 (1.75-4.08) Vs. mobile-active, women: mobile-sedentary: RR = 0.87 (0.55-1.40) impaired-active: RR = 1.72 (1.10-2.70) impaired-sedentary: RR = 2.83 (1.82-3.81)	N	–	–	–	–	Age, sex, marital status, education, asthma, neurological diseases, stroke, mental disease, CVD, musculoskeletal disease, smoking, past physical activity	Inverse association with physical activity apparent only in those with impaired mobility.
Lee & Paffenbarger 2000 (29)	13,485 men, mean age 57.5 y (Harvard Alumni Health Study)	–	Up to 15 y; 2,359	Reported walking, climbing stairs, sports/recreational activity	Vs. <1,000 kcal/wk: 1,000-1,999 kcal/wk: RR = 0.80 (0.72-0.88) 2,000-2,999 kcal/wk: RR = 0.74 (0.65-0.83) 3,000-3,999 kcal/wk: RR = 0.80 (0.69-0.93) ≥4,000 kcal/wk: RR = 0.73 (0.64-0.84) <i>P</i> for trend <0.001 <i>P</i> for linear trend across categories of: walking = 0.004 climbing stairs <0.001 light activities = 0.72 moderate activities = 0.07 vigorous activities <0.001	Y	Y	Y (walking, stairs, and vigorous activity)	–	–	Age, BMI, smoking, alcohol, early parental mortality. Analyses of the different physical activity components were adjusted for the other activity components.	–

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Stessman et al., 2000 (30)	249 men and 207 women born in 1920-21 (Jerusalem 70-Year-Olds Longitudinal Study)	All subjects 70 y	6 y; 240	Interview asking about LTPA at baseline - no activity (walks less than 4 hours weekly), moderate activity (walks ~4 hours weekly), sports participation at least twice weekly, and regular activity (walks at least 1 hour a day)	Vs. no activity: moderate: RR = 0.41 (0.19-0.91) sports: RR = 0.73 (0.33-1.62) regular: RR = 0.14 (0.04-0.50)	N	Apparent N	–	–	–	Sex, smoking, subjective economic hardship, preexisting medical conditions	–
Hein et al., 2001 (31)	2,826 men, 53-75 y (Copenhagen Male Study)	–	11 y; 214	Questionnaire on LTPA, 4 response options; grouped in analyses as low (1 and 2) and high (3 and 4) LTPA	Vs. low LTPA, Le(a-b-) phenotype: high LTPA: RR = 0.76 Vs. low LTPA, Le(a+b-)/Le(a-/b+) phenotype: high LTPA: RR = 0.84	N	–	–	–	–	Crude	–
Rockhill et al., 2001 (32)	80,348 women, 34-59 y (Nurses' Health Study)	–	16 y; 4,746	Questionnaire asking about hr/wk in moderate to vigorous activities 1980-1982; 1986-1992, questionnaire on walking pace and time/wk participating in a list of LTPA	Vs. <1 hr/wk moderate to vigorous LTPA: 1-1.9: RR = 0.82 (0.76-0.89) 2-3.9: RR = 0.75 (0.69-0.81) 4-6.9: RR = 0.74 (0.68-0.81) ≥7: RR = 0.71 (0.61-0.82) P for trend <0.001	Y	Y	–	Y	–	Age, smoking, alcohol, BMI, height, postmenopausal hormones	Physical activity updated over time. Analyses of duration do not address short vs. long bouts.
Aijo et al., 2002 (33)	499 men and 704 women, 75 y (Nordic Research Project on Ageing, NORA)	All subjects 75 y	5 y; 212	Questionnaire on LTPA, work, and daily activities, with 6 responses; collapsed to 2 levels for analyses	Vs. active men: inactive (Glostrup): RR = 2.46 (1.29-4.69) inactive (Goteborg): RR = 2.88 (1.31-6.34) inactive (Jyvaskyla): RR = 1.33 (0.56-3.17) Vs. active women: inactive (Glostrup): RR = 2.26 (1.08-4.74) inactive (Goteborg): RR = 2.71 (1.07-6.90) inactive (Jyvaskyla): RR = 2.92 (1.56-5.46)	N	–	–	–	–	Smoking, alcohol, CVD	–

Table G1.A1. Summary of Epidemiologic Studies on Physical Activity and All-Cause Mortality (continued)

Reference	Subjects	Special Populations?	Follow-up Duration; No. of Deaths	Assessment of Physical Activity	Main Results*	Findings Independent of Body Weight? (Y/N)	Dose-Response? Volume† (Y/N)	Dose-Response? Intensity† (Y/N)	Dose-Response? Duration† (Y/N)	Dose-Response? Frequency† (Y/N)	Covariates Adjusted For	Comments
Batty et al., 2002 (34)	6,408 men, 40-64 y (Whitehall Study)	352 men with type 2 diabetes or IGT	25 y; 2,765	Reported walking pace, and types of hobbies/sports	<p>Among normoglycemic: Vs. faster pace, compared to others of same age: the same: RR = 1.22 (1.1-1.3) slower: RR = 1.76 (1.5-2.0) P for trend = 0.0001</p> <p>Vs. active LTPA: moderately active: RR = 1.05 (0.9-1.2) inactive: RR = 1.17 (1.1-1.3) P for trend = 0.002</p> <p>Among type 2 diabetics/IGT: Vs. faster pace, compared to others of same age: the same: RR = 1.15 (0.8-1.7) slower: RR = 2.36 (1.4-3.8) P for trend = 0.003</p> <p>Vs. active LTPA: moderately active: RR = 1.59 (1.1-2.4) inactive: RR = 1.65 (1.1-2.5) P for trend = 0.03</p>	Y	Y	–	–	–	Age, civil service grade, smoking, BMI, systolic blood pressure, cholesterol, FEV1, disease at study entry, unexplained weight loss in preceding year	Similar associations in normoglycemic and type 2 diabetes/IGT men
Crespo et al., 2002 (35)	9,136 men, 35-74 y (Puerto Rico Heart Health Program)	Hispanic men	12 y; 1,445	Time spent sleeping, resting, or engaged in light, moderate, or heavy physical activity assessed by interview (Framingham physical activity index)	Vs. lowest activity quartile (Q1): Q2: RR = 0.68 (0.58-0.79) Q3: RR = 0.63 (0.54-0.75) Q4: RR = 0.55 (0.45-0.65)	Y	Apparent Y	–	–	–	Age, smoking, education, residence, hypertension, high cholesterol	Similar associations in underweight, healthy weight, overweight, and obese
Ostbye et al., 2002 (36)	12,652 men and women, 50-60y (Health Retirement Survey)	–	6 y; 782	Interview with 2 questions on frequency of light and vigorous physical activity; combined responses classified as sedentary, light, moderate, and heavy	Vs. sedentary: light: RR = 0.44 moderate: RR = 0.40 heavy: RR = 0.21	N	Apparent Y	–	–	–	Crude	–

Table G1.A1. Summary of Epidemiologic Studies on Physical Activity and All-Cause Mortality (continued)

Reference	Subjects	Special Populations?	Follow-up Duration; No. of Deaths	Assessment of Physical Activity	Main Results*	Findings Independent of Body Weight? (Y/N)	Dose-Response? Volume† (Y/N)	Dose-Response? Intensity† (Y/N)	Dose-Response? Duration† (Y/N)	Dose-Response? Frequency† (Y/N)	Covariates Adjusted For	Comments
Wang et al., 2002 (37)	303 men and 67 women from 50 y+ Runners Association (throughout US); 139 men and 110 women, ≥50 y, from community around Stanford, CA	–	13 y; 93	Classified as running club member or not; questionnaire also assessed min/wk spent in aerobic exercise	Vs. not running club member: member: RR = 0.36 (0.20-0.65) Per additional unit of time/wk in aerobic exercise: RR = 0.88 (0.77-0.88)	N	Y	–	Y	–	Age, sex, smoking, running club member, time in aerobic exercise	Analyses of duration do not address short vs. long bouts
Batty et al., 2003 (38)	6,479 men, 40-64 y (Whitehall Study)	186 men with chronic bronchitis	25 y; 2,660	Reported types of hobbies/sports; classified as inactive, moderate, and active	Vs. active LTPA, no chronic bronchitis: moderately active: RR = 1.06 (1.0-1.2) inactive: RR = 1.21 (1.1-1.3) <i>P</i> for trend = 0.0003 Vs. active LTPA, chronic bronchitis: moderately active: RR = 0.73 (0.3-1.6) inactive: RR = 0.70 (0.3-1.4) <i>P</i> for trend = 0.45	Y	Y (among men without chronic bronchitis)	–	–	–	Age, civil service grade, smoking, BMI, systolic blood pressure, cholesterol, FEV1, disease at study entry	Results significantly different among men without and with chronic bronchitis
Gregg et al., 2003 (39)	1,376 men and 1,520 women with diabetes, ≥18 y (National Health Interview Study)	Diabetics in nationally representative sample	8 y; 671	Interview asking about walking frequency and duration, LTPA frequency and duration	Vs. no walking: >0-1.9 hr/wk: RR = 0.93 (0.74-1.16) ≥2 hr/wk: RR = 0.61 (0.48-0.78) <i>P</i> for trend <0.001 Vs. no LTPA: >0-1.9 hr/wk: RR = 0.95 (0.77-1.17) ≥2 hr/wk: RR = 0.71 (0.59-0.87) <i>P</i> for trend = 0.003	Y	Y	–	Y	–	Age, sex, race, BMI, self-rated health, smoking, weight loss approaches, hospitalizations, hypertension and use of antihypertensives, physician visits, limitations caused by CVD and cancer, functional limitation	Analyses of duration do not address short vs. long bouts
Schnohr et al., 2003 (40)	3,220 men and 3,803 women, 20-79 y (Copenhagen City Heart Study)	–	18 y; 2,725	Questionnaire on LTPA, 4 response options, administered 1976-78 and 1981-83. Top 2 levels grouped in analyses.	Vs. low activity both times, men: moderate: RR = 0.71 (0.57-0.88) high: RR = 0.61 (0.48-0.76) low to moderate: RR = 0.64 (0.49-0.83) low to high: RR = 0.64 (0.47-0.87) Vs. low activity both times, women: moderate: RR = 0.64 (0.52-0.79) high: RR = 0.66 (0.51-0.85) low to moderate: RR = 0.75 (0.57-0.97) low to high: RR = 0.72 (0.50-1.05)	Y	Apparent Y	–	–	–	Age, education, income, smoking, cholesterol, systolic blood pressure, diabetes, alcohol, BMI	–

Table G1.A1. Summary of Epidemiologic Studies on Physical Activity and All-Cause Mortality (continued)

Reference	Subjects	Special Populations?	Follow-up Duration; No. of Deaths	Assessment of Physical Activity	Main Results*	Findings Independent of Body Weight? (Y/N)	Dose-Response? Volume† (Y/N)	Dose-Response? Intensity† (Y/N)	Dose-Response? Duration† (Y/N)	Dose-Response? Frequency† (Y/N)	Covariates Adjusted For	Comments
Tanasescu et al., 2003 (41)	2,803 men with type 2 diabetes, 40-75 y (Health Professionals Follow-up Study)	Diabetics	14 y; 355	Questionnaire asking about walking pace and time/wk participating in a list of LTPA	Vs. 0-5.1 MET-hr/wk LTPA: 5.2-12.0: RR = 0.88 (0.64-1.21) 12.1-21.7: RR = 0.64 (0.45-0.91) 21.8-37.1: RR = 0.64 (0.45-0.90) ≥37.2: RR = 0.65 (0.45-0.93) <i>P</i> for trend = 0.01 Vs. 0-1.4 MET-hr/wk walking: 1.5-4.1: RR = 0.99 (0.71-1.40) 4.2-7.9: RR = 0.96 (0.68-1.36) 8.0-16.0: RR = 1.08 (0.76-1.53) ≥16.1: RR = 0.60 (0.41-0.88) <i>P</i> for trend = 0.004	Y	Y	–	–	–	Age, alcohol, smoking, family history of MI, vitamin E supplements, duration of diabetes, diabetes medication, trans fat, saturated fat, fiber, folate, angina and coronary artery bypass surgery, hypertension, high cholesterol	Physical activity updated over time
Wyshak 2003 (42)	4,171 alumnae from 10 colleges and universities, mean age 39 y	–	15 y; 258	Women were either former college athletes or not; all women also answered a questionnaire on contemporary regular exercise	Vs. non-athlete: athlete: RR = 0.94 (0.73-1.20) Vs. regular exercise: none: RR = 1.36 (1.06-1.74)	N	–	–	–	–	Age	–
Yu et al., 2003 (43)	1,975 men, 49-64 y (Caerphilly Collaborative Heart Disease Study)	–	11 y; 252	Modified Minnesota LTPA questionnaire, with light and moderate activities classified as those <6 METs and vigorous activities ≥6 METs; OPA classified as 4 levels	Vs. 0-161.6 kcal/day total LTPA: 161.8-395.3 kcal/day: RR = 0.79 (0.58-1.08) 395.5-2747.2 kcal/day: RR = 0.76 (0.56-1.04) <i>P</i> for trend = 0.08 Vs. 0-133.0 kcal/day light and moderate LTPA: 133.1-342.6 kcal/day: RR = 0.95 (0.65-1.31) 342.7-2743.2 kcal/day: RR = 1.04 (0.76-1.43) <i>P</i> for trend = 0.80 Vs. 0-0.6 kcal/day vigorous LTPA: 0.7-23.8 kcal/day: RR = 0.87 (0.65-1.17) 23.9-2142.9 kcal/day: RR = 0.61 (0.43-0.86) <i>P</i> for trend = 0.006 No association for OPA; <i>P</i> for trend = 0.71	Y	Y	Y (vigorous activity only)	–	–	Age, diastolic blood pressure, BMI, smoking social class, family history of CHD, diabetes, OPA	–

Table G1.A1. Summary of Epidemiologic Studies on Physical Activity and All-Cause Mortality (continued)

Reference	Subjects	Special Populations?	Follow-up Duration; No. of Deaths	Assessment of Physical Activity	Main Results*	Findings Independent of Body Weight? (Y/N)	Dose-Response? Volume† (Y/N)	Dose-Response? Intensity† (Y/N)	Dose-Response? Duration† (Y/N)	Dose-Response? Frequency† (Y/N)	Covariates Adjusted For	Comments
Barengo et al., 2004 (44)	15,853 men and 16,824 women, 30-59 y (FINMONICA Study)	–	20 y; 5,272	Questionnaire on LTPA, 4 response options; grouped in analyses as light, moderate, and high (3 and 4) LTPA; OPA classified into 3 levels, light, moderate, and active; commuting activity (walking, cycling)	<p>Vs. low LTPA: moderate, men: RR = 0.91 (0.84-0.98) high, men: RR = 0.79 (0.70-0.90) moderate, women: RR = 0.89 (0.81-0.98) high, women: RR = 0.98 (0.83-1.16)</p> <p>Vs. light OPA: moderate, men: RR = 0.75 (0.68-0.83) active, men: RR = 0.77 (0.71-0.84) moderate, women: RR = 0.79 (0.70-0.89) active, women: RR = 0.78 (0.70-0.87)</p> <p>Vs. <15 min/day walking/cycling commute: 15-29 min/day, men: RR = 1.01 (0.92-1.11) ≥30 min/day, men: RR = 1.07 (0.98-1.17) 15-29 min/day, women: RR = 0.89 (0.78-1.02) ≥30 min/day, women: RR = 0.98 (0.88-1.09)</p>	Y	Apparent Y	–	–	–	Age, study year, BMI, systolic blood pressure, cholesterol, education, smoking, different kinds of activity	–
Evenson et al., 2004 (45)	3,000 men and 2,712 women, mean age 43 y (Lipid Research Clinics Prevalence Study)	1,717 hypertensives examined separately	25 y; 1,225	Interview with 1 question on exercise training; classified in analyses as inactive (no strenuous exercise or hard labor) or active	<p>Vs. active-normotensive men: inactive-normotensive: RR = 1.4 (1.1-1.7) active-hypertensive: RR = 1.5 (1.1-2.1) inactive-hypertensive: RR = 1.9 (1.5-2.4)</p> <p>Vs. active-normotensive women: inactive-normotensive: RR = 1.4 (0.9-2.0) active-hypertensive: RR = 2.1 (1.2-3.5) inactive-hypertensive: RR = 2.2 (1.5-3.5)</p>	Y	–	–	–	–	Age, smoking, education, alcohol, BMI, race, hyperlipidemic sampling strata	Significant inverse relation apparent only in normotensives
Fujita et al., 2004 (46)	20,004 men and 21,159 women, 40-64 y (Miyagi Cohort Study)	–	11 y; 1,879	Questionnaire asking about average walking duration per day, with options ≤30 min, >30 min to <1 hr, ≥1 hr	<p>Vs. ≥1 hr/day, men: >0.5-<1: RR = 1.0 (0.87-1.15) ≤0.5: RR = 1.10 (0.96-1.25) P for trend = 0.32</p> <p>Vs. ≥1 hr/day, women: >0.5-<1: RR = 1.21 (0.99-1.47) ≤0.5: RR = 1.34 (1.11-1.62) P for trend = 0.002</p>	Y	Y	–	Y	–	Age, marital status, hypertension, renal disease, liver disease, diabetes, peptic ulcer, tuberculosis, BMI, intake of green vegetables and oranges	Analyses of duration do not address short vs. long bouts. Significant inverse associations seen in never and former smokers, but not current smokers.

Table G1.A1. Summary of Epidemiologic Studies on Physical Activity and All-Cause Mortality (continued)

Reference	Subjects	Special Populations?	Follow-up Duration; No. of Deaths	Assessment of Physical Activity	Main Results*	Findings Independent of Body Weight? (Y/N)	Dose-Response? Volume† (Y/N)	Dose-Response? Intensity† (Y/N)	Dose-Response? Duration† (Y/N)	Dose-Response? Frequency† (Y/N)	Covariates Adjusted For	Comments
Hillsdon et al., 2004 (47)	4,929 men and 5,593 women, 35-64 y (OXCHECK Study)	–	10 y; 825	1 question on baseline questionnaire regarding frequency of vigorous sports/recreation, classified as never/<1 per month, <2/wk or ≥2/wk; 1 similar question at nurse health check on a subset of 7,704, classified as <1/month, 1-3/month, 1/wk, or ≥2/wk	Vs. never/<1 per month (baseline): <2/wk: RR = 0.63 (0.45-0.89) ≥2/wk: RR = 0.81 (0.60-1.09) Vs. <1/month (nurse health check): 1-3/month: RR = 1.14 (0.74-1.78) 1/wk: RR = 0.53 (0.35-0.82) ≥2/wk: RR = 0.52 (0.35-0.78)	Y	Apparent Y	–	–	Apparent Y	Age, sex, smoking, alcohol, pre-existing disease, social class	Analyses of frequency not adjusted for total energy expended
Hu et al., 2004a (48)	116,564 women, 30-55 y (Nurses' Health Study)	–	24 y; 10,282	Questionnaire asking about hr/wk in moderate-to-vigorous activities 1980-1982; 1986-1992, questionnaire on walking pace and time/wk participating in a list of LTPA	Vs. ≥3.5/wk moderate-to-vigorous LTPA: 1.0-3.4: RR = 1.14 (1.06-1.22) ≤0.5: RR = 1.44 (1.34-1.55) <i>P</i> for trend <0.001	Y	Y	–	Y	–	Age, smoking, parental history of CHD, menopause, use of postmenopausal hormones, alcohol	Analyses of duration do not address short vs. long bouts. Similar associations seen in normal weight, overweight, and obese women.
Hu et al., 2004b (49)	1,637 men and 1,679 women, 25-74	All subjects had type 2 diabetes	18.4 y; 1,410	Questionnaire on LTPA, grouped in analyses as low (almost completely inactive), moderate (some activity for >4 hr/wk) and high (vigorous activity for >3 hr/wk); OPA classified into 3 levels, light, moderate, and active; commuting activity (walking, cycling) classified as 0, 1-29, and ≥30 min/day	Vs. low LTPA: moderate: RR = 0.82 (0.73-0.91) high: RR = 0.71 (0.56-0.92) <i>P</i> for trend <0.001 Vs. light OPA: moderate: RR = 0.86 (0.74-1.00) active: RR = 0.60 (0.52-0.69) <i>P</i> for trend <0.001 Vs. 0 min/day walking/cycling commute: 1-29 min/day: RR = 0.91 (0.76-1.05) ≥30 min/day: RR = 0.88 (0.75-1.04) <i>P</i> for trend = 0.21	Y	Y	–	–	–	Age, sex, study year, BMI, systolic blood pressure, cholesterol, smoking, kinds of physical activity	–

Table G1.A1. Summary of Epidemiologic Studies on Physical Activity and All-Cause Mortality (continued)

Reference	Subjects	Special Populations?	Follow-up Duration; No. of Deaths	Assessment of Physical Activity	Main Results*	Findings Independent of Body Weight? (Y/N)	Dose-Response? Volume† (Y/N)	Dose-Response? Intensity† (Y/N)	Dose-Response? Duration† (Y/N)	Dose-Response? Frequency† (Y/N)	Covariates Adjusted For	Comments
Lam et al., 2004 (50)	13,778 male cases and 3,918 male controls, 10,301 female cases and 9,136 female controls, ≥35 y	–	Cases were deaths over 2 y in Hong Kong; 24,079	Interview asking proxy (for both cases and controls) about frequency of LTPA lasting ≥30 min	Vs. <1/mo, men: 1/mo to 1-3/wk: RR = 0.60 (0.54-0.67) ≥4/mo: RR = 0.66 (0.60-0.73) Vs. <1/mo, women: 1/mo to 1-3/wk: RR = 0.81 (0.74-0.88) ≥4/mo: RR = 0.71 (0.66-0.77)	N	Apparent Y (women)	–	–	Apparent Y (women)	Age, education, smoking, alcohol, OPA	Analyses of frequency not adjusted for total energy expended.
Landi et al., 2004 (51)	1,137 men and 1,620 women, mean age 78.2 y, admitted to home care programs (Italian Silver Network Home Care Project)	Included subjects 70-80 and >80 y	10 months; 442	Single question on hr/wk in domestic activities or recreational activities	Vs. < 2hr/wk: ≥2 hr/wk: RR = 0.51 (0.35-0.73) Similar associations in <70, 70-80, and >80 y (RR = 0.48, 0.50, 0.55, respectively)	N	–	–	–	–	Age, sex, physical and cognitive disability, CVD, pneumonia, cancer, stroke, diabetes, chronic obstructive pulmonary disease, renal failure, Parkinson's disease, depression, delirium, arthritis	–
Lee et al., 2004 (52)	8,421 men, mean age 66 y (Harvard Alumni Health Study)	–	Up to 10 y; 1,234	Reported walking, climbing stairs, sports/recreational activity; classified as: sedentary (<500 kcal/wk), insufficiently active (500-999 kcal/wk), weekend warrior (≥1,000 kcal/wk in 1-2 episodes), regularly active (≥1,000 kcal/wk in ≥3 episodes)	Vs. sedentary: insufficiently active: RR = 0.75 (0.62-0.91) weekend warrior: RR = 0.85 (0.65-1.11) regularly active: RR = 0.64 (0.55-0.73) Among low-risk men (nonsmoker, normal BMI, normal BP, normal cholesterol), weekend warrior: RR = 0.41 (0.21-0.81) Among high risk-men (≥1 risk factor above), weekend warrior: RR = 1.02 (0.75-1.38)	N	–	–	–	–	Age, smoking, alcohol, red meat, vegetables, vitamins/minerals, early parental mortality	Physical activity updated over time
Myers et al., 2004 (53)	842 men, mean age 58.9 y	–	5.5 y; 89	Modified Harvard Alumni Health Study questionnaire on walking, stairs, and recreational activity	Vs. lowest (sedentary) quartile (Q1): Q2: RR = 0.63 (0.36-1.10) Q3: RR = 0.42 (0.23-0.78) Q4 (most active): RR = 0.38 (0.19-0.73)	N	Apparent Y	–	–	–	Age	–

Table G1.A1. Summary of Epidemiologic Studies on Physical Activity and All-Cause Mortality (continued)

Reference	Subjects	Special Populations?	Follow-up Duration; No. of Deaths	Assessment of Physical Activity	Main Results*	Findings Independent of Body Weight? (Y/N)	Dose-Response? Volume† (Y/N)	Dose-Response? Intensity† (Y/N)	Dose-Response? Duration† (Y/N)	Dose-Response? Frequency† (Y/N)	Covariates Adjusted For	Comments
Richardson et al., 2004 (54)	4,642 men and 4,969 women, 51-61 y (Health Retirement Survey)	Subgroup analyses by low (0 CVD risk factor), moderate (1) or high (≥ 2) CVD risk	8 y; 810	Interview with 2 questions on frequency of light and vigorous physical activity; combined responses classified as sedentary, occasional, and regular	Vs. sedentary: occasional: RR = 0.64 (0.52-0.81) regular: RR = 0.62 (0.44-0.86) No significant interactions with CVD risk group.	Y	Apparent N	–	–	–	Age, sex, race, history of cancer, self-rated health status, obesity, income, CVD risk	–
Shnohr et al., 2004 (55)	16,236 men and 14,399 women, 20-93 y (Copenhagen City Heart Study, Glostrup Population Studies, Copenhagen Male Study)	–	16 y; 10,952	Questionnaire on LTPA, 4 levels analyzed: none/very little LTPA, 1-4 hr/wk light activity, >4 hr/wk light activity or 2-4 hr/wk high-level activity, >4 hr/wk high-level activity or competition level sports	Generally inverse linear dose-response across all 4 levels of LTPA in men and women, stratified by <8, 8-11, and ≥ 12 y education (graphical data only)	N	Apparent Y	–	–	–	Age, birth cohort, cohort membership	–
Sundquist et al., 2004 (56)	1,414 men and 1,792 women, ≥ 65 y (Swedish Annual Level of Living Survey)	All subjects ≥ 65 y	11.7 y, 1,806	Questionnaire on LTPA with 5 response options: no exercise, occasional exercise, 1/wk, ≥ 2 /wk, or vigorous exercise ≥ 2 /wk	Vs. none: occasional: RR = 0.72 (0.64-0.81) 1/wk: RR = 0.60 (0.50-0.71) ≥ 2 /wk: RR = 0.50 (0.42-0.59) ≥ 2 /wk vigorous exercise: RR = 0.60 (0.46-0.79)	Y	Apparent Y	–	–	–	Age, sex, education, smoking, BMI	–

Table G1.A1. Summary of Epidemiologic Studies on Physical Activity and All-Cause Mortality (continued)

Reference	Subjects	Special Populations?	Follow-up Duration; No. of Deaths	Assessment of Physical Activity	Main Results*	Findings Independent of Body Weight? (Y/N)	Dose-Response? Volume† (Y/N)	Dose-Response? Intensity† (Y/N)	Dose-Response? Duration† (Y/N)	Dose-Response? Frequency† (Y/N)	Covariates Adjusted For	Comments
Bucksch 2005 (57)	3,742 men and 3,445 women, 30-69 y	–	16 y; 943	Modified Minnesota LTPA questionnaire, classified into 4 groups. Also classified as meeting moderate-intensity PA recommendation vs. not, meeting vigorous-intensity PA recommendation vs. not, and meeting either recommendation vs. not.	<p>Vs. 0 kcal/kg/wk LTPA, men: >0 to <14: RR = 0.98 (0.76-1.17) 14 to <33.5: RR = 0.80 (0.63-1.00) ≥33.5: RR = 0.91 (0.74-1.13) P for trend = 0.20</p> <p>Vs. 0 kcal/kg/wk LTPA, women: >0 to <14: RR = 0.79 (0.57-1.08) 14 to <33.5: RR = 0.68 (0.50-0.94) ≥33.5: RR = 0.57 (0.41-0.79) P for trend <0.001</p> <p>Vs. not meeting moderate PA recommendation: meeting, men: RR = 0.90 (0.77-1.01) meeting, women: RR = 0.65 (0.51-0.82)</p> <p>Vs. not meeting vigorous PA recommendation: meeting, men: RR = 0.74 (0.61-0.90) meeting, women: RR = 0.78 (0.57-1.08)</p> <p>Vs. not meeting either PA recommendation: meeting, men: RR = 0.80 (0.68-0.94) meeting, women: RR = 0.60 (0.47-0.75)</p>	Y	Y (women only)	–	–	–	Age, social class, smoking, BMI, CVD risk factors, chronic disease, alcohol, diet	–
Fang et al., 2005 (58)	3,779 men and 6,012 women, 25-74 y (NHANES I)	Normotensive, prehypertensive and hypertensive subjects examined separately	17 y; 3,069	1 question on recreational activity, with response options: much exercise, moderate exercise, little/no exercise	<p>Vs. little/no exercise, normotensives: moderate exercise: RR = 0.75 (0.53-1.05) much exercise: RR = 0.71 (0.45-1.12)</p> <p>Vs. little/no exercise, pre-hypertensives: moderate exercise: RR = 0.79 (0.65-0.97) much exercise: RR = 0.93 (0.74-1.18)</p> <p>Vs. little/no exercise, hypertensives: moderate exercise: RR = 0.88 (0.80-0.98) much exercise: RR = 0.83 (0.72-0.95)</p>	Y	Apparent Y (normotensives and hypertensives only)	–	–	–	Age, sex, race, BMI, education, diabetes, smoking, alcohol, caloric, sodium, calcium and potassium intake, systolic blood pressure, serum cholesterol	–
Hu et al., 2005 (59)	22,258 men and 24,684 women, 25-64 y	–	17.7 y; 7,394	Questionnaire on LTPA and OPA grouped in analyses as low (light for both), moderate (moderate or high in one domain), and high (moderate or high in both domains). For joint analyses with BMI, classified as inactive (low) vs. active (moderate or high).	<p>Vs. low activity, men: moderate: RR = 0.74 (0.68-0.81) high: RR = 0.63 (0.58-0.70) P for trend <0.001</p> <p>Vs. low activity, women: moderate: RR = 0.64 (0.58-0.70) high: RR = 0.58 (0.52-0.64) P for trend <0.001</p> <p>Vs. non-obese/active: obese/active: RR = 1.21 men, 1.12 women non-obese/inactive: RR = 1.53 men, 1.59 women obese/inactive: RR = 1.78 men, 2.10 women</p>	Y	Y	–	–	–	Age, study year, education, smoking, systolic blood pressure, cholesterol, diabetes, BMI	–

Table G1.A1. Summary of Epidemiologic Studies on Physical Activity and All-Cause Mortality (continued)

Reference	Subjects	Special Populations?	Follow-up Duration; No. of Deaths	Assessment of Physical Activity	Main Results*	Findings Independent of Body Weight? (Y/N)	Dose-Response? Volume† (Y/N)	Dose-Response? Intensity† (Y/N)	Dose-Response? Duration† (Y/N)	Dose-Response? Frequency† (Y/N)	Covariates Adjusted For	Comments
Trolle-Lagerros et al., 2005 (60)	99,099 women, 30-49 y (Women's Lifestyle and Health Study, Norway/Sweden)	–	11.4 y; 1,313	Questionnaire asking about overall level of activity (including household, occupation, and recreation), ranked on a 5-point scale, at ages 14, 30, and baseline	Vs. none, at baseline: low: RR = 0.78 (0.61-1.00) moderate: RR = 0.62 (0.49-0.78) high: RR = 0.58 (0.44-0.75) vigorous: RR = 0.46 (0.33-0.65) <i>P</i> for trend <0.0001 No significant associations for physical activity at ages 30 or 14; when examining changes in physical activity, only activity at baseline predicted lower mortality.	Y	Y	–	–	–	Age, education, BMI, alcohol, smoking, country	–
Carlsson et al., 2006 (61)	27,734 women, 51-83 y (Swedish Mammography Cohort)	–	7 y; 1,232	Questionnaire asking about average time in household work, walking and bicycling, work activity, and leisure-time activity; MET-hr/day estimated	Vs. >50 MET-hr/day: 45-50: RR = 1.05 (0.77-1.42) 40-45: RR = 1.09 (0.81-1.46) 35-40: RR = 1.26 (0.94-1.70) <35: RR = 2.56 (1.85-3.53) Significant inverse associations observed for all domains of activity, analyzed separately	Y	Y	–	–	–	Smoking, education, number of children, hormone therapy, fruit and vegetable intake, BMI, various chronic diseases	–
Janssen & Jolliffe 2006 (62)	603 men and 442 women, ≥65 y (Cardiovascular Health Study)	All subjects with CAD and ≥65 y	9 y; 489	Interview asking about frequency and duration of 12 common leisure-time activities at baseline and year 3 (in 785 subjects)	Vs. <500 kcal/wk, baseline: 500-999: RR = 0.87 (0.68-1.26) 1000-1999: RR = 0.77 (0.59-0.99) 2000-2999: RR = 0.54 (0.36-0.81) ≥3000: RR = 0.63 (0.44-0.91) <i>P</i> for trend <0.001 <i>P</i> for trend <0.001 (inverse, linear trend) for change in activity between baseline and year 3	Y	Y	–	–	–	Age, sex, race, smoking, alcohol, socioeconomic class, adiposity, prevalent disease, type of CAD	–
Katzmarzyk & Craig 2006 (63)	5,421 women, 20-69 y (Canada Fitness Survey)	–	12.4 y; 225	Modified Minnesota LTPA questionnaire	Per 1 SD unit of activity: RR = 0.79 (0.65-0.96)	Y	Y	–	–	–	Age, smoking, alcohol	–

Table G1.A1. Summary of Epidemiologic Studies on Physical Activity and All-Cause Mortality (continued)

Reference	Subjects	Special Populations?	Follow-up Duration; No. of Deaths	Assessment of Physical Activity	Main Results*	Findings Independent of Body Weight? (Y/N)	Dose-Response? Volume† (Y/N)	Dose-Response? Intensity† (Y/N)	Dose-Response? Duration† (Y/N)	Dose-Response? Frequency† (Y/N)	Covariates Adjusted For	Comments
Khaw et al., 2006 (64)	9,984 men and 12,207 women, 45-79 y (EPIC-Norfolk study)	Similar results in subgroup >65 y	8 y; 1,553	1 question each on job and recreational activity (rec); combined into 4 groups: inactive (no job and rec), moderately inactive (sedentary job + <0.5 hr/d rec or standing job + no rec), moderately active (sedentary job + 0.5-1 hr/d rec or standing job + <0.5 hr/d rec or physical job + no rec), active (sedentary/standing job + >1 hr/d rec or physical job + some rec or heavy manual job)	Vs. inactive: moderately inactive: RR = 0.83 (0.73-0.95) moderately active: RR = 0.68 (0.58-0.80) active: RR = 0.68 (0.57-0.81)	Y	Apparent Y	–	–	–	Age, sex, blood pressure, cholesterol, smoking, alcohol, diabetes, BMI, social class	Similar results in men and women
Lan et al., 2006 (65)	1,081 men and 1,032 women, ≥65 y (Taiwan National Health Interview Survey)	All subjects ≥65 y	2 y; 197	Interview asking about kinds, frequency, and duration of LTPA	Vs. sedentary: <500 kcal/wk: RR = 0.80 (0.49-1.30) 500-999 kcal/wk: RR = 0.74 (0.46-1.17) 1000-1999 kcal/wk: RR = 0.50 (0.27-0.90) ≥2000 kcal/wk: RR = 0.43 (0.21-0.87) <i>P</i> for trend = 0.04 A model simultaneously considered amount (<i>p</i> <0.05), intensity (<i>p</i> <0.05), duration (<i>p</i> =0.06), and frequency (<i>p</i> =0.08) of LTPA.	Y	Y	Y	Borderline <i>p</i> =0.06	Borderline <i>p</i> =0.08	Age, sex, education, number of diseases, alcohol, smoking, BMI, self-rated health, physical function, occupation	–
Manini et al., 2006 (66)	150 men and 152 women, 70-82 y (Health ABC Study)	All subjects ≥70 y	6.2 y; 55	Doubly-labeled water	Vs. <521 kcal/day of activity energy expenditure: 521-770 kcal/day: RR = 0.65 (0.33-1.28) >770 kcal/day: RR = 0.33 (0.15-0.74) <i>P</i> for trend = 0.007	Y	Y	–	–	–	Age, sex, race, study site, weight, height, % body fat, sleep duration, self-rated health, smoking, CVD, lung disease, diabetes, osteoarthritis, osteoporosis, cancer, depression	–

Table G1.A1. Summary of Epidemiologic Studies on Physical Activity and All-Cause Mortality (continued)

Reference	Subjects	Special Populations?	Follow-up Duration; No. of Deaths	Assessment of Physical Activity	Main Results*	Findings Independent of Body Weight? (Y/N)	Dose-Response? Volume† (Y/N)	Dose-Response? Intensity† (Y/N)	Dose-Response? Duration† (Y/N)	Dose-Response? Frequency† (Y/N)	Covariates Adjusted For	Comments
Schooling et al., 2006 (67)	1,875 men and 37,417 women, ≥65 y (Hong Kong Elderly Health Centers)	All subjects ≥65 y	4.1 y; 3,819	Interview on frequency and duration of LTPA; classified as none, ≤30 min/day, or >30 min/day	Vs. no LTPA: ≤30 min/day: RR = 0.83 (0.76-0.91) >30 min/day: RR = 0.73 (0.67-0.80) P for trend <0.001	Y	Y	–	Y	–	Age, sex, education, alcohol, smoking, income, housing, BMI	Analyses of duration do not address short vs. long bouts
Schnohr et al., 2006 (68)	2,136 men and 2,758 women, 20-79 y (Copenhagen City Heart Study)	–	19 y; 1,787	Questionnaire on LTPA, 3 levels analyzed: none/very little LTPA (low), 1-4 hr/wk light activity (moderate), >4 hr/wk light activity or >2 hr/wk high level activity (high). Only subjects with unchanged activity levels in 1976-78 and 1981-83 included.	Vs. low LTPA: moderate: RR = 0.78 (0.68-0.89) high: RR = 0.75 (0.64-0.87) P for trend = 0.001	Y	Y	–	–	–	Age, sex, smoking, total cholesterol, HDL-cholesterol, systolic blood pressure/anti-hypertensive drugs, diabetes, alcohol, BMI, education, income, FEV1	–
Boyle et al., 2007 (69)	205 men and 582 women, men age 80.5 y (Rush Memory and Aging Project)	Mean age 80.5 y	2.6 y; 156	Adapted from 1985 National Health Interview Survey (types, duration, and frequency of LTPA)	Per hr/wk of LTPA: RR = 0.89 (0.83-0.95)	N	Y	–	Y	–	Age, sex, education, baseline gait	Analyses of duration do not address short vs. long bouts

Table G1.A1. Summary of Epidemiologic Studies on Physical Activity and All-Cause Mortality (continued)

Reference	Subjects	Special Populations?	Follow-up Duration; No. of Deaths	Assessment of Physical Activity	Main Results*	Findings Independent of Body Weight? (Y/N)	Dose-Response? Volume† (Y/N)	Dose-Response? Intensity† (Y/N)	Dose-Response? Duration† (Y/N)	Dose-Response? Frequency† (Y/N)	Covariates Adjusted For	Comments
Matthews et al., 2007 (70)	67,143 women, 40-70 y (Shanghai Women's Health Study)	–	5.7 y; 1,091	Interview asking about exercise participation, household activities, walking/cycling for transport, occupation. Analyses also considered exercise and non-exercise (walking/cycling, household activities, stair climbing) separately	<p>Vs. ≤ 9.9 MET-hr/day, overall activity: 10.0-13.6 MET-hr/day: RR = 0.81 (0.69-0.96) 13.7-18.0 MET-hr/day: RR = 0.67 (0.57-0.80) ≥ 18.1 MET-hr/day: RR = 0.61 (0.51-0.73) <i>P</i> for trend <0.001</p> <p>Vs. 0 MET-hr/day, exercise: 0.1-3.4 MET-hr/day: RR = 0.84 (0.74-0.96) 3.5-7.0 MET-hr/day: RR = 0.77 (0.59-0.99) ≥ 7.1 MET-hr/day: RR = 0.64 (0.36-1.14) <i>P</i> for trend = 0.008</p> <p>Vs. ≤ 9.9 MET-hr/day, exercise: 10.0-13.6 MET-hr/day: RR = 0.81 (0.69-0.94) 13.7-18.0 MET-hr/day: RR = 0.63 (0.53-0.75) ≥ 18.1 MET-hr/day: RR = 0.66 (0.55-0.79) <i>P</i> for trend = 0.07</p> <p>Vs. 0-3.4 MET-hr/day, walking for transport: 3.5-7.0 MET-hr/day: RR = 0.94 (0.81-1.09) 7.1-10.0 MET-hr/day: RR = 0.83 (0.69-1.00) ≥ 10.1 MET-hr/day: RR = 0.86 (0.75-1.05) <i>P</i> for trend = 0.07</p> <p>Vs. 0 MET-hr/day, cycling for transport: 0.1-3.4 MET-hr/day: RR = 0.79 (0.61-1.01) ≥ 3.5 MET-hr/day: RR = 0.66 (0.40-1.07) <i>P</i> for trend = 0.02</p> <p>Higher levels of non-exercise activity associated with lower risks; at the highest level of non-exercise activity (≥ 18.1 MET-hr/day), the addition of exercise activity did not change risk.</p>	N	Y	–	–	–	Age, marital status, education, income, smoking, alcohol, number of pregnancies, oral contraceptive use, menopause, chronic disease, kinds of physical activity	–
Schnohr et al., 2007 (71)	3,204 men and 4,104 women, 20-93 y (Copenhagen City Heart Study)	–	12 y; 1,391	Questionnaire on walking pace and duration	<p>Vs. <0.5 hr/day walking duration, men: 0.5-1 hr/day: RR = 1.00 (0.77-1.30) 1-2 hr/day: RR = 1.04 (0.80-1.36) >2 hr/day: RR = 0.80 (0.59-1.10)</p> <p>Vs. slow walking pace, men: average: RR = 0.75 (0.61-0.92) fast: RR = 0.48 (0.35-0.66)</p> <p>Vs. <0.5 hr/day walking duration, women: 0.5-1 hr/day: RR = 0.87 (0.68-1.10) 1-2 hr/day: RR = 0.95 (0.75-1.21) >2 hr/day: RR = 0.89 (0.69-1.14)</p> <p>Vs. slow walking pace, women: average: RR = 0.54 (0.45-0.67) fast: RR = 0.43 (0.32-0.59)</p>	Y	Y	Y	Y	–	Age, number of sports, BMI, systolic BP, antihypertensive medication, cholesterol, HDL-cholesterol, smoking, education, income, alcohol, diabetes	Analyses of walking intensity were adjusted for walking duration. Analyses of duration do not address short vs. long bouts.

Table G1.A1. Summary of Epidemiologic Studies on Physical Activity and All-Cause Mortality (continued)

Reference	Subjects	Special Populations?	Follow-up Duration; No. of Deaths	Assessment of Physical Activity	Main Results*	Findings Independent of Body Weight? (Y/N)	Dose-Response? Volume† (Y/N)	Dose-Response? Intensity† (Y/N)	Dose-Response? Duration† (Y/N)	Dose-Response? Frequency† (Y/N)	Covariates Adjusted For	Comments
Smith et al., 2007 (72)	741 men and 923 women, 50-90 y (Rancho Bernado Study)	347 with type 2 diabetes	10 y; 538	Reported city blocks walked daily	Normal, vs non-walker: <1 mile/d: RR = 0.98 (0.76-1.25) ≥1 mile/d: RR = 0.89 (0.67-1.18) Diabetics, vs non-walker: <1 mile/d: RR = 1.02 (0.70-1.43) ≥1 mile/d: RR = 0.54 (0.33-0.88)	Y	Apparent Y	–	–	–	Age, sex, smoking, BMI, alcohol, exercise, hypertension, triglycerides, HDL, history of CHD	In a sample followed 6-12 y from baseline, 45% reported same level of walking.
Wyshak 2007 (73)	5,398 alumnae from 10 colleges and universities, mean age 39 y	–	15 y; 259	Questionnaire on contemporary regular exercise	Vs. no regular exercise: regular exercise: RR = 0.76 (0.57-1.00)	N	–	–	–	–	Age, BMI, smoking, alcohol, breast cancer, high blood pressure, asthma/emphysema/bronchitis	–

* Numbers in parentheses are 95% confidence limits; if not provided, they were not available. *P*-values for trend come from tests of linear trend.

† “Apparent” associations refer to those where the data appear to support an inverse, dose-response relation, but no formal statistical testing was conducted.

ADL, activities of daily living; BMI, body mass index; BP, blood pressure; CAD, coronary artery disease; CHD, coronary heart disease; CHF, congestive heart failure; CVD, cardiovascular disease; ECG, electrocardiogram; FEV1, forced expiratory volume in one second, HDL, high-density lipoprotein cholesterol; IGT, impaired glucose tolerance; KKD, kcal/kg body weight/day; LDL, low-density lipoprotein cholesterol; LTPA, leisure-time physical activity; MI, myocardial infarction; N, no; OPA, occupational physical activity; RR, risk ratio; y, year; Y, yes

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