Associations of Total Daily Steps and Aerobic Steps with Respiratory Impairment in Older Adults

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BACKGROUND

Respiratory impairment (RI):

Below normal lung function

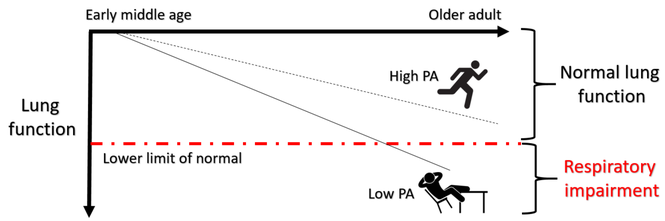
Associated with adverse outcomes:

- Frailty
- COPD
- Mortality

Older adults (OAs) are highly susceptible to RI due to:

- Greater lifetime exposure to tobacco smoke
- High rates of respiratory infections
- Cumulative effects of aging on respiratory structures

Physical activity (PA) may attenuate RI risk by slowing lung function decline:



Adapted from Burtscher et al. Does Regular Physical Activity Mitigate the Age-Associated Decline in Pulmonary Function? *Sports Med*. 2022;52(5):963-970.

RELEVANCE

- **Walking** is the most common and safest form of physical activity for OAs.
- Higher **stepping volumes** are associated with favorable health outcomes.
- Steps accumulated at **faster rates of walking** may also be beneficial for health.
- The associations of different **stepping behaviors** with RI is underexplored.

RESEARCH QUESTION

What are the associations between **total daily steps** and **aerobic steps** with prevalent **RI** in **OAs?**

METHODS

- **Participants**: 410 adults (58.3% female, 97.6% white), aged 65-95 years, and without asthma.
- **Daily steps:** Average daily steps obtained from a pedometer worn at the level of the hip for 7 consecutive days in a free-living environment.
- **Aerobic steps:** Average number of steps taken at a rate ≥60 steps/min for 10 continuous minutes (determined by manufacturer's in-built algorithm).
- **RI:** Determined by spirometry (**any** one of the following) –
  - *Forced Expiratory Volume* in 1 second (FEV_1) <Lower Limit of Normal (LLN)
  - *Forced Vital Capacity* (FVC) <LLN
  - *Ratio between FEV_1 and FVC* (FEV_1/FVC) <LLN

  LLNs derived from the Global Lung Function Initiative reference database.
- **Statistical analysis:** Multivariate logistic regression (adjusting for potential confounders).

PARTICIPANT CHARACTERISTICS

Characteristic	All	Lower tertile (<4,043 steps/day)	Middle tertile (4,043 to <6,674 steps/day)	Upper tertile (≥6,674 steps/day)	P-value (between tertiles)
Number of participants	410	136	137	137	---
Cases of RI, n (%)	46 (11.2)	20 (14.7)	15 (11.0)	11 (8.0)	0.216
FEV_1, Z-score, (SD)	-0.19 (0.93	-0.40 (1.06)	-0.05 (0.87)	-0.11 (0.81)	**0.005**
Age, years, mean (SD)	74.2 (6.7)	77.7 (7.6)	73.3 (6.2)	71.6 (4.4)	**<0.001**
Female, n (%)	239 (58.3)	88 (64.7)	75 (54.7)	76 (55.5)	0.118
Total steps/day, mean (SD)	5,682 (3425)	2,581 (907)	5,214 (770)	9,766 (2,706)	**<0.001**
Aerobic steps/day, mean (SD)	1962 (2,530)	306 (508)	1,256 (1,115)	4,311 (2,990)	**<0.001**
Body mass index, kg/m², mean (SD)	26.9 (4.7)	28.3 (5.5)	26.7 (4.2)	25.7 (4.0)	**<0.001**
Never smoker, n (%)	305 (74.4)	101 (74.3)	100 (73.0)	104 (75.9)	0.932
Former smoker, n (%)	103 (25.1)	34 (25.0)	36 (26.3)	33 (24.1)	
Current smoker, n (%)	2 (0.5)	1 (0.7)	1 (0.7)	0	
Heavy drinking, n (%)	35 (8.5)	7 (5.2)	17 (12.4)	11 (8.0)	0.097
Diabetes, n (%)	38 (9.3)	24 (17.7)	9 (6.6)	5 (3.7)	**<0.001**
Hypertension, n (%)	237 (57.8)	89 (65.4)	78 (56.9)	70 (51.1)	0.054
History of CVD, n (%)	25 (6.1)	14 (10.3)	5 (3.7)	6 (4.4)	**0.042**
<4-year college degree, n (%)	108 (26.3)	43 (31.6)	30 (21.9)	35 (25.6)	0.184
≥4-year college degree, n (%)	302 (73.7)	93 (68.4)	107 (78.1)	102 (74.5)	

RESULTS

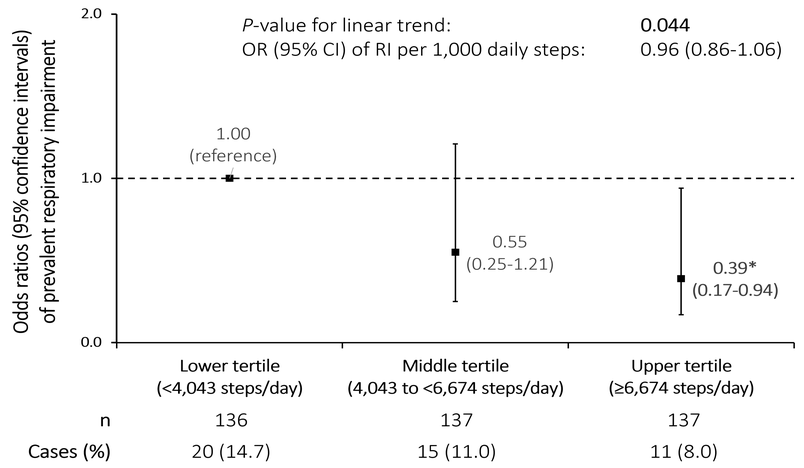


Figure 1. Associations of total daily steps with prevalent respiratory impairment.

Logistic regression model adjusted for the following covariates: age (years), sex (male or female), body mass index (kg/m²), smoking status (never, former, or current), heavy drinking (>14 or >7 alcoholic beverages/week for males or females, respectively), diabetes (yes or no), hypertension (yes or no), history of cardiovascular disease (yes or no), highest level of educational attainment (junior high school, high school, Associates/Technical degree, Bachelor's degree, or Graduate/Professional degree). *P <0.05.

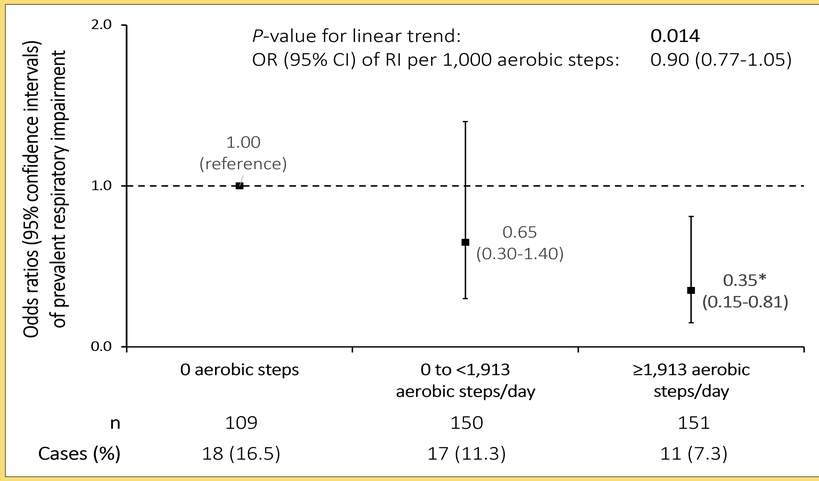


Figure 2. Associations of aerobic steps with prevalent respiratory impairment.

Logistic regression model adjusted for the following covariates: age (years), sex (male or female), body mass index (kg/m²), smoking status (never, former, or current), heavy drinking (>14 or >7 alcoholic beverages/week for males or females, respectively), diabetes (yes or no), hypertension (yes or no), history of cardiovascular disease (yes or no), highest level of educational attainment (junior high school, high school, Associates/Technical degree, Bachelor's degree, or Graduate/Professional degree). *P <0.05.

KEY MESSAGE & FUTURE DIRECTIONS:

- Achieving **higher total daily steps** or **higher aerobic steps** may have **favorable implications** for **respiratory health** in OAs.
- Larger, **prospective studies** of OAs from **racially & socioeconomically diverse communities** are needed to **validate** these findings at the population level.