Exploring the currency of spirometric predictive equations from the viewpoint of the Lung Age concept.

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Abstract

Spirometry is used to diagnose respiratory disease, to monitor disease progression and response to treatment, and in epidemiological surveys. As a large burden of disease is caused by cigarette smoking, spirometry has been incorporated in smoking cessation counselling in an attempt to improve quit rates. The concept of lung age (LA) was developed in 1985 in an effort to make spirometry results more easily understood by the lay person. Research results using LA to aid quitting remain inconclusive. This thesis investigates the need to update LA equations, as predictive equations based on old data may not be relevant for today's populations, and contemporary equations may result in a stronger message for smokers.

New LA equations were firstly developed using contemporary Australian data and four further LA equations were derived from previously published FEV_1 predictive equations. A series of comparisons of LA equations in contemporary Australian datasets followed.

The first project compared the original Morris LA equations with newly developed Australian LA equations in an independent workplace dataset (males only).

The second project compared four extra LA equations derived from previously published FEV_1 equations from Europe, the United Kingdom, America and Australia with the Morris and the new Australian equations. An independent dataset of randomly-selected males and females was used to compare these equations with the Morris LA equations and contemporary Australian LA equations.

Lastly, a different type of LA equation expressed as delta lung age (ΔLA), the difference between chronological age and lung age, based on the ratio of Forced Expiratory Volume in one second/Forced Vital Capacity (FEV_1/FVC), was compared with three other LA equations based on FEV_1 alone. This project used three independent datasets (urban, rural and a workplace) for added strength.

All LA equations confirmed poorer lung function in smokers than in never smokers in all 3 independent datasets. LA estimates were approximately 20 years lower using the original Morris equations when compared with the newest LA equations. The differences seen between estimated LA using all six equations were consistent in each analysis. The ΔLA equation gave extreme LA estimates in both the community-based datasets compared with the LA equations based on FEV_1 alone.

These results show that the Morris LA equations need to be updated. However, there appears to be no advantage in using the ΔLA equation. The differences between the older and the newer LA equations are most likely a result of cohort and period effects. This is also the case in the predictive equations themselves. Continuously updating predictive equations using recently acquired data will result in LA equations that are more relevant to contemporary populations.

Declaration

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Wendy Newbury (candidate)

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Abbreviations

ATS	American Thoracic Society
COPD	Chronic Obstructive Pulmonary Disease
CS	Current Smokers
ECSC	European Community for Steel and Coal
ERS	European Respiratory Society
FEF_{50}	Forced Expiratory Flow at 50%
FEV_1	Forced expiratory volume in first second
FEV_1/FVC	ratio of FEV_1 to FVC
FVC	Forced Vital Capacity
IOS	Impulse Oscillometry System
LA	Lung Age
ΔLA	Delta Lung Age (Difference between LA and chronological age)
LLN	Lower Limit of Normal
MFS	Metropolitan Fire Service
NHANES III	Third National Health and Nutrition Examination Survey
NWAHS	North West Adelaide Health Study
PEF	Peak Expiratory Flow
RCT	Randomised Controlled Trial
SA	South Australia
SDL-age	Spirometry Derived Lung Age
UK	United Kingdom
ULN	Upper Limit of Normal
USA	United States of America
WISH	Whyalla Intergenerational Study of Health