

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

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A thesis submitted in fulfilment of the requirements for the degree
of Doctor of Philosophy at the University of Adelaide

June 2013

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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 FEV₁ 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 FEV₁ 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 (Δ LA), 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 Δ LA 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 Δ LA 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

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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Wendy Newbury (candidate)

Acknowledgements

I would like to thank the North West Adelaide Health Study team, the Whyalla Intergenerational Study of Health team, and the Metropolitan Fire Service Study team for generously providing access to their datasets. Obviously, this data would not exist without the hard work of the research and clinic teams, and the subjects themselves. I sincerely thank you all.

A special thank you is also due to the Port Lincoln subjects who kindly presented for spirometry and IOS tests in 2007.

I would like to thank the Discipline of Rural Health, University of Adelaide, for providing a workplace for me in Port Lincoln for the duration of my candidature. The support provided by their IT team is gratefully acknowledged.

Special thanks are also due to Nancy Briggs, and Michelle Lorimer, for statistical assistance and support.

To my supervisors, Alan Crockett and Richard Ruffin, I sincerely thank you both. In particular, Alan has been incredibly supportive, happy to share his knowledge of all things respiratory, and very generous with his time over the last six years. Thank you Alan for introducing me to a respiratory world very different to the one I knew from my nursing training many years ago.

To my husband Jonathan and our daughters, thank you all for helping me get through these last 4 years – and for every distraction away from my computer. Thanks for your belief that I could do this. Your encouragement helped me beyond belief.

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
Δ LA	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