



Redefining normal reference ranges for echocardiography: a major new individual person data meta-analysis

Katrina K. Poppe^{1*}, Robert N. Doughty¹, and Gillian A. Whalley^{1,2}

¹Department of Medicine, The University of Auckland, Park Road, Private Bag 92019, Auckland 1142, New Zealand; and ²Faculty of Social and Health Sciences, Unitec Institute of Technology, Auckland, New Zealand

Received 11 July 2012; accepted after revision 13 July 2012

Current recommended reference ranges for echocardiographic measurements may not be relevant to the diverse world population they are applied to. A new study, the echocardiographic normal reference ranges of the left heart (EchoNoRMAL) study, is an individual person data meta-analysis of standard echocardiographic measurements which aims to re-define normal reference ranges of left heart dimensions, areas, volumes, mitral inflow and tissue Doppler, and associated calculated variables.

Keywords Echocardiography • Reference ranges • Meta-analysis

The effectiveness of any diagnostic test is dependent upon the test's ability to accurately detect abnormalities. An assumption of reliability and validity underlies all medical tests and echocardiography is no exception. The definition of 'abnormal' relies on the definition of 'normal' and needs to acknowledge normal physiological variation that may arise from factors such as body size, gender, and ethnicity.

The current recommended echo reference ranges, jointly published by the American Society of Echocardiography (ASE)¹ and the European Association of Echocardiography (EAE)², were an important advance in quantitative echocardiography. They represent a mixture of expert opinion and included published and unpublished reports that were available at the time. However, any reference ranges are dependent upon the individuals studied, and the values for left ventricular quantification were typically developed from North American cohorts recruited in the 1970–80s and therefore do not represent the diverse world population they are now applied to.

The echocardiographic normal ranges meta-analysis of the left heart (EchoNoRMAL) study

The echocardiographic normal ranges meta-analysis of the left heart (EchoNoRMAL) collaboration is an individual person data

meta-analysis of echocardiographic measurements obtained from healthy volunteers >18 years of age, from the general population, without cardiovascular (CV) disease or CV symptoms, hypertension or diabetes. This excludes patients referred for an echocardiogram and later judged to be free of the disease of interest who are typically found through searching an echo database for patients with a 'normal' echo. This group will include people with CV symptoms and comorbidity and are therefore a potential source of bias.

We have undertaken a comprehensive systematic review to identify studies (published and unpublished) that have echo data on >50 healthy volunteers, and have contacted the lead investigators to request collaboration. We are also contacting investigators of large population studies in which echocardiography was undertaken, and inviting others through personal communication. We are particularly interested to incorporate data sets from all major population groups in the world to ensure that the derived reference ranges will have widespread generalizability across geographical regions, and across people of different age, body size, and ethnicity.

Relevance

The study aims to re-define normal echocardiographic reference ranges (for the left heart including dimensions, areas, volumes, Doppler, and associated calculated variables) for populations across the world, and to do that, requires data from those

* Corresponding author. Tel: +64 9 9239803; fax: +64 9 3677146, Email: k.poppe@auckland.ac.nz

Published on behalf of the European Society of Cardiology. All rights reserved. © The Author 2012. For permissions please email: journals.permissions@oup.com

populations. Such data will make an important contribution to future guidelines. With this in mind, we have made formal approaches to both the ASE and EAE to receive their feedback on the meta-analysis and to ensure they are aware of the project.

Contributing data

This is a genuine collaboration. We anticipate publishing this work in high profile journals under the name of the EchoNoRMAL collaboration. The study will be managed by an executive committee, and the data managed and securely stored at a central site at The University of Auckland in New Zealand. Each collaborator that contributes data will be a named member of the steering committee and all individual study investigators listed in the Acknowledgement section of any presentation or publication. Initial funding for this project has been provided by the National Heart Foundation of New Zealand and ethics approval granted by our regional ethics committee.

We may have already been in touch about your study. If so, thank you for considering this project and for joining our collaboration. We currently have data on over 17 800 individuals from parts of

Europe, Asia, North and South America, and Australasia. Data from a similar number of individuals have been committed and there is the potential for even more people to be included. We would be delighted to hear from you should you wish to contribute data that we have not yet identified in our search process.

Conflict of interest: none declared.

Funding

This project has received initial funding from the Heart Foundation of New Zealand. K.K.P. is supported by a Research Fellowship from the Heart Foundation of NZ; R.N.D. holds the NZ Heart Foundation Chair in Heart Health.

References

1. Lang RM, Bierig M, Devereux RB, Flachskampf FA, Foster E, Pellikka PA et al. Recommendations for chamber quantification: A report from the American Society of Echocardiography's guidelines and standards committee and the Chamber Quantification Writing Group, developed in conjunction with the European Association of Echocardiography, a branch of the European Society of Cardiology. *J Am Soc Echocardiogr* 2005;**18**:1440–63.
2. Lang RM, Bierig M, Devereux RB, Flachskampf FA, Foster E, Pellikka PA et al. Recommendations for chamber quantification. *Eur J Echocardiogr* 2006;**7**:79–108.