Indexing of LV mass to account for body habitus in an Aotearoa population

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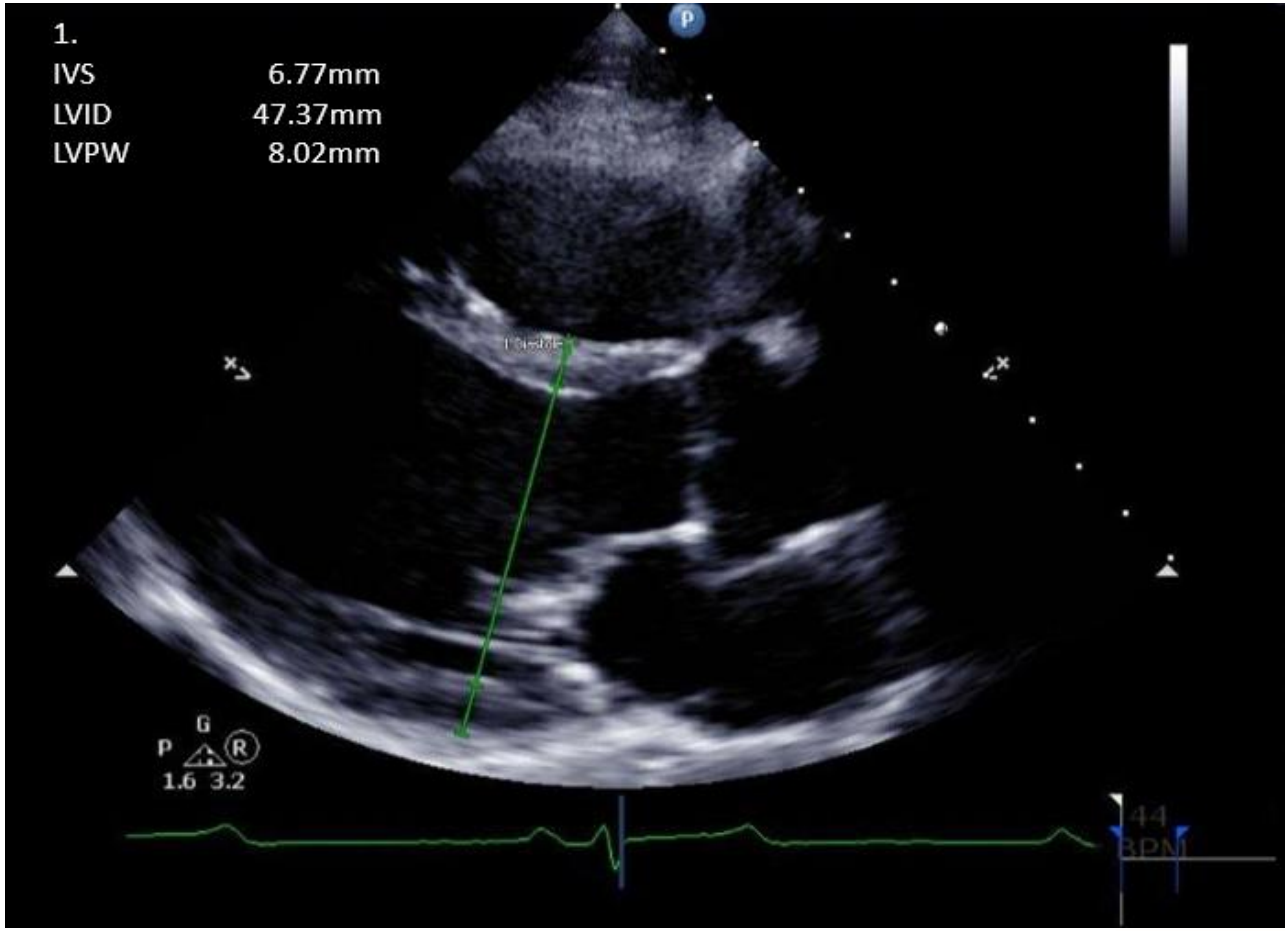
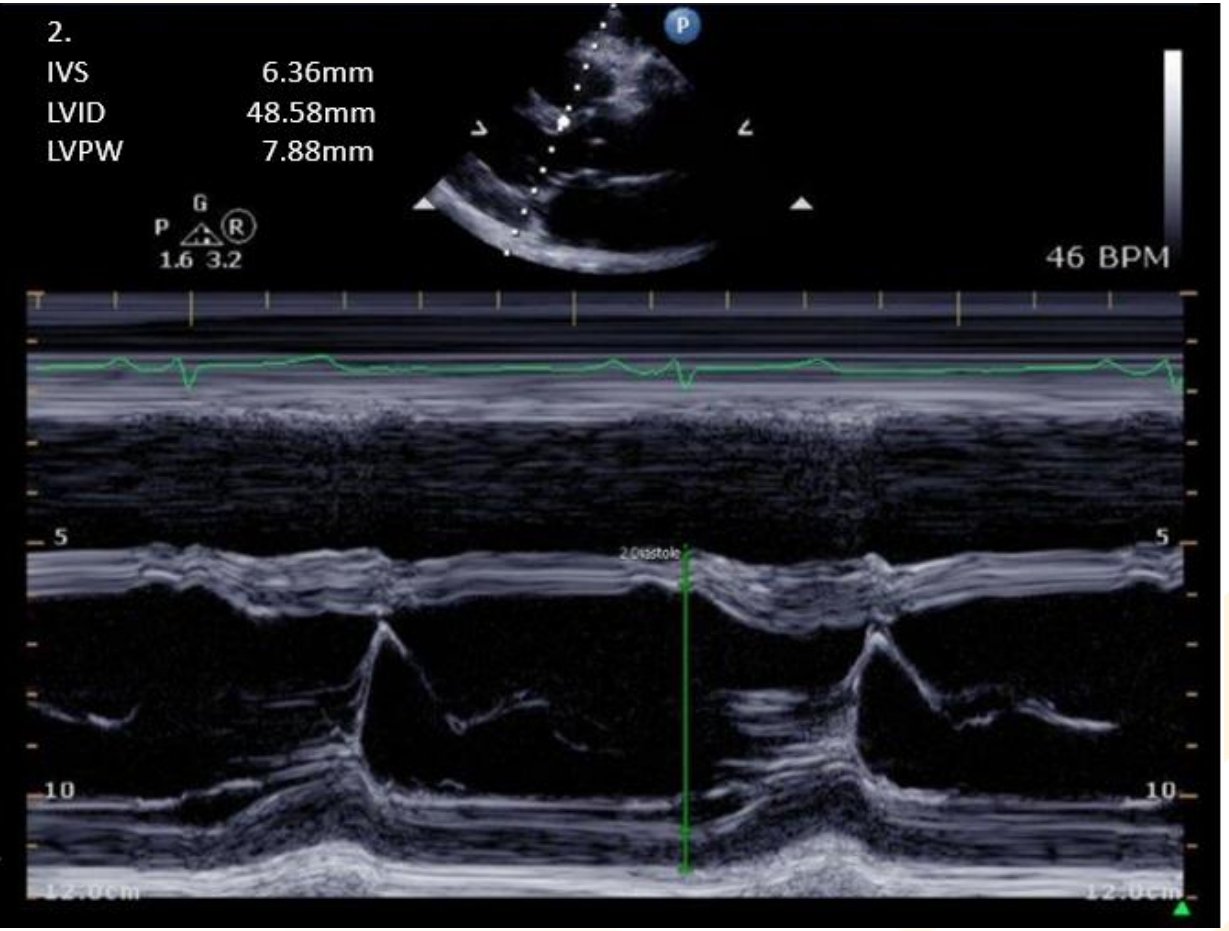
I have no disclosures

Heart size varies with body size

- Your heart is approximately the size of your fist
- Sex differences
- Indexing measurements provides an attempt to account for variation in body size
- Ethnic differences in body habitus

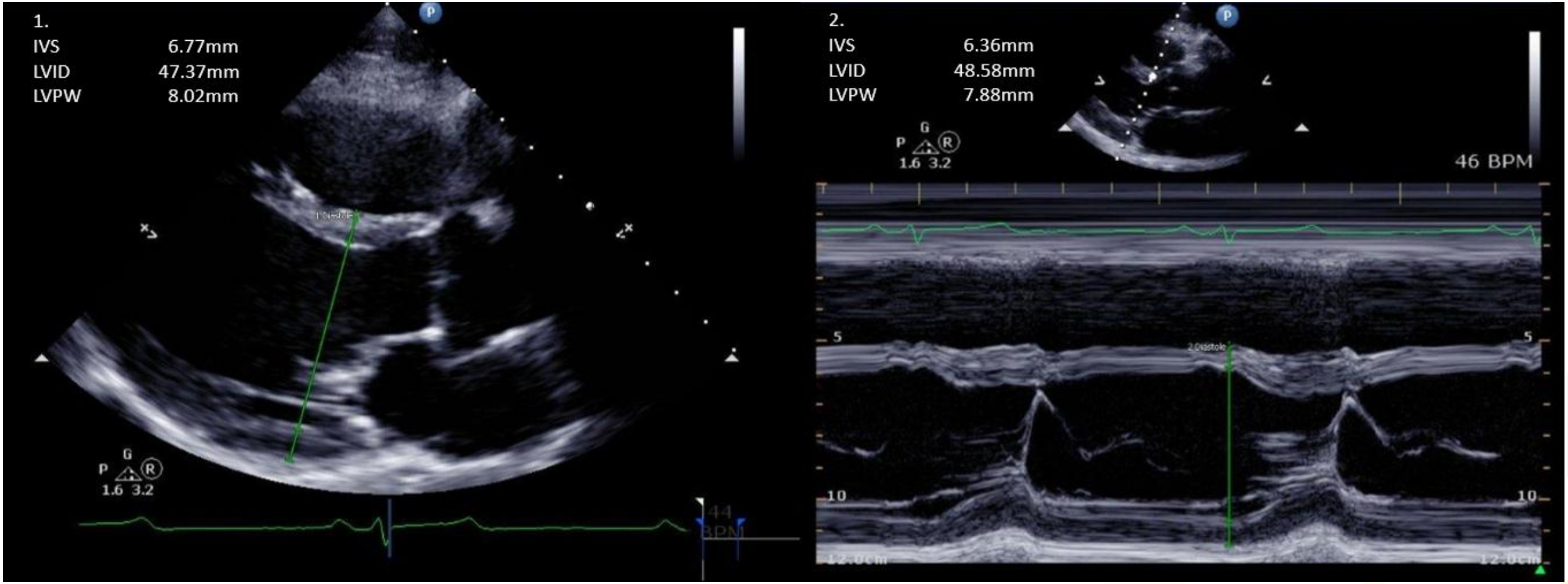

1.
IVS 6.77mm
LVID 47.37mm
LVPW 8.02mm
P
G
R
1.6 3.2
44 BPM


2.
IVS 6.36mm
LVID 48.58mm
LVPW 7.88mm
P
G
R
1.6 3.2
46 BPM
5
10
5
10

$LV\ mass = 0.8(1.04\ [(IVS + LVEDD + PWT)^3 - LVEDD^3]\ ) + 0.6$

IVS = interventricular septal thickness; PWT = posterior wall thickness;

LVEDD = Left ventricular end diastolic dimension



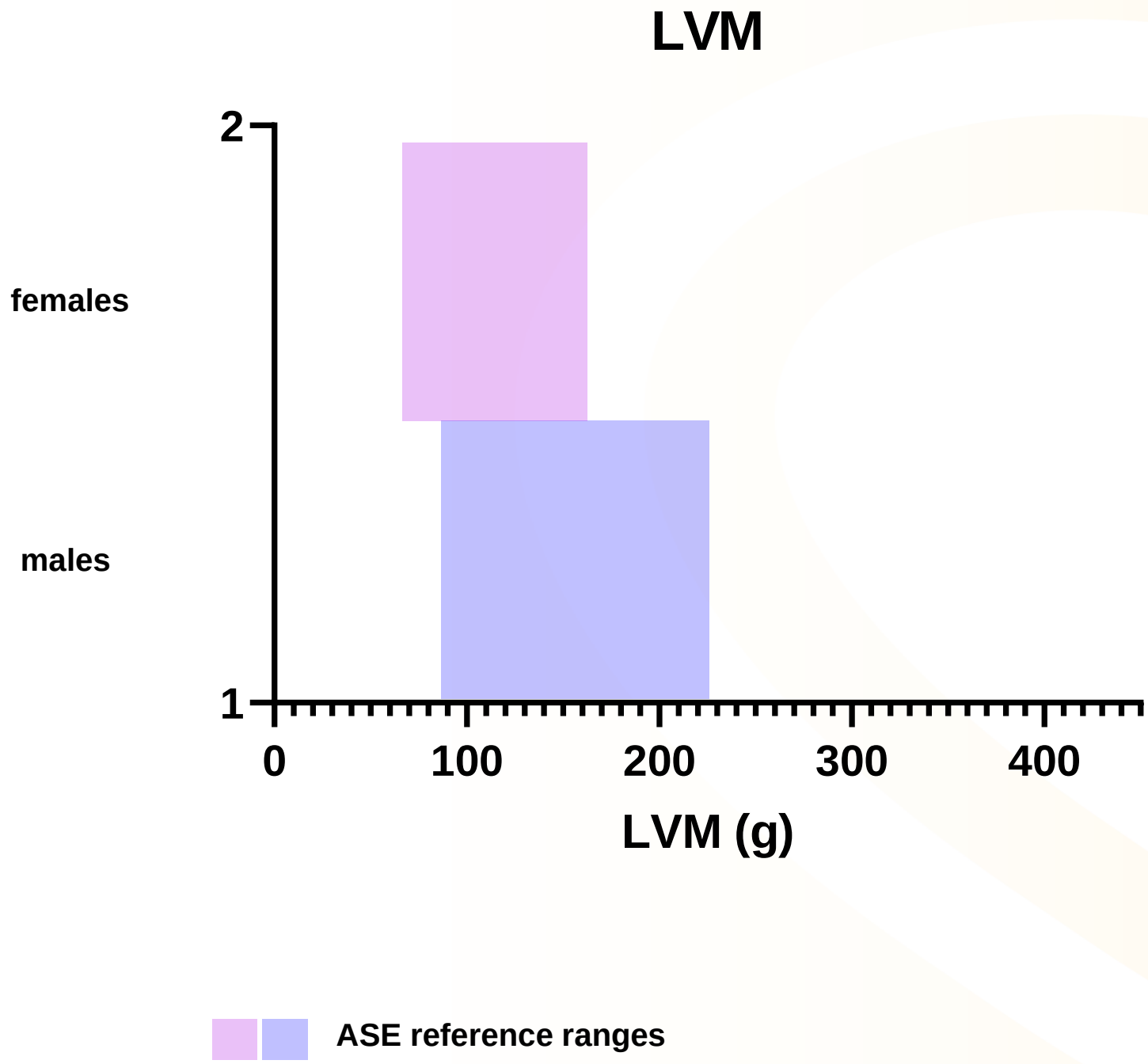
GUIDELINES AND STANDARDS

Recommendations for Cardiac Chamber Quantification by Echocardiography in Adults: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging

Roberto M. Lang, MD, FASE, FESC, Luigi P. Badano, MD, PhD, FESC, Victor Mor-Avi, PhD, FASE, Jonathan Afilalo, MD, MSc, Anderson Armstrong, MD, MSc, Laura Ernande, MD, PhD, Frank A. Flachskampf, MD, FESC, Elyse Foster, MD, FASE, Steven A. Goldstein, MD, Tatiana Kuznetsova, MD, PhD, Patrizio Lancellotti, MD, PhD, FESC, Denisa Muraru, MD, PhD, Michael H. Picard, MD, FASE, Ernst R. Rietzschel, MD, PhD, Lawrence Rudski, MD, FASE, Kirk T. Spencer, MD, FASE, Wendy Tsang, MD, and Jens-Uwe Voigt, MD, PhD, FESC, *Chicago, Illinois; Padua, Italy; Montreal, Quebec and Toronto, Ontario, Canada; Baltimore, Maryland; Créteil, France; Uppsala, Sweden; San Francisco, California; Washington, District of Columbia; Leuven, Liège, and Ghent, Belgium; Boston, Massachusetts*

The rapid technological developments of the past decade and the changes in echocardiographic practice brought about by these developments have resulted in the need for updated recommendations to the previously published guidelines for cardiac chamber quantification, which was the goal of the joint writing group assembled by the American Society of Echocardiography and the European Association of Cardiovascular Imaging. This document provides updated normal values for all four cardiac chambers, including three-dimensional echocardiography and myocardial deformation, when possible, on the basis of considerably larger numbers of normal subjects, compiled from multiple databases. In addition, this document attempts to eliminate several minor discrepancies that existed between previously published guidelines. (J Am Soc Echocardiogr 2015;28:1-39.)

Keywords: Adult echocardiography, Transthoracic echocardiography, Ventricular function, Normal values


LVM
2
females
males
1
0
100
200
300
400
LVM (g)
ASE reference ranges

New Echocardiography Reference Ranges for Aotearoa (NewERA) Study: the application of international echocardiographic reference values to linear measurements of the hearts of healthy, young Māori and Pacific adults may not detect cardiac enlargement

Gillian A Whalley, Allanah Harrington, Jonathan Christiansen, Bettina Ikenasio, Arun Deo, Greg D Gamble, Sue Crengle

ABSTRACT

AIMS: To develop ethnic-specific echocardiography reference ranges for Aotearoa, and to investigate the impact of indexation to body surface area (BSA). Current reference international ranges are derived from people of mostly NZ European ethnicity and may not be appropriate for Māori and New Zealanders of Pacific ethnicity, who both experience high rates of cardiovascular disease.

METHODS: Echocardiography was performed in a cross-sectional study of 263 healthy adults (18–50 years): Māori (N=71, 43 female), Pacific (N=53, 28 female), European (N=139, 74 female). Linear measurements of the left heart are reported and indexed to BSA. The upper/lower limit of normal (ULN/LLN) by ethnicity and sex were derived (quantile regression). Ethnic- and sex-specific differences were examined using ANOVA.

RESULTS: The ULN was higher for all un-indexed dimensions in men compared to women, and for most indices the ULN was smallest in NZ Europeans and largest in Māori and Pacific peoples. Indexation reversed these relationships: NZ Europeans had higher ULN for many measurements.

CONCLUSIONS: Indexing to BSA introduced bias that preferences the NZ European ethnicity by creating an upper limit reference threshold that far exceeds this sample's upper range. As a result, this may lead to under-recognition of cardiac enlargement in Māori and Pacific patients, and in particular for women. Unique reference ranges for all ethnic groups and sexes are required to optimally detect and manage cardiovascular diseases (CVD) in Aotearoa.

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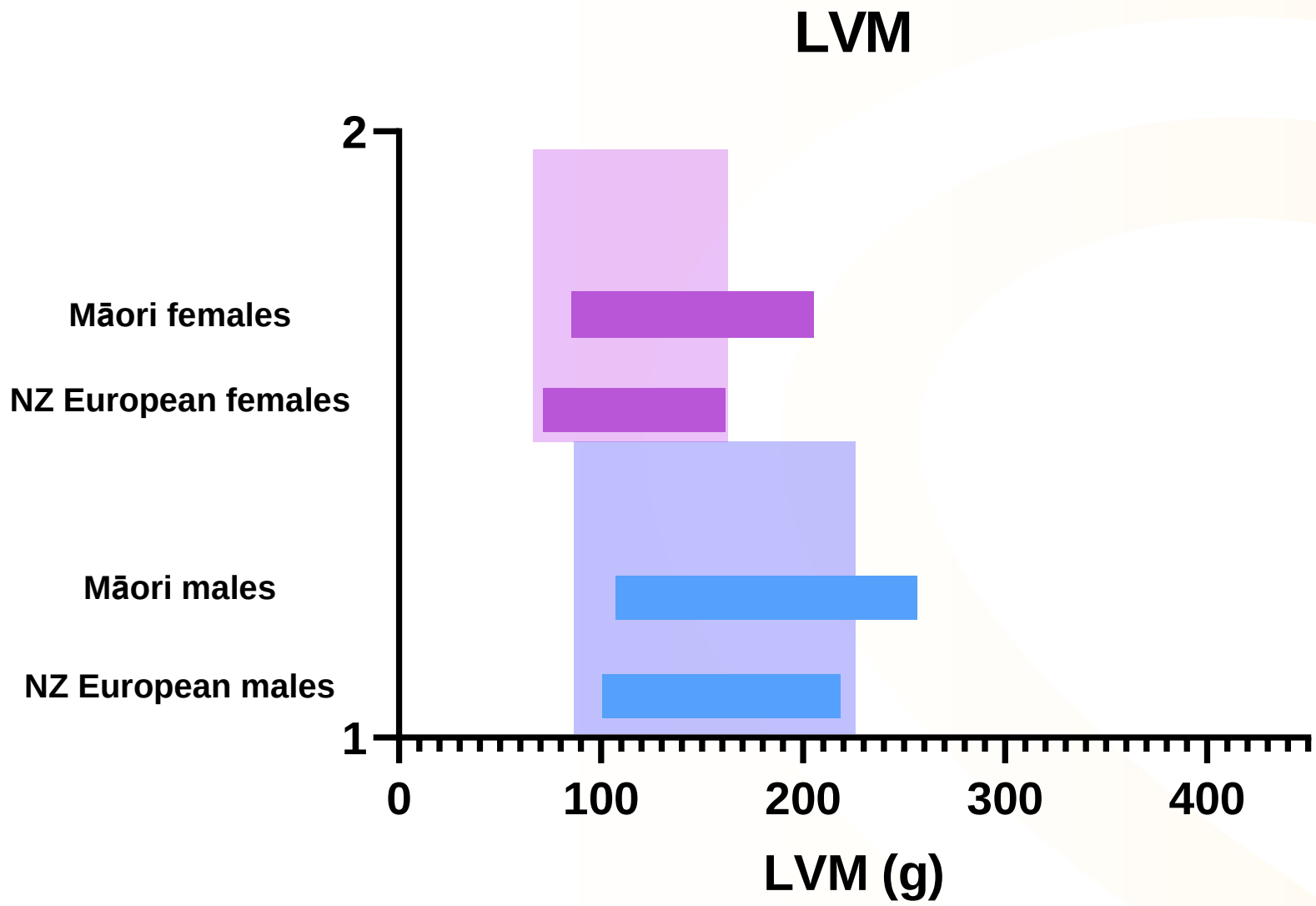
NewERA

- Healthy adults (18-50 years)
  - 71 Māori (43 female)
  - 53 Pacific (28 female)
  - 139 NZ European (74 female)

- Reference ranges derived by ethnicity and sex
- Validated by comparing NZ Europeans with ASE normal ranges


LVM
2
Māori females
NZ European females
Māori males
NZ European males
1
0
100
200
300
400
LVM (g)
NewERA reference ranges
ASE reference ranges

Hauora Manawa/ Heart Health: The Community Heart Study

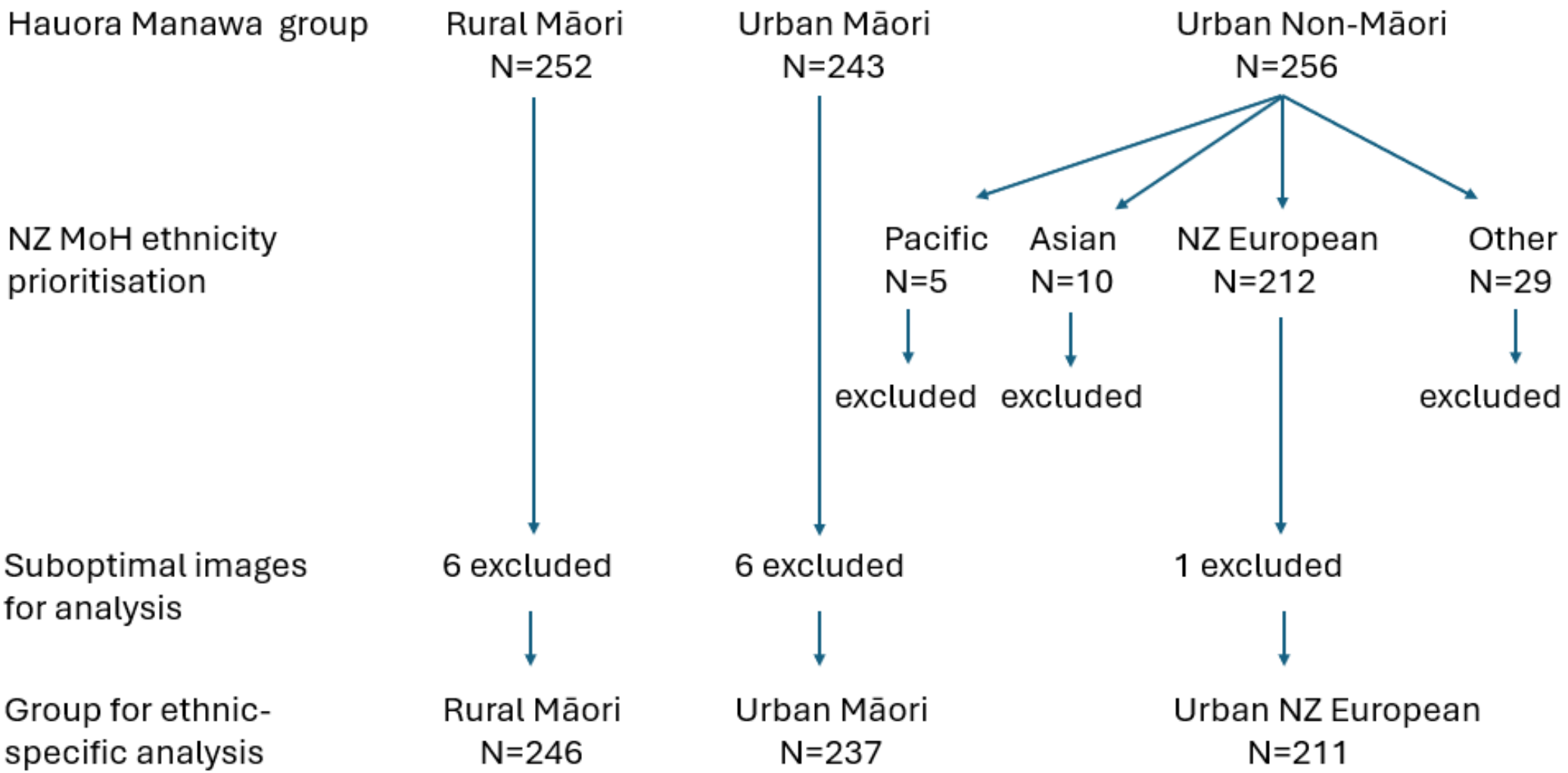
- Designed to documents the rates of CV risk factors and disease

- 252 Rural Māori (Wairoa)
- 243 Urban Māori (Christchurch)
- 256 Urban Non-Māori (Christchurch)

Aim

- To compare indexation approaches for LV mass in a community study to understand the effect this has on the detection of left ventricular hypertrophy (LVH)

Method: Inclusion pathway

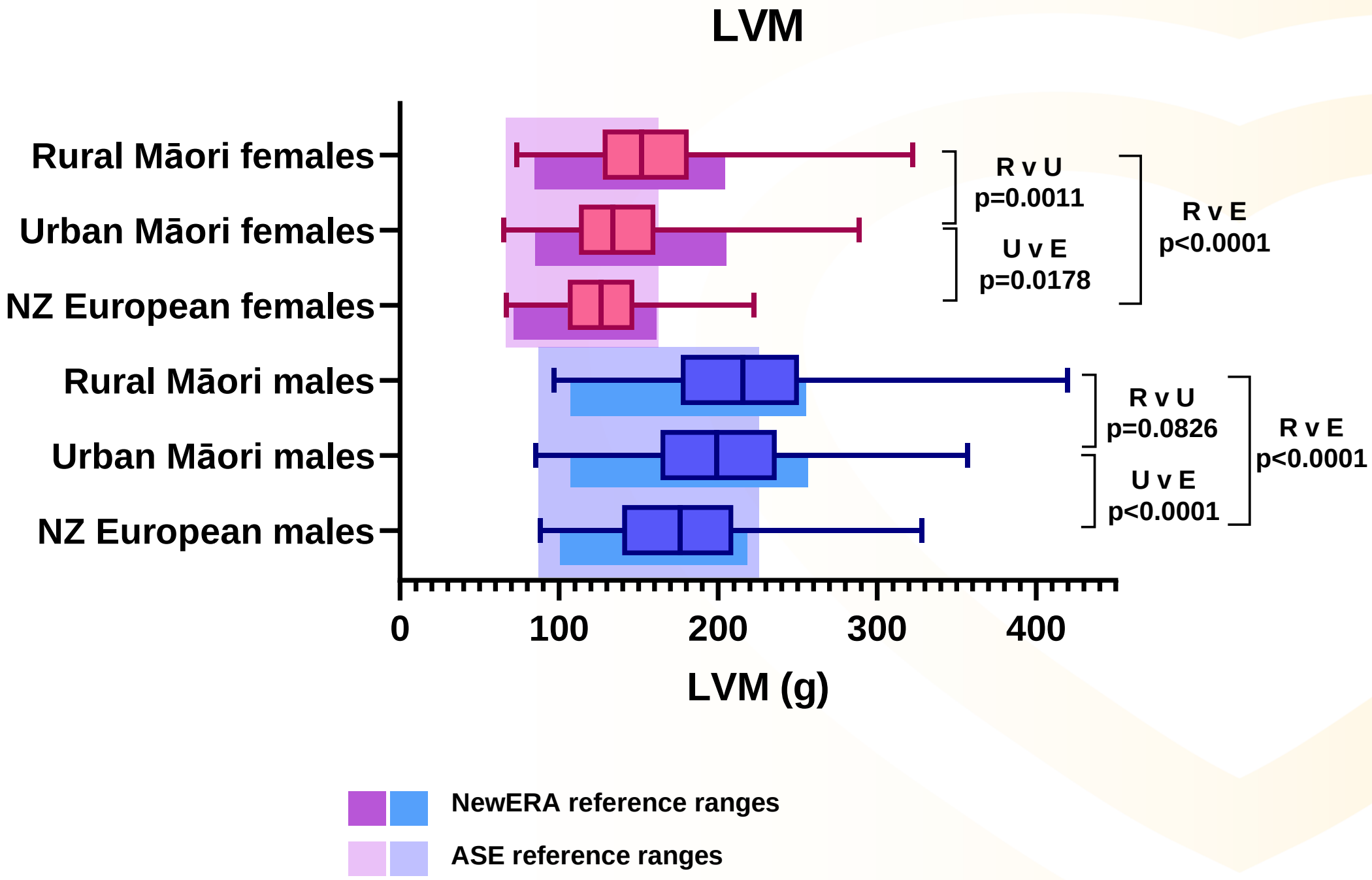


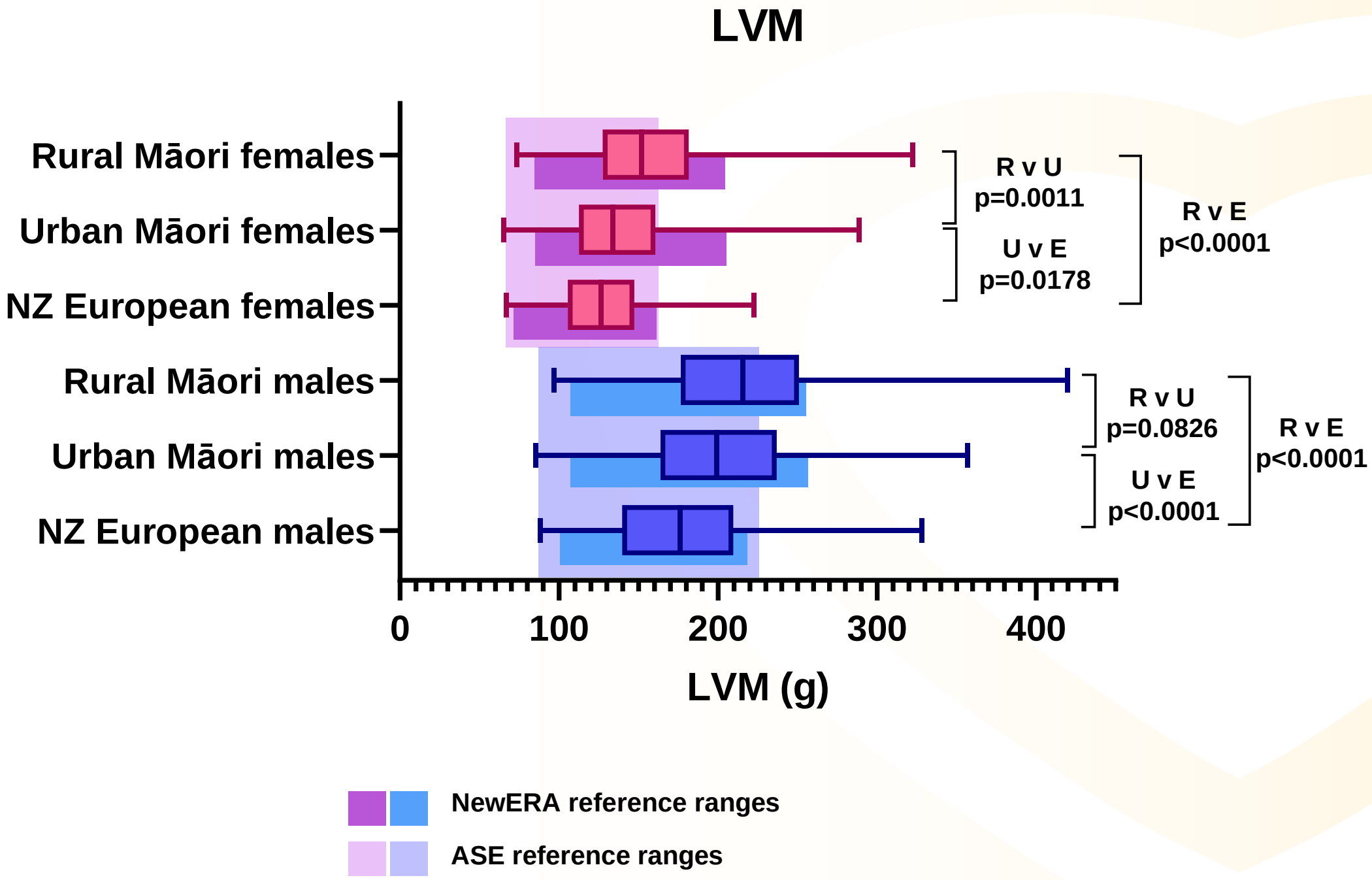
Method

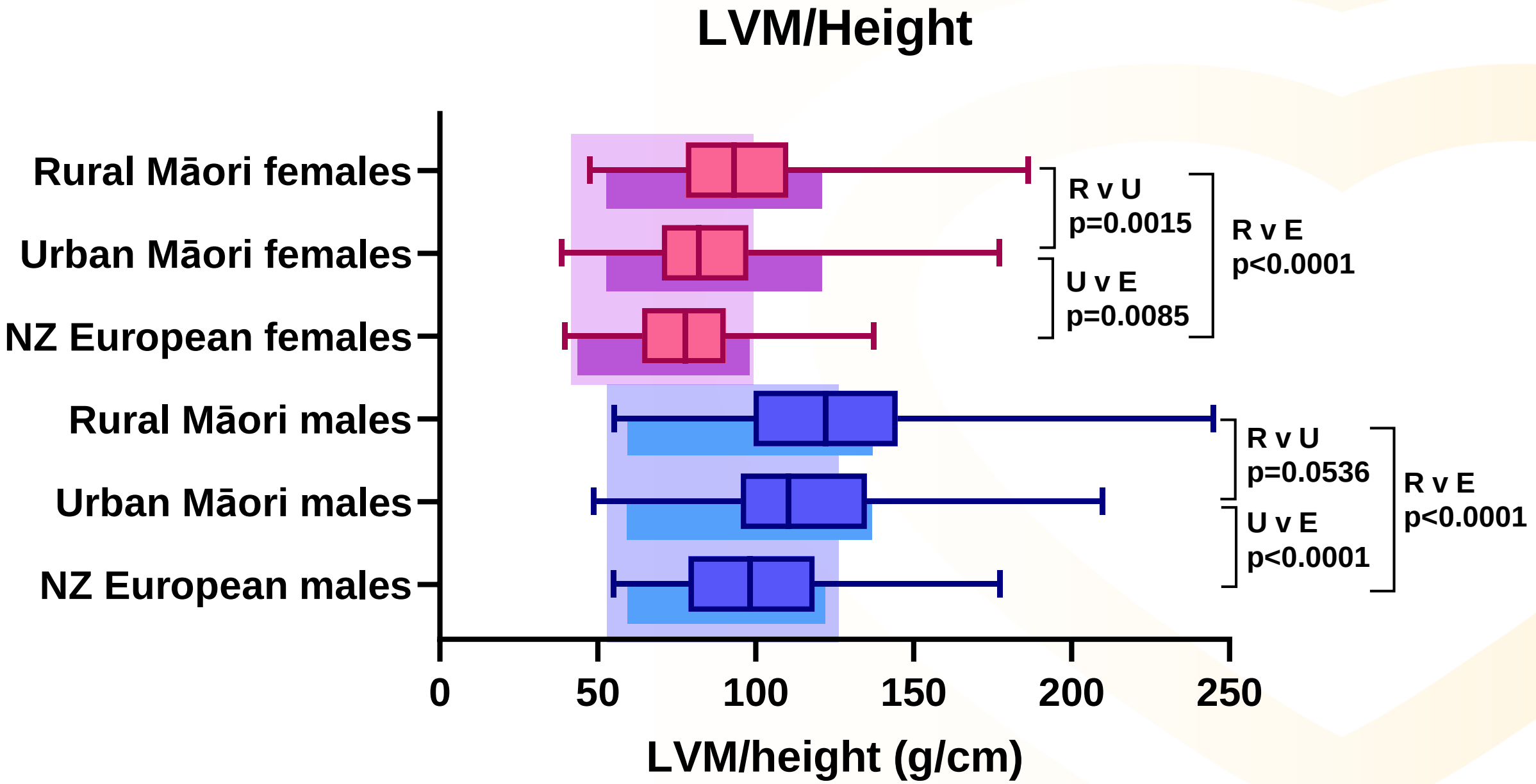
- M mode measurements were used to calculate LV mass
- Unindexed LV mass was compared across each of the Hauora Manawa groups
- LV mass was also indexed for height, BSA and FFM

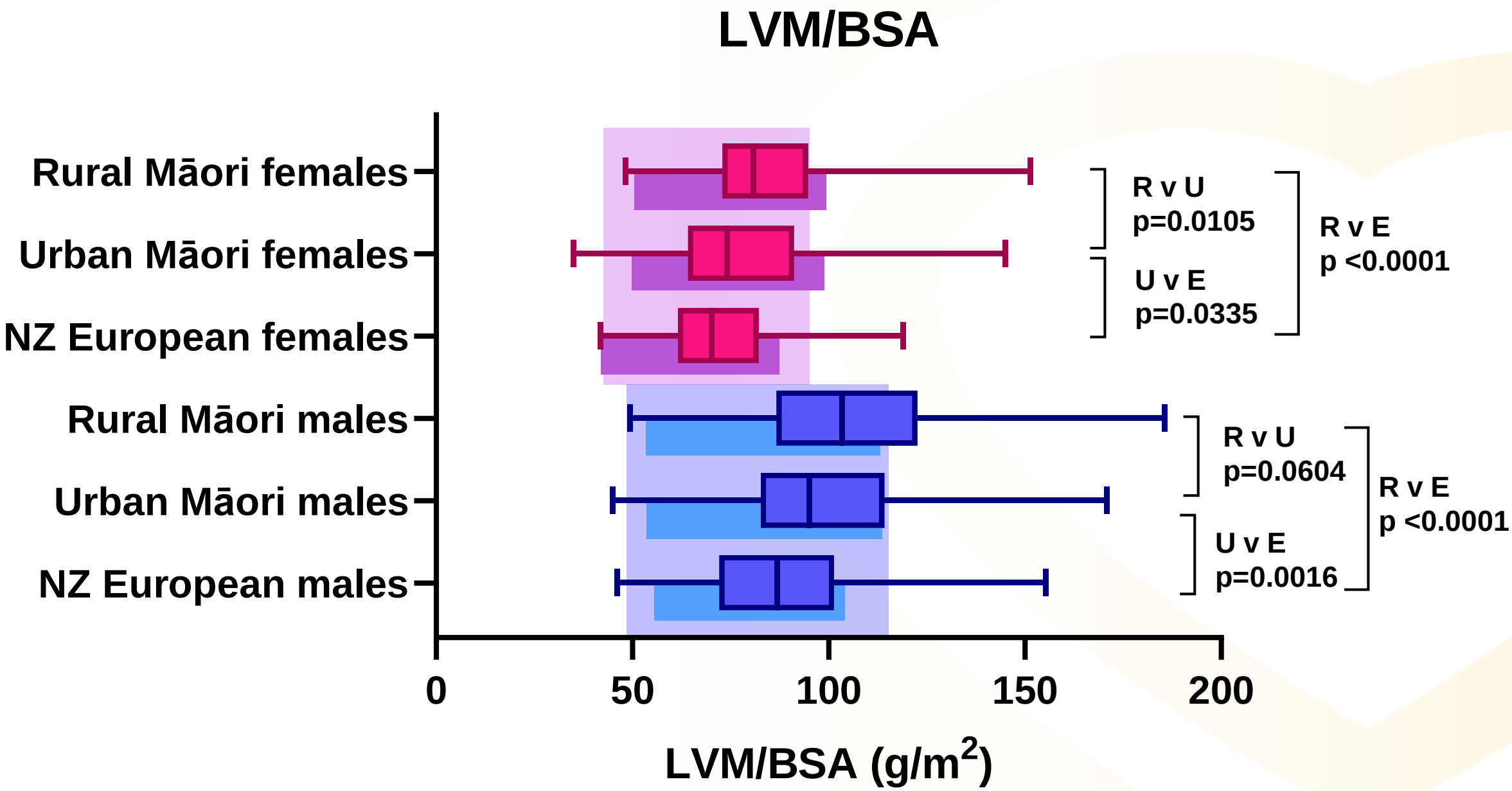
	Rural Māori N = 246 Mean (sd)	Urban Māori N = 237 Mean (sd)	Urban NZ European N = 211 Mean (sd)	ANOVA p value
Age, years	45.5 (11.5)	42.5 (11.1)	43.7 (11.6)	0.0151
Systolic BP, mmHg	130 (20)	128 (21)	125 (16)	0.0310
Diastolic BP, mmHg	85 (12)	86 (14)	83 (13)	0.1026
Height, cm	168.4 (8.7)	169.1 (9.1)	171.4 (9.0)	0.0011
Weight, kg	86.7 (21.7)	82.7 (19.1)	77.1 (14.4)	<0.0001
Body Mass Index, kg/m2	30.5 (7.2)	28.9 (6.2)	26.2 (4.3)	<0.0001
Fat free mass, kg	55.1 (11.1)	55.4 (7.9)	54.6 (9.6)	0.7512
Body surface area, m2	1.96 (0.24)	1.93 (0.23)	1.92 (0.22)	0.1945

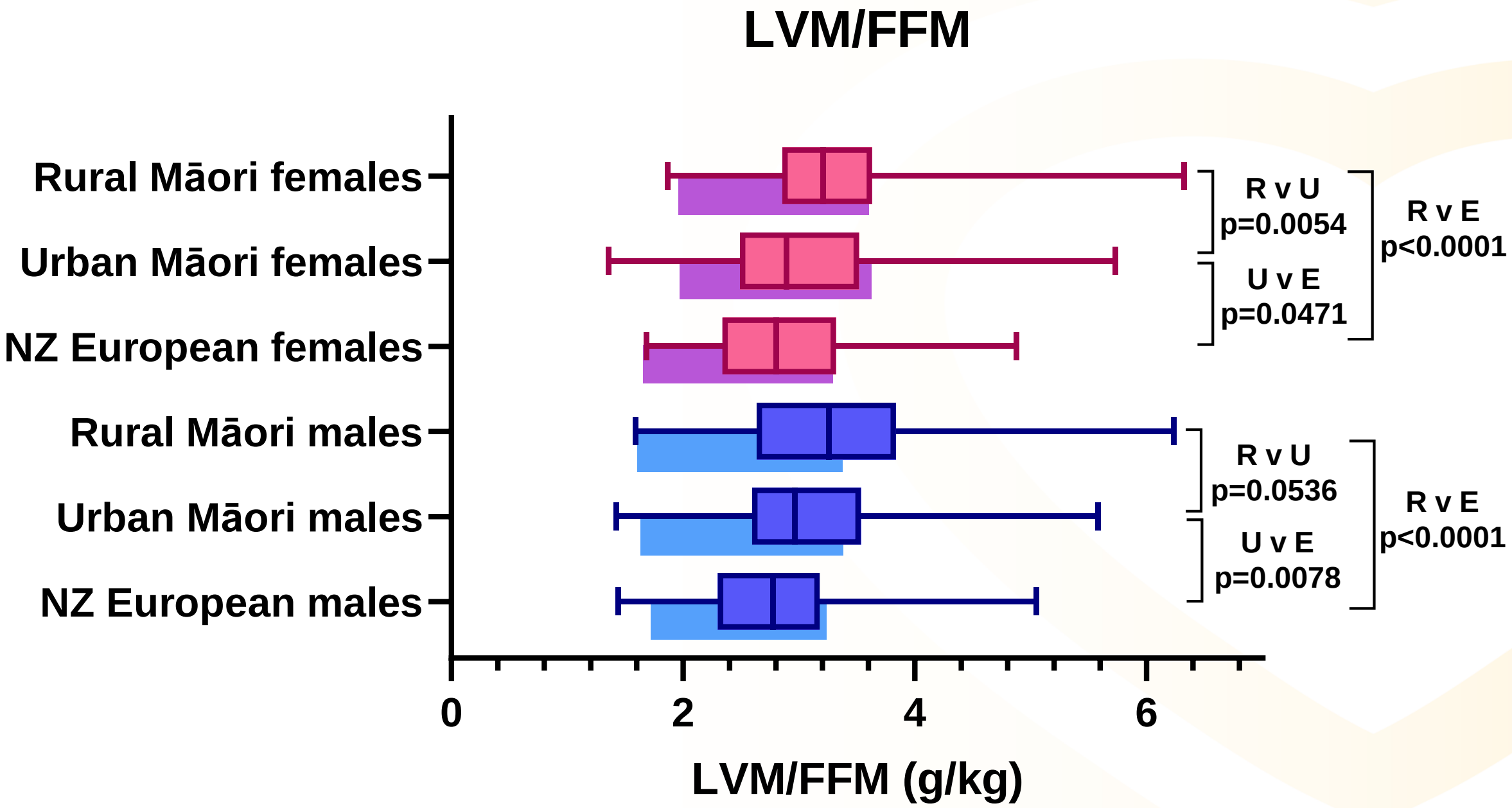
	Rural Māori N = 246 Number (%)	Urban Māori N = 237 Number (%)	Urban NZ European N = 211 Number (%)	Chi-squared p value
Gender, male	100 (40.7%)	105 (44.3%)	107 (50.7%)	0.0950
Hypertension, n (%)	62 (25.2)	47 (19.8)	29 (13.7)	0.0093
Dyslipidaemia, n (%)	57 (23.2)	45 (19.0)	33 (15.6)	0.1249
Type 2 diabetes, n (%)	27 (11.0)	9 (3.8)	4 (1.9)	<0.0001


LVM
Rural Māori females
Urban Māori females
NZ European females
Rural Māori males
Urban Māori males
NZ European males
R v U
p=0.0011
U v E
p=0.0178
R v E
p<0.0001
R v U
p=0.0826
U v E
p<0.0001
R v E
p<0.0001
0
100
200
300
400
LVM (g)
NewERA reference ranges
ASE reference ranges


LVM
Rural Māori females
Urban Māori females
NZ European females
Rural Māori males
Urban Māori males
NZ European males
R v U
p=0.0011
U v E
p=0.0178
R v E
p<0.0001
R v U
p=0.0826
U v E
p<0.0001
R v E
p<0.0001
0
100
200
300
400
LVM (g)
NewERA reference ranges
ASE reference ranges


LVM/Height
Rural Māori females
Urban Māori females
NZ European females
Rural Māori males
Urban Māori males
NZ European males
R v U
p=0.0015
U v E
p=0.0085
R v E
p<0.0001
R v U
p=0.0536
U v E
p<0.0001
R v E
p<0.0001
0
50
100
150
200
250
LVM/height (g/cm)


LVM/BSA
Rural Māori females
Urban Māori females
NZ European females
Rural Māori males
Urban Māori males
NZ European males
R v U
p=0.0105
U v E
p=0.0335
R v E
p <0.0001
R v U
p=0.0604
U v E
p=0.0016
R v E
p <0.0001
0
50
100
150
200
LVM/BSA (g/m2)


LVM/FFM
Rural Māori females
Urban Māori females
NZ European females
Rural Māori males
Urban Māori males
NZ European males
R v U
p=0.0054
U v E
p=0.0471
R v E
p<0.0001
R v U
p=0.0536
U v E
p=0.0078
R v E
p<0.0001
0
2
4
6
LVM/FFM (g/kg)

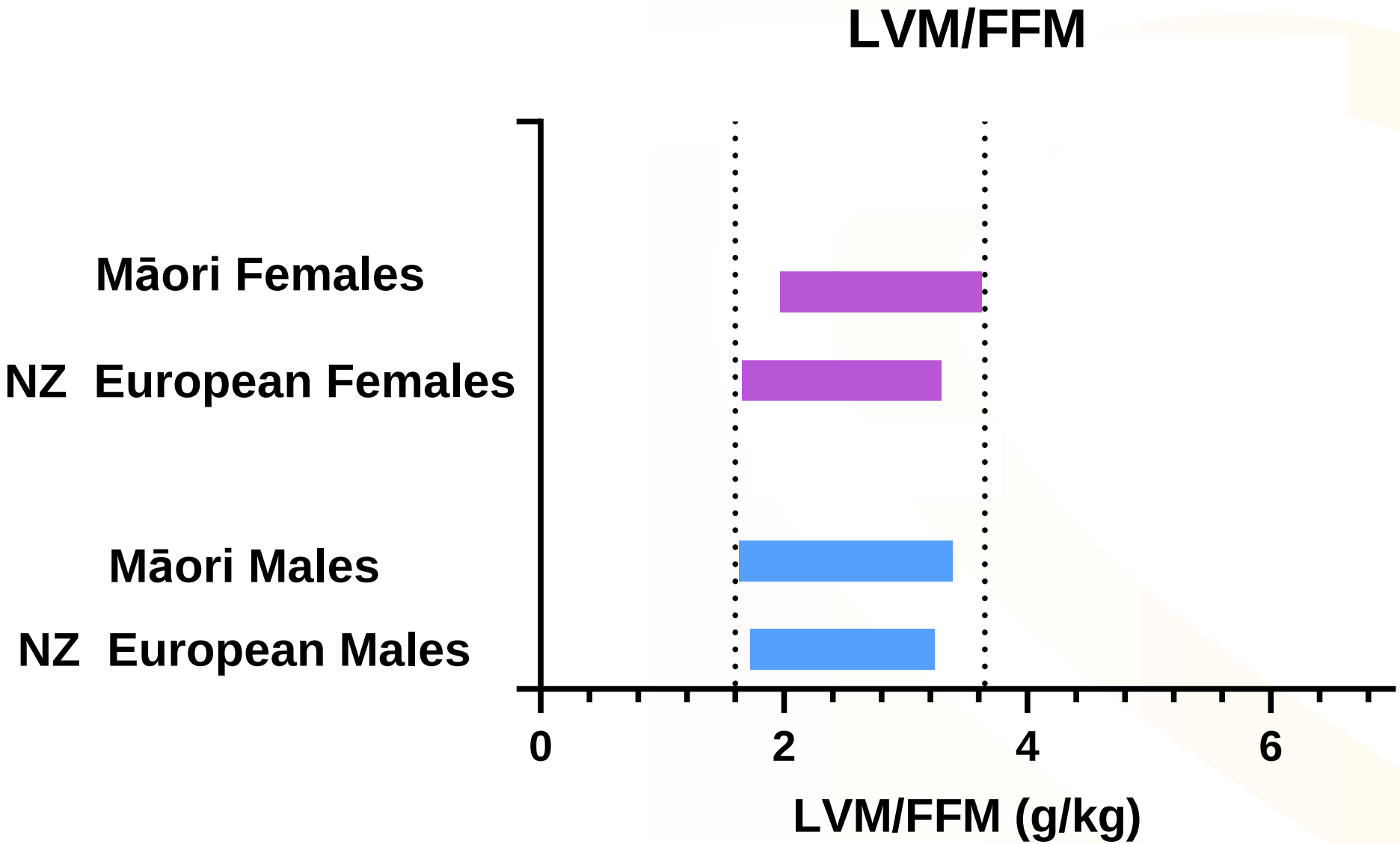
Conclusions

- In the Hauora Manawa cohort, Māori have higher LV mass when compared to NZ Europeans
- Rural Māori females have higher LV mass than Urban Māori females

- The indexing approach alters the observed prevalence of LVH
- The clinical significance of this is unclear

Limitations

- Assumptions of LV shape
- Measurement error
- M-mode measurements
- Defining ethnicity


LVM/FFM
Māori Females
NZ European Females
Māori Males
NZ European Males
0
2
4
6
LVM/FFM (g/kg)

Future direction

- 15 year follow up data
  - Mortality/ CV hospital presentations
  - CV Medication changes
- Risk stratification
  - Relating cardiovascular events to the presence of LVH
  - Which indexing method identifies those most at risk?

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