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**PHYSICAL ACTIVITY AND FITNESS
MEASURES IN NEW ZEALAND:
A STUDY OF VALIDATION AND
CORRELATION WITH
CARDIOVASCULAR RISK FACTORS**

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**A thesis submitted in fulfilment of the requirements for the
degree of Doctor of Philosophy in Population Health,**



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ABSTRACT

The primary aim of the study was to validate the short and long form of the recently-created NZ physical activity questionnaires (NZPAQ-SF and NZPAQ-LF, respectively) in a multi-ethnic sample in Auckland. An international physical activity questionnaire (IPAQ-long) was also validated and compared to the NZ instruments. Objective PA measures were used to create a NZ compendium of PA intensities, providing baseline data for culturally-specific PAs. Secondary aims included an examination of the relationship between PA and CRF, and their associations with cross-sectional measures of cardiovascular (CV) risk factors.

The study sample consisted of 186 apparently healthy males (n=90) and females (n=96) aged 19-86 yrs, classified as European/Other (n=60), Māori (n=61), and Pacific (n=65). Heart rate monitoring (HRM) with individual calibration was used to objectively measure the duration, frequency, and intensity of at least moderate-intensity PAs performed over 3 consecutive days. Type of PA and the context in which it was performed was simultaneously recorded by participants on daily PA logs. Correlations between HRM and self-reported levels of brisk walking, moderate-intensity, vigorous-intensity, were poor for each questionnaire, and correlations were lower for Māori and Pacific ethnic groups than for European/Other. The NZPAQ-SF ($r=0.3$, $p<0.001$) and NZPAQ-LF ($r=0.3$, $p<0.001$) performed better than the IPAQ-long ($r=0.1$, $p=0.37$). The culturally-specific list of PA intensities showed strong correlation ($R^2=0.68$) to an internationally-accepted compendium of PA intensities, and provided baseline energy cost data for 13 PAs performed by Māori and Pacific people in NZ. CRF levels were primarily influenced by gender, ethnicity, obesity, and performing at least 15 min/day of vigorous-intensity PA, and showed stronger associations with fasting blood lipids and glucose, while PA was more strongly related to SBP and DBP.

The validated NZPAQs are acceptable for measuring population level PA prevalence in NZ adults, although accuracy is lower for Māori and Pacific people. However, the availability of a culturally-specific list of PA intensities could potentially increase the accuracy of self-reported PA by Māori and Pacific people. Results from this study highlight the importance of vigorous-intensity PA for CV health, and identifies NZ Pacific people as high risk in terms of PA, obesity, and CRF.

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LIST OF ABBREVIATIONS

ACSM	American College of Sports Medicine
AEE	activity energy expenditure
API	Asian and Pacific Island people
BMI	body mass index
BMR	basal metabolic rate
BP	blood pressure
bpm	beats per minute
CAL _{EE}	energy expenditure determined by calorimetry
CDC	Center for Disease Control
CHD	coronary heart disease
CI	confidence interval
CO ₂	carbon dioxide
CRF	cardiorespiratory fitness
CSA	Computer Science and Applications, Inc.
CV	cardiovascular
CVD	cardiovascular disease
DBP	diastolic blood pressure
DGPS	differential satellite global positioning system
DLW	doubly labeled water
DLW _{EE}	energy expenditure determined by doubly labeled water
EE	energy expenditure
EPAQ2	European Physical Activity Questionnaire (modified)
EPIC	European Prospective Investigation into Cancer and Nutrition
FWH	four-week histories
HDL	high density lipoprotein
HR(s)	heart rates
HRFlex	heart rate flex method
HRFlex _{EE}	energy expenditure determined by heart rate flex method
(%)HR _{max}	(percentage of) maximum heart rate
HRM	heart rate monitoring

HRM _{EE}	energy expenditure determined by heart rate monitoring
HR _{net}	net heart rate
(%)HRR	(percentage of) heart rate reserve
IPAQ-long	International Physical Activity Questionnaire – long Form
kcal(s)	kilocalorie(s)
kg	kilogram
L	litres
LDL	low density lipoprotein
ln	natural log
LTPA	leisure-time physical activity
MET(s)	metabolic equivalent(s)
min(s)	minute(s)
ml	millilitres
MOH	Ministry of Health
n	number
NCD	non-communicable diseases
NZ	New Zealand
NZHS	New Zealand Health Survey
NZPAQs	New Zealand Physical Activity Questionnaires
NZPAQ-LF	New Zealand Physical Activity Questionnaire – long form
NZPAQ-SF	New Zealand Physical Activity Questionnaire – short form
NZSPAS	New Zealand Sport and Physical Activity Questionnaire
O ₂	oxygen
PA	physical activity
PAJMG	Physical Activity Joint Monitoring Group
PA Log(s)	physical activity log(s)
PAL	physical activity level
PAQ(s)	physical activity questionnaire(s)
PAR	population attributable risk
PAR-Q	Physical Activity Readiness Questionnaire
PWC	physical work capacity
r	Spearman's correlation coefficient
R ²	correlation coefficient squared

RHR	resting heart rate
RMR	resting metabolic rate
RPE	ratings of perceived exertion
rpm	revolutions per minute
SBP	systolic blood pressure
SD	standard deviation
SE	standard error
SeDS	Sedentary Death Syndrome
SEE	standard error of the estimate
SEM	standard error of the mean
SPARC	Sport and Recreation New Zealand
SSAAQ	Sub-Saharan Africa Activity Questionnaire
TC	total cholesterol
TEE	total energy expenditure
US	United States
VO ₂	oxygen consumption
VO _{2max}	maximum oxygen consumption
WHO	World Health Organization
WPV	within-person variation
yrs	years