CLOSER Conference

Health 1: Health behaviour

Chair: **Mark Hamer**

- Physical activity in adolescence and health in mid-life: Evidence from the 1958 and 1970 British birth cohorts
  David Bann
- Ethnic differences in exercise on referral programme efficacy and completion rates
  Jacqueline Francis

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Institute of Education

Physical activity in adolescence and health in mid-life: Evidence from the 1958 and 1970 British birth cohorts

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SLLS Conference

12 October 2017

Outline

- Background
- Aims
- Data and methods
- Results
- Discussion

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Background

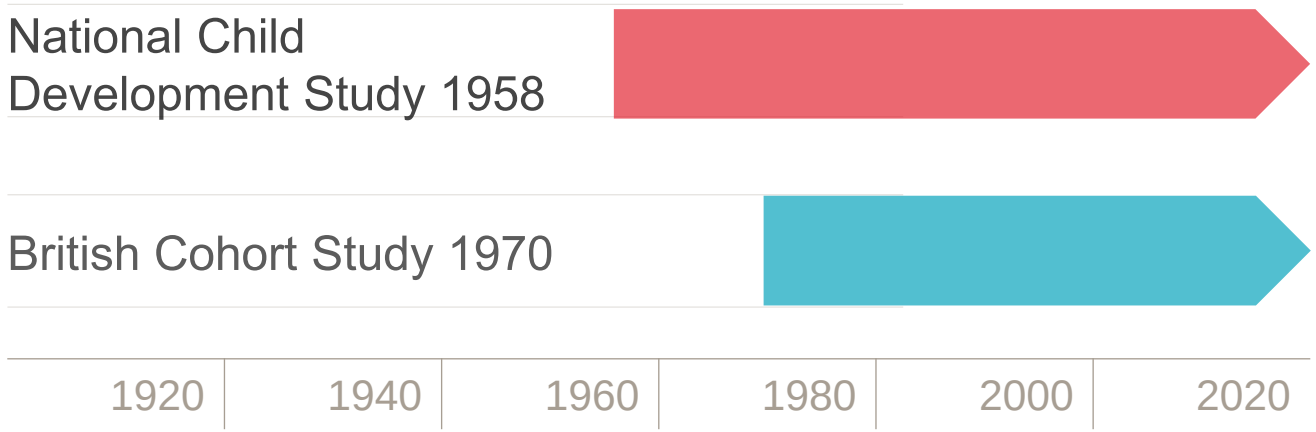
- There is a rich body of evidence on the health benefits of physical activity across different age groups.
- Less investigated is the long-term impact of early-life activity on mid-life health.

Aims

- To assess the impact of physical activity in adolescence on mid-life physical activity and physical and mental health outcomes.
- To investigate this association across different generations, born in 1958 and 1970.

Data

- 1958 National Child Development Study (NCDS)
- 1970 British Cohort Study (BCS)



NCDS follows the lives of over 17,000 babies who were all born in England, Scotland and Wales in a single week of 1958

BCS70 study follows more than 17,000 people who were all born in England, Scotland and Wales in a single week of 1970

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Data **NCDS**

- Data from birth and ages 7, 11, 16 and 42 and 44/45 years were used for this analysis (N=15,296).
- **Measures**
  - Physical activity at 16 years: 3 measures of PA in adolescence:
    - Playing Outdoor (often, sometimes, hardly ever, no chance);
    - Playing Indoor (often, sometimes, hardly ever, no chance);
    - General Scale combining indoor, outdoor and swimming (often, sometimes, hardly ever or never)
  - Physical activity in mid-life (age 42): (1) general physical activity variable asking whether respondent exercises regularly (yes/no) (2) measure of how often respondent takes part in any exercise activity.
  - Health in mid-life: 10 outcomes
    - 6 objective measures (age 44): fibrinogen; C-reactive protein; glycated haemoglobin; cholesterol; high blood pressure; respiratory function;
    - 4 self-reported indicators (age 42): obesity (yes/no); waist-hip ratio; self-rated health (fair or poor / good, very good, excellent); psychological distress (Malaise score no=0-3, yes=4+)

Data **BCS**

- Data from birth and ages 6, 10, 16 and 42 were used for this analysis (N=17,270).
- **Measures**
  - Physical activity at 16 years: 43 in-school physical activities and 43 out of school physical activities.
  - Physical activity in mid-life (age 42): A general physical activity variable collecting the number of days in a typical week that the cohort member exercised for 30+ minutes. This variable was ordinal, with values ranging from 0 to 7.
  - Health in mid-life (age 42): 5 separate health outcomes were used, including psychosocial distress measured by Malaise score (no=0-3; yes=4+), disability status (yes/no), obesity status (yes/no), self-reported high blood pressure (yes/no) and self-reported general health (fair or poor/good, very good, excellent).

Methods **NCDS**

- Statistical Analysis: multivariable linear model (for continuous outcomes), logistic regression (binary outcome) and ordinal logistic regression models (ordinal outcomes) to estimate the association between PA in adolescence and mid-life health and PA
- Individual models for each health outcomes and PA at age 42, stratified by sex.
- Adjusted for parental health, socio-economic characteristics in childhood, family structure, and physical and mental health covariates at age 7 and 11, birthweight, maternal smoking during pregnancy.
- Missing data: addressed using Multiple Imputation with chained equations and 20 imputations.

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Methods **BCS**

- Summary measure of PA at 16 years: latent class analysis used to reduce 43 in-school and 43 out of school physical activity variables in separate models and by gender.

  →4 models: i) males in-school: 3-class model; ii) males out of school: 3-class model;
  iii) females in school: 4-class model; iv) females out of school: 3-class model.

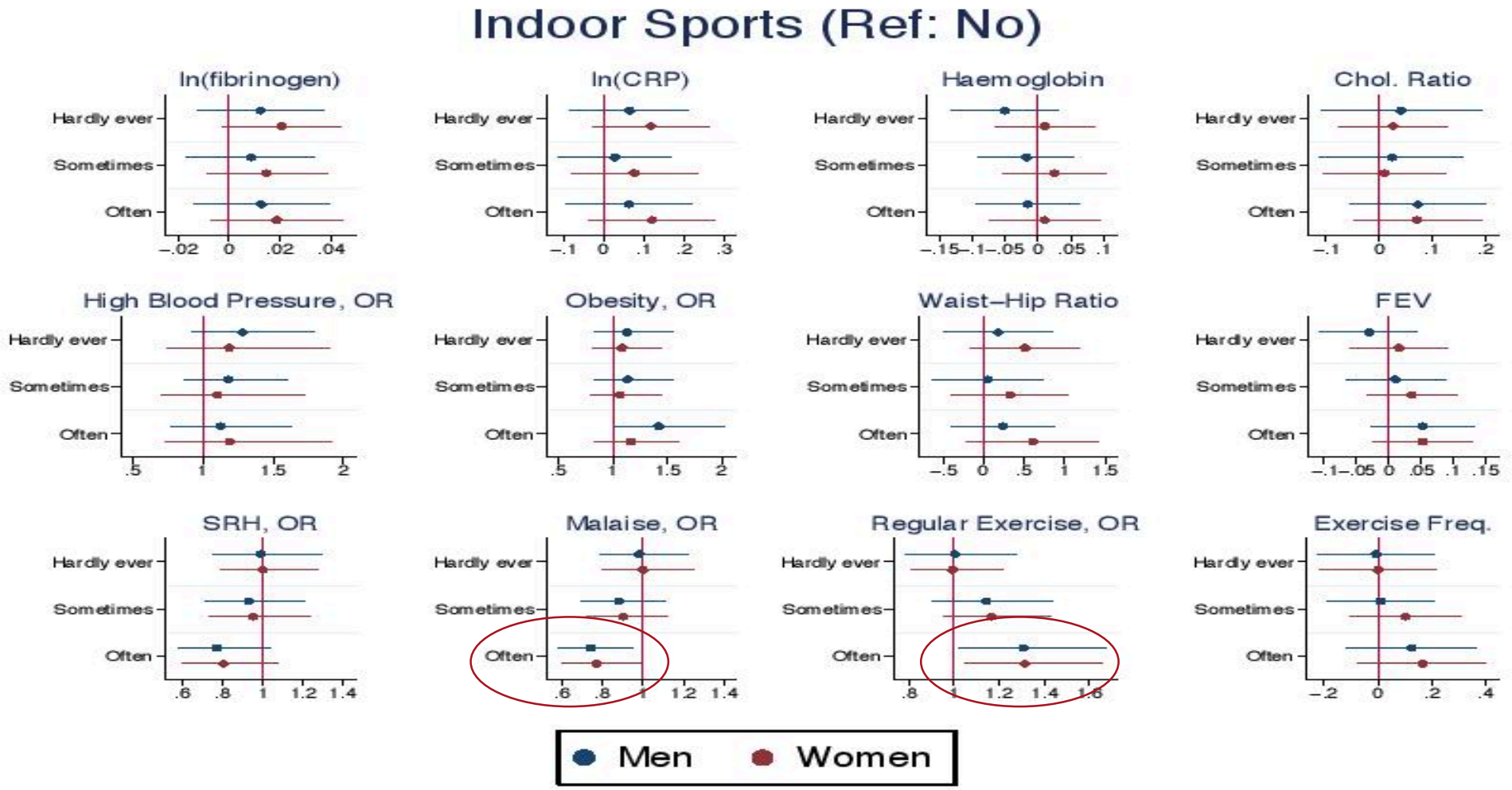
- Variable Selection: stepwise regression and GLMNET used to identify specific physical activities in adolescence which functioned as strong predictors of health and PA at age 42.
- Cumulative measure of PA: summarising all in-school and out-school activities separately in two continuous indicators (in progress).

Methods **BCS** – cont'd

- Statistical Analysis: multivariable logistic regression models to estimate odds ratios for the association between PA in adolescence and mid-life health and PA. Individual models for each of the 5 health outcomes at age 42, stratified by sex and by in-school vs out of school.
- Adjusted for parental health, socio-economic characteristics, family structure, and age 16 physical and early-life mental health covariates.
- Missing data: addressed using Multiple Imputation with chained equations and 20 imputations.

Results **NCDS**

Association of adolescent **indoor sports** and health and exercising at age 42 and biomarkers at age 44/45 in men and women.



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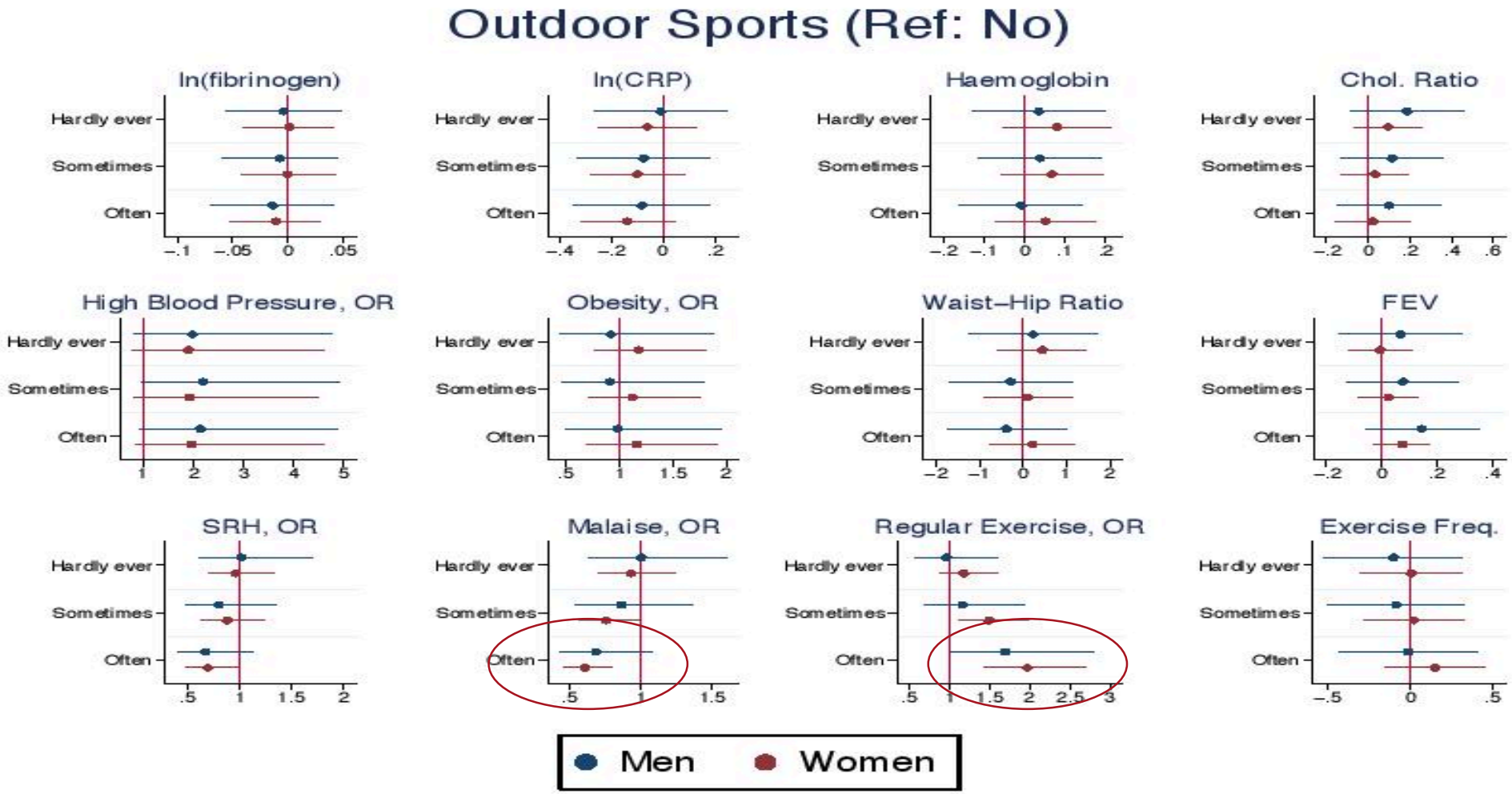
Results **NCDS**

Association of adolescent **outdoor sports** and health and exercising at age 42 and biomarkers at age 44/45 in men and women.



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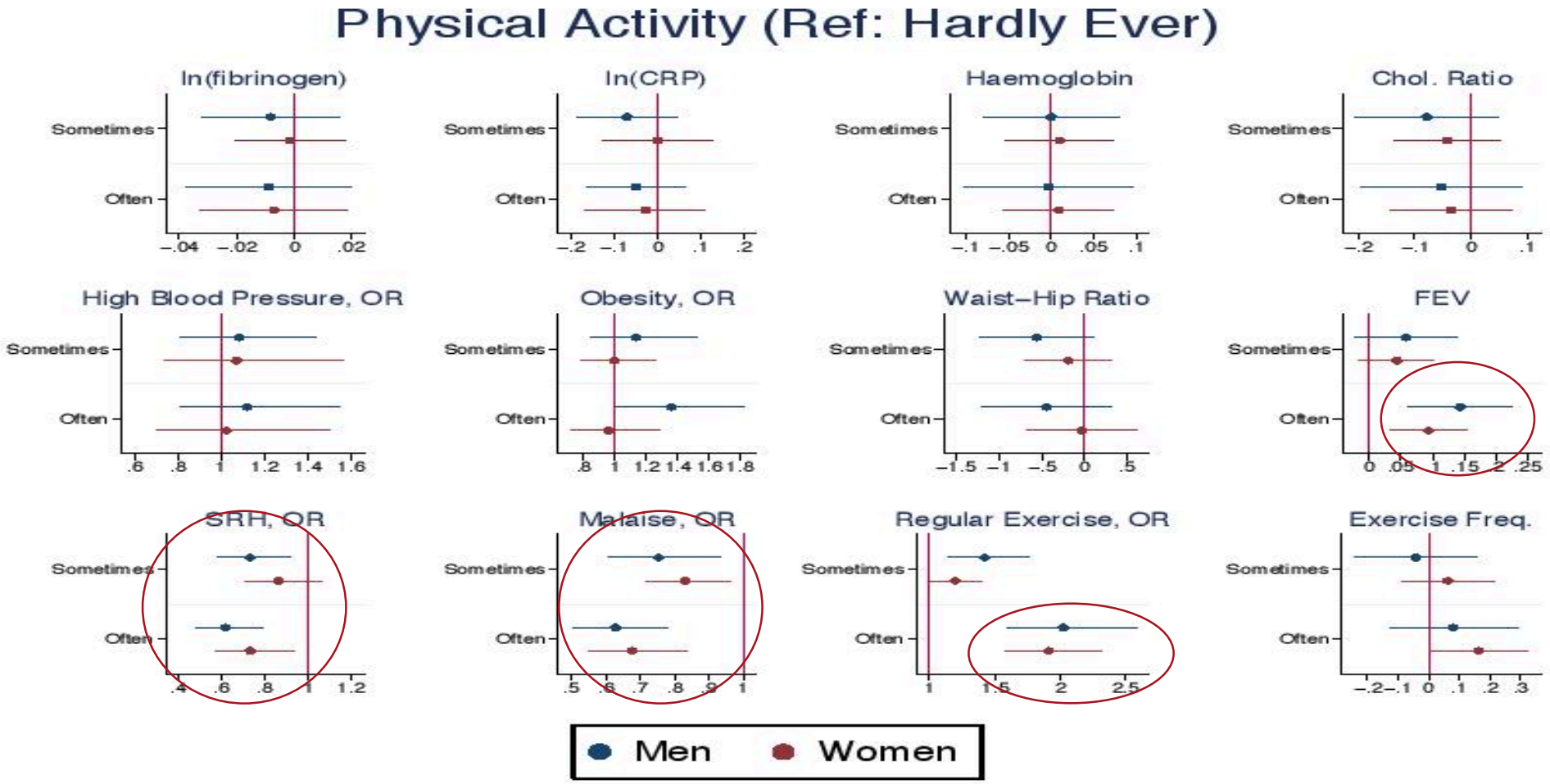
Results **NCDS**

Association of adolescent **general sport scale** and health and exercising at age 42 and biomarkers at age 44/45 in men and women.



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Results **BCS**

Latent classes of PA, by sex and in-school and out of school activity

	Males	**%**	**Females**	**%**
In school	Low	54.68	Low	37.08
			Low-medium	27.12
	Medium	44.01	Medium	29.8
	High	1.31	High	6.01
Out of school	Low	42.83	Low	57.57
	Medium	53.24	Medium	40.79
	High	3.93	High	1.64

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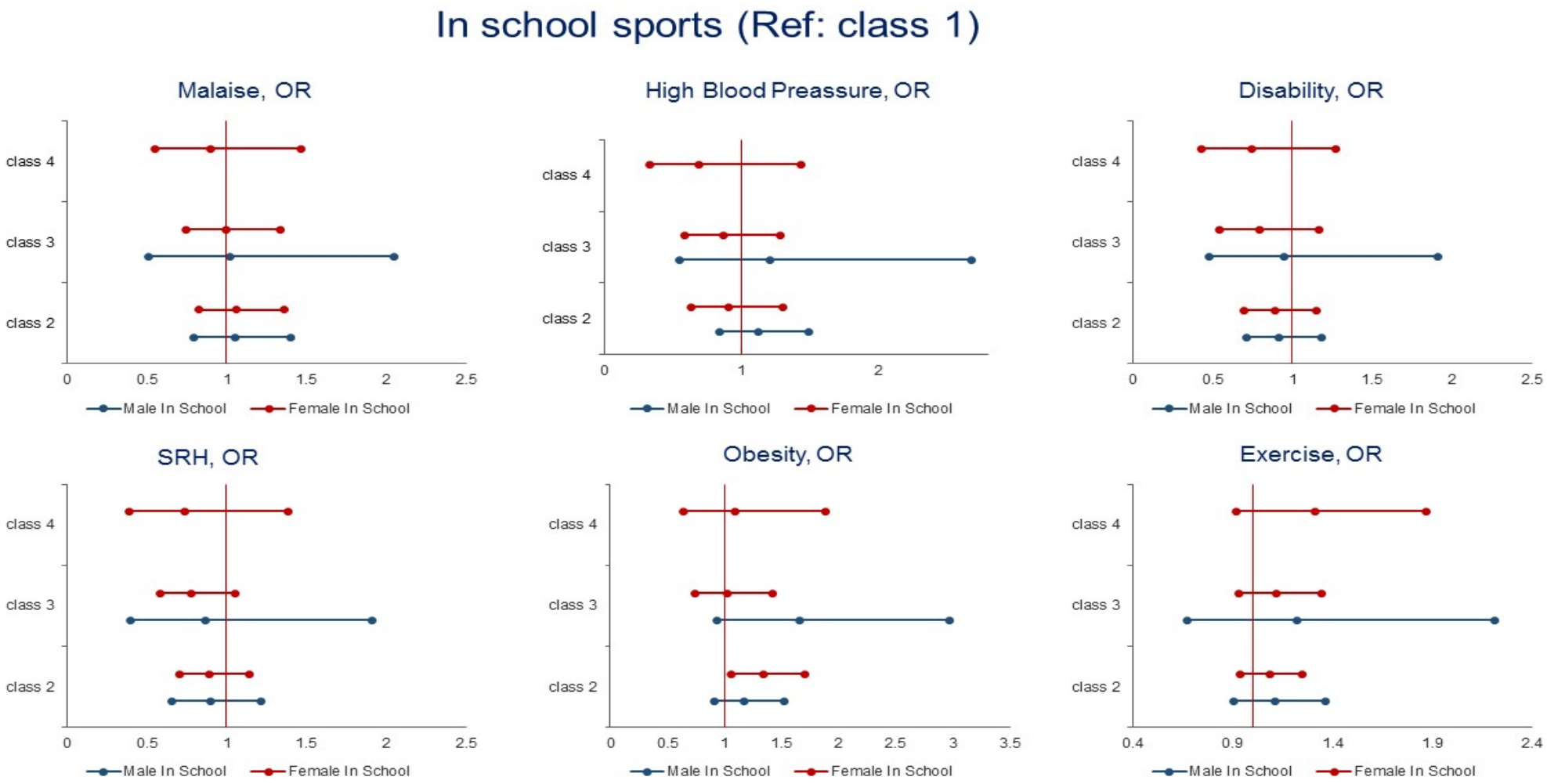
Results **BCS**

Odds Ratios and 95% CIs for the association of adolescent physical activity and health and exercising at age 42, by sex.



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Results **BCS**

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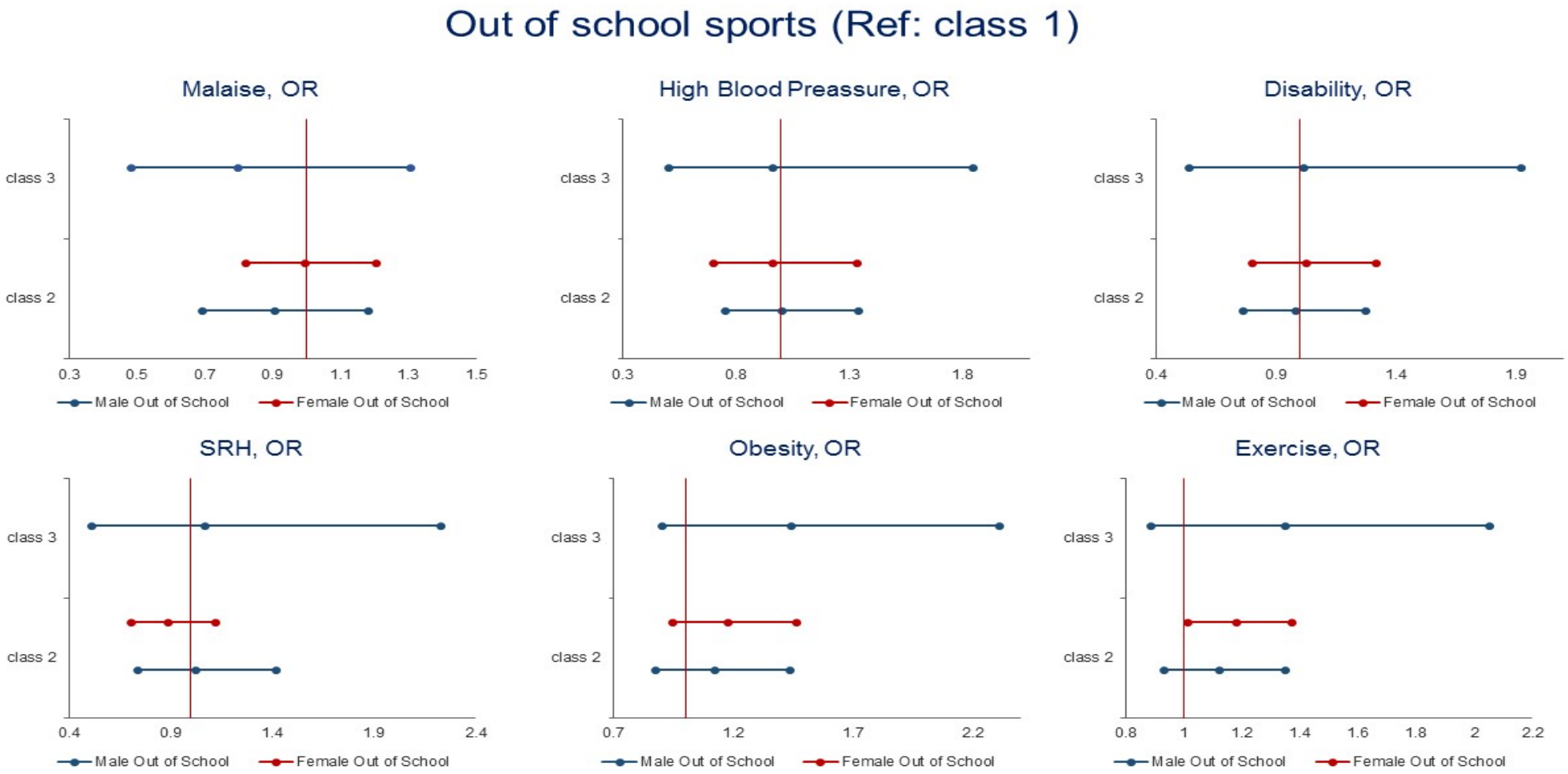

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Results BCS for association of adolescent in-school and out of school physical activities and health at age 42

- **Psychological distress:** 4 predictive activities
  badminton (+); motorcycle (-); dancing (+); waterskiing (-)
- **High Blood Pressure**: 4 predictive activities
  cricket (+); canoeing (+); roller/ice-skating (+); motorcycling (-)
- **Disability**: 3 predictive activities
  tennis (+); waterskiing (-); canoeing (+)
- **SRH**: 3 predictive activities
  snooker (+); shooting (+); fishing (+)
- **Obesity**: 4 predictive activities
  rugby (+); aerobics (-); water-skiing (-); fishing (+)
- **Physical activity**: 7 predictive activities
  hockey (+); waterskiing (+); swimming (-); badminton (-); dancing (+); canoeing (-); jogging (+)

Discussion

- 1958 cohort: most outcomes were not associated with in door activities, out door activities and a cumulative scale of physical activity in adolescence → weak evidence of association
- 1970 cohort: very few individual physical activities significantly associated with one or more health outcomes in mid-life
- Latent classes of physical activity not associated with any outcome → weak evidence of association
- Across cohorts, physical activity in adolescence appears to be weakly associated at best with health outcomes in midlife
- Policies needed to encourage continued participation in physical activity through all stages of the life course
- Are results cohort specific or generally reveal that physical activity in adolescence is not/weakly associated with mid-life health outcomes? Is this a trend in more recently born cohorts?

Limitations

- Self-report of PA (measurement error, recall bias, etc)
- Measures of PA in adolescence: no pre-determined time frame for assessing frequency of activity, no mention of intensity
- Limitations in the comparability of 1958 and 1970 cohorts due to availability of different indicators of PA, especially in adolescence

Next steps

- Additional ages – eg, cross-sectional at 16, 42y
- Sensitivity analysis for unmeasured confounders with negative controls

Thank you!

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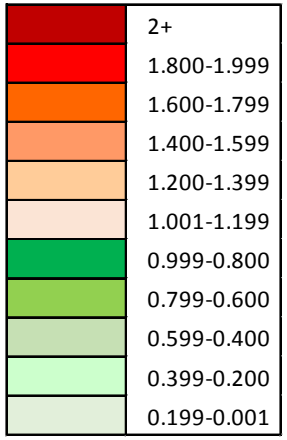
Appendix

Results **BCS**

Significant results out of 86 activities for association of adolescent **in-school** and **out of school sports** and health and exercising at age 42 in the BCS70, by sex.



Activity Variables	Psychological distress		High Blood Pressure		Disability		SRH		Obesity		Days in a Week with 30+ min of Exercise	
Male In School	**OR**	**95%**	**OR**	**95%**	**OR**	**95%**	**OR**	**95%**	**OR**	**95%**	**OR**	**95%**
Badminton	1.28	(1.014, 1.618)										
Motorcycling	0.72	(.551, .939)										
Snooker							2.34	(1.034, 5.305)				
Cricket			1.19	(1.008, 1.413)								
Hockey											1.19	(1.034, 1.373)
Male Out of School	**OR**	**95%**	**OR**	**95%**	**OR**	**95%**	**OR**	**95%**	**OR**	**95%**		
Shooting							1.27	(1.023, 1.573)				
Tennis					1.34	(1.029, 1.745)						
Rugby									1.492	(1.094, 2.035)		
Aerobics									0.528	(.307, .906)		
Water-skiing									0.846	(.736, .973)	1.14	(1.002, 1.296)
Canoeing			1.42	(1.067, 1.881)								
Roller or ice-skating			1.49	(1.012, 2.181)								
Swimming											0.8	(.668, .952)
Female In School	**OR**	**95%**	**OR**	**95%**	**OR**	**95%**	**OR**	**95%**	**OR**	**95%**		
Motorcycling			0.7	(.528, .923)								
Badminton											0.89	(.797, 1.00)
Female Out of School	**OR**	**95%**	**OR**	**95%**	**OR**	**95%**	**OR**	**95%**	**OR**	**95%**		
Dancing	1.23	(1.023, 1.486)									1.31	(1.142, 1.501)
Water-skiing	0.86	(.744, .997)			0.82	(.703, .955)						
Fishing							1.33	(1.027, 1.733)	1.183	(1.027, 1.361)		
Canoeing					1.2	(1.025, 1.392)					0.83	(.737, .936)
Jogging											1.53	(1.200, 1.960)

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ETHNIC DIFFERENCES IN EXERCISE ON REFERRAL PROGRAMME EFFICACY AND COMPLETION RATES

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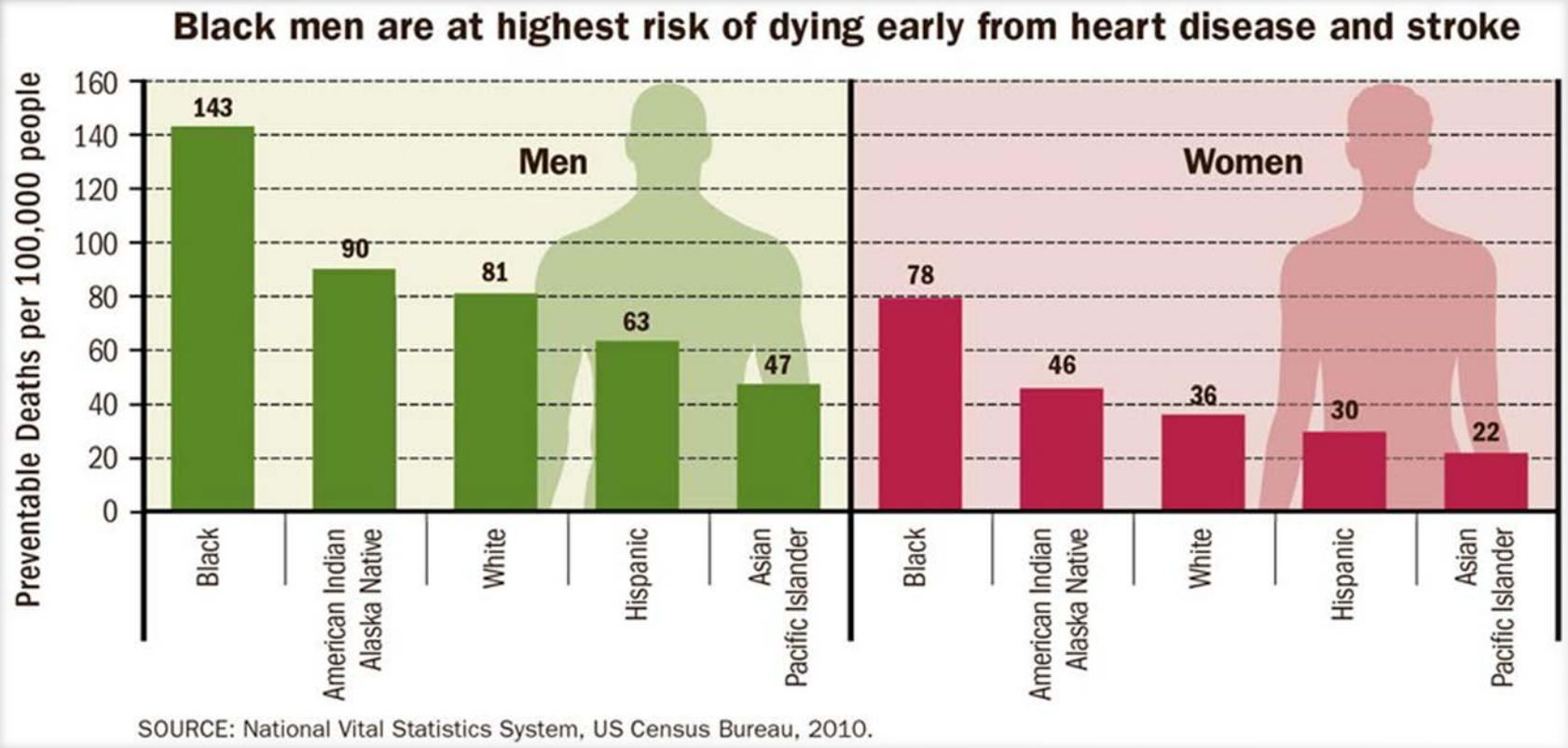
ETHNICITY AND CARDIOVASCULAR DISEASE



A high incidence of cardiovascular disease in those of African origin is somewhat attributed to proportionally lower activity levels and not solely ethnic predisposition (Koshoedo et al. 2015).

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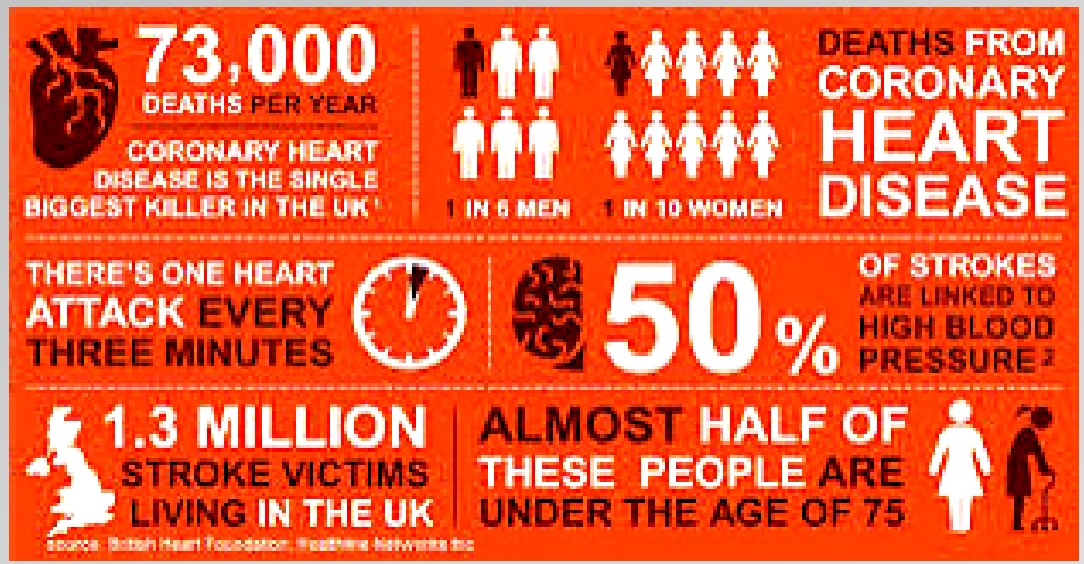
CARDIOVASCULAR DISEASE



Costs the National Health Service £6.8 billion per year

CARDIOVASCULAR DISEASE AND PHYSICAL ACTIVITY

An increase in physical activity levels is a modifiable factor known to reduce the risk of developing the disease (Thompson et al. 2003).

Achieving 150 minutes of moderate physical activity or an hour of vigorous physical activity per week confers a 30% reduction in risk (Warburton 2006).

PHYSICAL INACTIVITY

However, 39% of UK adults fail to meet current public health department guidelines (British Heart Foundation 2017).

ETHNICITY AND PHYSICAL ACTIVITY

Those of Black African origin 72-76% less likely to meet physical activity guidelines than White participants (Song et al., 2013)

Black African and Caribbean participants cultural expectations affect exercise participation (Bramble, Cornelius, & Simpson, 2009).

Lack of culturally relevant exercise opportunities, for those of black African and Caribbean origin (Koshoedo, Simkhada, & Van. Teijlingen, 2009).

Public health department initiatives are numerous.

Primary health care practitioners often refer their inactive patients to community based exercise on referral programmes.

WHAT IS EXERCISE ON REFERRAL?

Exercise on referral programmes are short behavioural change interventions that are purported to have beneficial health outcomes that contribute to a reduction in the incidence of cardiovascular disease (Isaacs et al. 2007).

- lower blood pressure, resting heart rate and body mass index
- improved mental well being

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EXERCISE ON REFERRAL PROGRAMME EFFICACY

Only effective in reducing cardiovascular disease risk if participants achieve high attendance and continue to maintain this increase in physical activity (Press, 2003).

Further study needed as to why particular groups uptake and others do not (Hanson, Allin, Ellis, & Dodd-Reynolds, 2013).

Participation confers only a small improvement in physical activity levels (Campbell et al., 2015).

A meta analysis of 444 studies found few actually report details of analyses to determine which population subgroups benefit from interventions and only four analyzed ethnic differences (Attwood, van Sluijs, & Sutton, 2016).

HEALTH LEVELS

Many referred to such programmes are new to exercise and have low health levels which may limit their achievement (Lee, Arthur, & Avis, 2008; Taylor, 2014).

Poor physical health has been found to affect self-esteem and people's ability to meet their goals, which leads to unhappiness or even depression (Elliott, I., 2016).

Participants with the least desirable starting profile for a given health outcome experienced the greatest improvement (Stewart, Dolan, Carver, & Swinton, 2017).

PHYSICAL ACTIVITY BEHAVIOUR CHANGE

Behaviour change research suggests that individuals' physical activity stage of change is related to nonparticipation (Marcus, Selby, Niaura, & Rossi, 1992).

Cultural differences influence intrinsic participation motives or goals associated with exercise, such as affiliation and social engagement which relate to long-term exercise maintenance (Ryan & Deci, 2000; Teixeira, Carraça, Markland, Silva, & Ryan, 2012).

WELLBEING LEVELS

Evidence shows people of African and Caribbean descent are disproportionately exposed to factors such as poverty, which relate to their increase likelihood of experiencing compromised well-being and poor mental health (Lambeth Black Health and Well-being Commission, 2014).

CURRENT RESEARCH

Hypothesis 1

Participation in a 12 week exercise on referral programme improves health outcomes. These health outcomes vary by ethnicity, with black participants having a poorer improvement than white participants.

Hypothesis 2

Initial levels of health, stage of change and well-being predict programme completion and ethnicity may moderate these relationships.

CURRENT RESEARCH

Hypothesis 1

Within-group IV: time (pre versus post programme participation)

Between-group IV: ethnicity (black versus white participants)

DV: health, stage of change and mental wellbeing

Hypothesis 2

IV: health, stage of change and mental wellbeing

DV: programme completion

Moderator: ethnicity

METHOD

Design & Participants

- Longitudinal
- *N* = 882 participants (Black *N* = 636 White *N* = 246)
- aged 16 or over
- referred between 2013 and 2016 to a 12-week exercise on referral programme.

MEASURES

Participants completed the following questionnaires pre and post programme:

- Single health measure (composed of waist circumference, weight and BMI)
- The Physical Activity Stage of Change questionnaire (Prochaska & DiClemente, 1986)
- The Short Warwick and Edinburgh Well-being Scale

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HYPOTHESIS 1 RESULTS

Health scores increased significantly initial score (*M* = 8.67, *SD* = 2.75), final score (*M* = 9.08, *SD* = 2.80), *F* (1,875) = 291.23, ***p* < .001**, ηp^2 = .250

Stage of changes levels increased significantly initial score (*M* = 2.82, *SD* = 1.28), final score (*M* = 3.46, *SD* = 0.85), *F* (1,897) = 179.00, ***p* < .001**, ηp^2 = .166.

Wellbeing scores increased significantly initial score (*M* = 26.02, *SD* = 5.67), final score (*M* = 28.10, *SD* = 4.90), *F* (1,859) = 160.65, ***p* < .001**, ηp^2 = .158

There was a significant main effect of ethnicity on participants' well-being scores black participants (*M* = 27.58, *SD*= 5.57), white participants (*M* = 25.80, *SD* = 8.70), *F* (1,859) = 25.44, ***p* < .001**, ηp^2 = .029.

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HYPOTHESIS 1 RESULTS

All measures improved significantly upon completion of the 12-week programme.

Black participants' initial well-being measures were higher but improved less than for white participants.

There was a greater improvement in stage of change levels for white participants than for black participants.

HYPOTHESIS 2 RESULTS

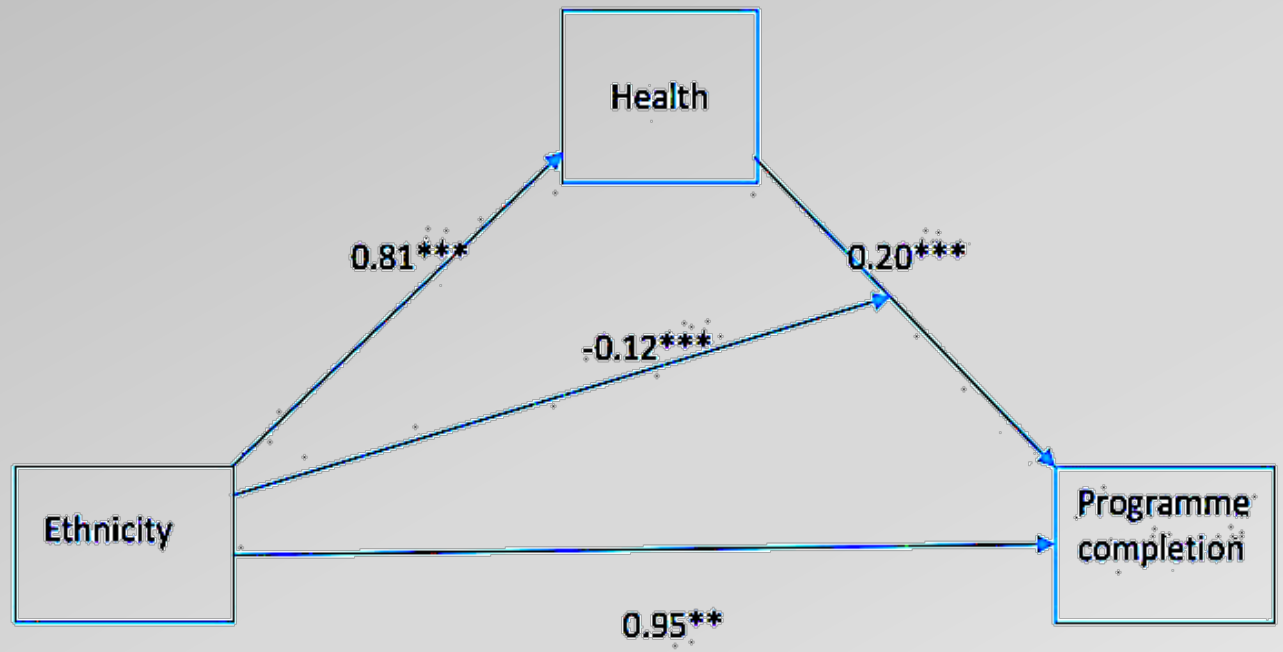
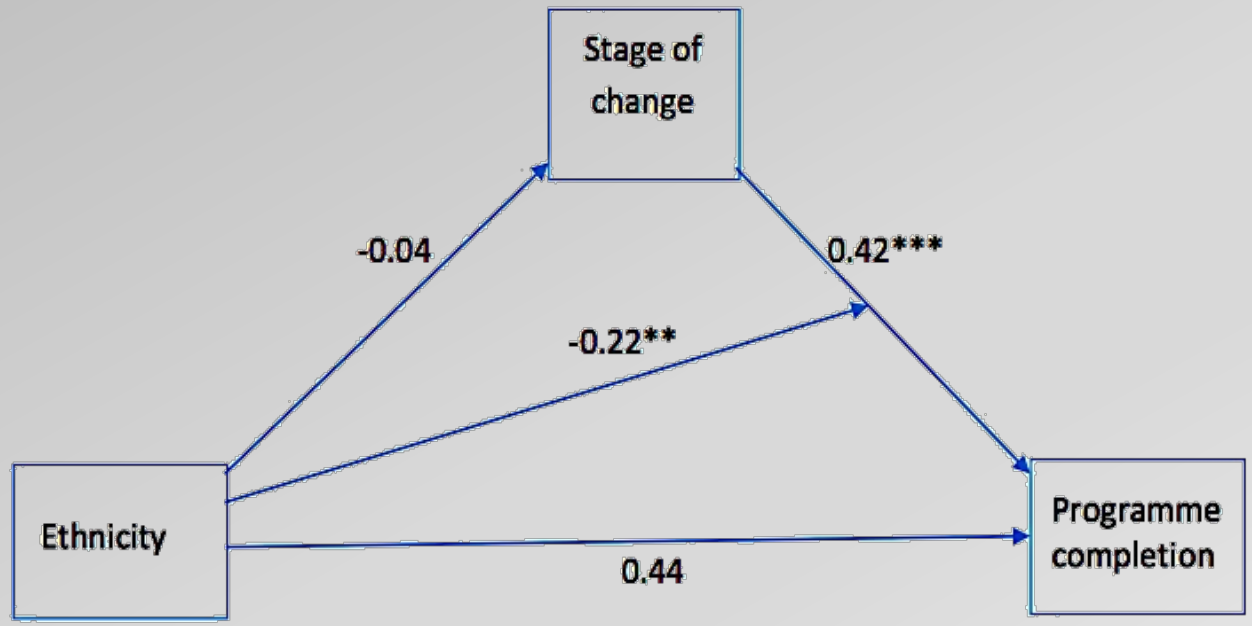


Figure 1. Moderated mediation analysis for two categories of ethnicity, health and programme completion.

Black participants b = 0.077, 95% CI [0.032, 0.123], z = 3.32, p = .0009
White participants, b = -0.047, 95% CI [-0.103, 0.11], z = -1.58, p = .114.

HYPOTHESIS 2 RESULTS



Black participants b = 0.2022, 95% CI [0.108, 0.297], z = 4.19, p < .001
White participants, b = -0.020, 95% CI [-0.156, 0.119], z = -0.29, p = .775

Figure 2. Moderated mediation analysis for two categories of ethnicity, readiness for change and programme completion.

HYPOTHESIS 2 RESULTS

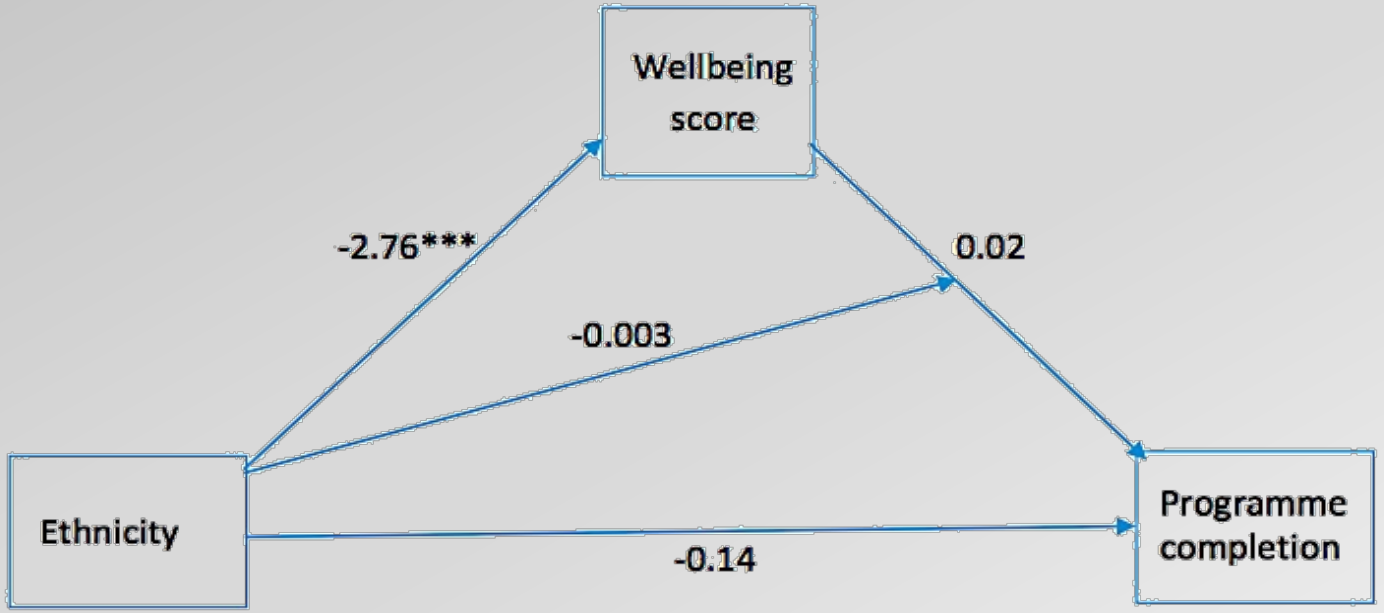


Figure 3. Moderated mediation analysis for two categories of ethnicity, wellbeing score and programme completion.

HYPOTHESIS 2 RESULTS

Completion rates significantly related to participants' initial health levels and initial stage of change, with ethnicity moderating both these relationships.

Black participants' ability to complete the programme related to their initial health levels and stage of change more so than for white participants.

DISCUSSION

Hypothesis 1

Exercise on referral programmes are successful in improving participants' levels of health, stage of change and wellbeing.

Hypothesis 2

Participants' initial health levels and stage of change affect completion of such interventions.

Black participants appear to be more sensitive to their stage of change in relation to completing exercise on referral programmes than white participants.

Further research into:

- potential predictors of black participants stage of change
- motivational impact of relevant role models

LIMITATIONS

Self report measures

- Social acceptance bias
- Reliant upon participant interpretation and understanding

Lack of control group

- Difficulty following up drop outs

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THANK YOU

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