HERU
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MODELLING THE PARTICIPATION DECISION AND DURATION OF SPORTING ACTIVITY IN SCOTLAND

Background

Motivating individuals to engage in physical activity due to its beneficial health effects has been an integral part of Scotland's health policy agenda. The current Scottish physical activity guideline recommends that individuals participate in physical activity of moderate vigour for a total of 30 minutes at least five times per week. For an individual contemplating the recommendation, decisions have to be made in regard to (i) whether to participate in physical activity, and if so (ii) with what intensity, (iii) for how long, and (iv) how often. For the policy maker, understanding the factors influencing each decision will assist in designing interventions to achieve the recommendation. This is the focus of analysis. Whilst physical activities can be carried out during work, home, and leisure time, we focus on sporting activities undertaken during leisure time.

KEY MESSAGES

1. Time and financial constraints are significant barriers to sports participation
2. Sports participation has a reducing effect on BMI
3. Sport undertaken with high vigour has an additional reducing effect on BMI

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Data

Data were taken from the 2003 Scottish Health Survey. The estimation sample comprises 4,380 adults aged between 16 and 64 years with a Body Mass Index (BMI) between 20 and 40, of whom 2,327 report that they have engaged in sporting activities during the four week period prior to interview. These data are summarised in terms of the Scottish policy recommendation components: total time involvement, number of events, and the intensity at which sporting activities were undertaken (for details see [1]).

Methods

We model jointly the likelihood to participate in sporting activity and, contingent upon participation, sporting activity duration lengths (details of the econometric methods used can be found in [1, 2]). We control for intensity and frequency, alongside other factors including demographic, economic, lifestyle and health-related determinants. Predictions generated from the model are subsequently used in conjunction with regression analysis to compare the effect of interventions designed to increase the vigour with which individuals undertake sport, relating it to BMI as a health indicator.

Results

Main analysis of participation and duration

Table 1 summarises the main results for the joint model of participation and duration. The significant θ value confirms that participation and duration should be modelled jointly. The Kendall τ statistic indicates a positive association; the stronger the propensity to participate in sports, the longer sporting duration.

The results suggest sports participation significantly reduces with increasing age; as does duration length. Men are more likely to participate relative to women and have longer sporting durations. Household characteristics, such as the presence of infants, impact negatively on sports participation and duration length. Married individuals are less likely to participate relative to non-married individuals and, conditional on participation, have shorter duration compared to singles. Both of these factors may point to time constraints arising from the competing demands of family life. Low income is shown to be a significant barrier to sports participation in the sample whilst

Table 1 Main results

	Participation		Duration	
Constant	3.277		1.325	**
Gender (male = 1)	0.200	**	0.172	**
Age 16 to 24	0.697	**	0.203	**
Age 25 to 34	0.491	**	0.187	**
Age 35 to 44	0.352	**	0.134	*
Age 45 to 54	0.096		0.133	**
Ln equivalised household income	0.107	**		
Single	0.238	**	0.175	**
Divorced/Separated/Widowed	0.122	*	-0.116	**
No. children aged 2-15	0.042		-0.029	
No. children under age 2	-0.223	**	-0.285	**
Natural mother alive	0.102	*	0.038	
Hours watching TV per week	-0.037	**	-0.019	**
Car available in household	0.015			
No education	-0.325	**		
Retired	0.234	*	-0.024	
Unemployed	0.185	*	0.073	
Economically inactive	-0.050		-0.040	
General health: Very good	0.608	**	0.550	**
Good	0.459	**	0.433	**
Fair	0.240	*	0.359	**
Psychological wellbeing:				
Good	-0.009			
Fair	0.164	**		
missing	-0.252	*		
Longstand ingillness:				
Limiting			-0.098	**
Non-limiting			0.020	
Accident	0.058	*		
Health Board average hours physical activity	0.309	**		
Health Board average BMI	-0.226	**		
Smoker	-0.155	**	-0.076	*
Ex-smoker	0.094	*	0.066	*
Regular under limit drinker	0.142	**	0.034	
Regular over limit drinker	0.150	**	0.046	
Healthy diet score	0.028	**	0.002	
Moderate vigour			-0.861	**
High vigour			-0.710	**
Gamma shape			0.218	**
Copula θ			5.597	**
logL		-9155.25		
Kendall τ			0.492	**

Notes: Significance from zero at the 5% level is indicated by *, and at the 1% level by **.
Units of measure: hours over a 4 week period.

higher educated individuals have a greater propensity to participate in sports. This may be due in part to the more educated being better aware of the beneficial health effects of sports participation relative to the uneducated. The employed are less likely to participate in sports relative to the retired and unemployed implying that time constraints may pose a significant deterrent to participation. Lifestyle factors significantly affect participation and duration. Smoking has the anticipated negative effect on both, while higher levels of alcohol consumption have an increasing effect. This latter result refutes the belief that individuals consuming high levels of alcohol do not invest in their health. The result may be interpreted as sports encouraging social networks, especially team sports, or that an unhealthy behaviour may be compensated for by vigorously pursuing another healthy behaviour. A healthy diet score significantly increases the likelihood of participation in sports but has no significant impact on duration. Hours watching television impacts negatively on sports participation and, conditional on participation, duration length. Neighbourhood effects, proxied by the average hours of sporting activity and average BMI in the health board the respondent lives in, reveal active and healthy neighbourhoods to have positive participation and duration effects. As expected, individuals in good health are more likely to participate in sport activities of higher duration length, with the effect diminishing as general health declines. Finally, individuals undertaking sports with low vigour have higher duration length relative to those exercising with moderate or high vigour. This is expected as moderate and vigorous activity also implies that 'burn out' sets in after a shorter period of time.

Aspects of the guideline are assessed by examining the implications on durations resulting from shifting participants from low to higher degrees of vigour associated with their sporting activity. For example, the model predicts durations for low vigour of 2.5, for moderate vigour of 1.0 and for high vigour of 1.2 hours per week for a male aged between 35 and 44, married with no children and in very good health undertaking one sporting event per week. For participants the increase in vigour from low to higher degrees of vigour results in a decrease in sporting duration, bringing this representative individual below the recommended duration per week. Hence, the example shows large trade-offs between duration and increases in vigour. In this case, the individual would need to be motivated to bolster the number of events undertaken to maintain the recommendation.

Table 2 BMI regression

	Coefficient Estimate	Std. Error
Constant	29.682	(0.803)***
Gender (male=1)	0.364	(0.127)***
Age 16-24	-2.930	(0.257)***
Age 25-34	-1.625	(0.212)***
Age 35-44	-1.017	(0.184)***
Age 45-54	-0.575	(0.183)***
Ln equivalised household income	-0.058	(0.078)
Ex-smoker	0.313	(0.156)**
Smoker	-0.829	(0.154)***
Regular drinker, over limit	-0.134	(0.172)
Regular drinker, under limit	-0.664	(0.149)***
Healthy diet score	-0.024	(0.014)*
Participation indicator	-0.516	(0.144)***
Weekly duration in hours at low vigour	0.101	(0.035)***
Weekly duration in hours at moderate vigour	-0.035	(0.055)
Weekly duration in hours at high vigour	-0.075	(0.025)***
Observations	4,380	
R^2	0.07	

Note: Significance from zero at the 10% level is indicated by *, at the 5% level by **, and at the 1% level by ***.

Investigating the impact of physical activity guidelines
Predictions generated from the main model can be used as inputs into a standard linear regression model with body mass index (BMI) as the dependent variable. The estimated BMI model is presented in table 2.

Undertaking sport (participation indicator = 1) significantly decreases BMI on average by 0.516 units relative to non-participants. Looking at the three interactions between weekly duration and the three types of vigour in isolation of the other variables in the model reveals that time spent at moderate vigour does not significantly affect BMI, suggesting that BMI is maintained irrespective of the time spent on sport. The other interaction terms do have significant effects but are of opposite sign. An additional hour spent on sport of high vigour significantly reduces BMI on average by 0.075 units while an additional hour spent at low vigour significantly increases BMI on average by 0.101 units, thereby lending support to the guidelines aiming to motivate individuals to exercise more vigorously. According to the model in table 2, the

combined effect of participation and an additional hour spent at high vigour results in a drop in BMI of 0.591 units, further accentuating the health benefits from participation.

Continuing with the earlier example concerning a male aged between 35 and 44, married with no children and in very good health undertaking one sporting event per week, we can assess the change in BMI from shifting the individual from low to moderate and high vigour by substituting the associated predicted durations into the BMI model. At 2.5 hours at low vigour the BMI model predicts a BMI of 28.77, at 1 hour of moderate vigour a BMI of 28.48 and at 1.2 hours of high vigour a BMI of 28.42. However, the drop in BMI when shifting the individual from low to higher degrees of vigour is small. This reinforces the trade-offs between vigour and duration. Additional benefits in terms of a significant change BMI are achievable through increased duration length at high vigour or bolstering the number of events per week.

Discussion

We examined the link between sporting participation and duration motivated by the premise that the two components cannot be studied independently of one another. The findings provide significant evidence that the two components are associated with the direction of the association being positive. The results reveal participation and duration to be significantly affected by age, gender, economic, household and lifestyle characteristics. The analysis further finds significant health improvements in terms of BMI from sports participation and sports performed at a high degree of vigour. From a policy point of view this suggests that encouraging participation in sports should take first priority. Barriers to participation have been found to relate to income and time constraints. Low household income was revealed to significantly reduce participation whilst those in employment are less likely to participate relative to those retired or unemployed. This may reflect the higher opportunity cost of time of individuals in employment. Being married as well as the presence of infants also impacts negatively on participation which may be reflective of the competing demands of family commitments. Policies directed at inducing sports participation should therefore aim to reduce the financial inaccessibility of sports to low income earners and address how time constraints may be overcome. Second, policies should also reflect the additional health benefits from exercising vigorously.

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