Demand for sports and exercise: results from a pilot study

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Abstract

Aim: To investigate how the demand for sports and exercise is influenced by costs and perceived benefits.
Methods: An illustrative face-to-face interview survey was conducted in 2008 using a purposive sample of 60 adults at Brunel University, West London. The interview covered: indicators of sports ad exercise behaviour; money and time costs, and perceived benefits of participation; and socio-economic and demographic details. Descriptive analyses provide mean (SD) and median (IQR) for total costs and individual costs components associated with participation in sports and exercise. Count, linear, and probit regression models were fitted respectively to determine how time and money costs, as well as perceived benefits explain different specifications of sports and exercise behaviour including number of days, total time spent, and meeting the recommended level of participation or not; controlling for socio-economic and demographic variables. *Results:* 78% of the sample participated in physical activity, and spent an average of £27.41 per month and an average of 19.8 minutes travelling, per occasion of sports and exercise per month. Time and money costs per occasion of participation in physical activity were negatively associated with sports and exercise behaviour, and this is mitigated where the perceived benefits of sports and exercise are high. The demand was price inelastic except at the point of meeting the recommended level of participation, which was highly responsive (2.2) to changes in time price. *Discussion:* The discussion considers: the case for data from a larger nationally representative sample; and the role of economic incentives in promoting uptake of sports and exercise.

Keywords: public health, sports and exercise, demand

Physical inactivity is a major public health concern in England as it is associated with about 20 health conditions including coronary heart disease, cancer, diabetes, and stroke (1-4) and rated among the top ten leading causes of death in 'high income countries'(5). Only 40% of men and 28% of women in England are physically active, i.e. they participate in physical activity of either moderate intensity for a minimum of 30 minutes on five days each week or vigorous intensity for a minimum of 20 minutes on three days each week (6). Physical activity is multi-faceted and encompasses any energy expenditure resulting from skeletal movements and thus includes a wide range of activities such as sports and exercise, housework, as well as occupational activity (7). This study, however, focuses on the sports and exercise component of physical activity, as it

represents a planned aspect often aimed at attaining health benefits (8) and as such can be relatively easily targeted by policies to improve uptake rates. Also, it reduces measurement errors since sports and exercise activities are usually conducted in a premeditated mode and hence are easier to recall by respondents (9).

The target set out in 2002 by the Cabinet Office Strategy Unit, outlined: the 'Game Plan' strategy to increase adult physical activity participation in England from 32% to 50% in 2010, and up to 70% in 2020; and the 'Legacy Action Plan' to make the UK a 'world leading sporting nation' by helping 'at least two million *more people* in England be more active by 2012' (1). As "Choosing activity: a physical activity action plan" (4) points out, the key challenge facing efforts to increase physical activity across populations is "to encourage *more people* to become *more active*" (our italics). Therefore policy aims at increasing activity not only among the inactive but also among those who are active but who do not participate sufficiently often or with sufficient intensity to increase their activity.

To achieve government targets we need to understand determinants of physical activity participation in order to identify target areas for policy. The challenge that public health practitioners face in securing adherence to physical activity guidelines might be attributed partially to inadequate understanding of the economic factors influencing the degree to which an individual participates and is willing to change their behaviour (10-12). Economics can play a key role in developing our understanding of preferences of individuals, as it examines how scarce resources of time and money are traded off by individuals (13,14). Individuals are the 'best judges' of their welfare and hence efforts to improve lifestyle behaviour must incorporate individual interests in order to be effective (15).

The available theoretical and empirical literature on the economics of participation in sports and exercise suggest the need to account for costs (i.e. time and money costs) and perceived benefits among other factors in explaining such behaviour (11,12,16). To date, there is a paucity of studies looking at this issue particularly from an economic perspective, mainly due to the lack of such

data (17). A few studies (11,12,16) have explored effects of costs but only partially, with attempts limited to either assessing the impact of time costs only, using proxies to capture the opportunity cost of time (11,12) or money cost via the reduction in admission charges to exercise referral programs (18). To the best of our knowledge, no study has collected and analysed data on both costs and perceived benefits of sports and exercise participation.

The overall aim of this study is therefore to investigate how demand for sports and exercise is influenced by costs and perceived benefits. The objectives are two fold: (a) to estimate how much it costs people to do physical activity, and describe what the sources of cost are and (b) to assess the impact of cost and perceived benefits on physical activity behaviour given participation. The paper intends to inform the current policy of making people sufficiently active.

2 Methods

2.1 Theoretical framework

This study adopts a utility framework, which accounts for both costs and perceived benefits, to study demand for sports and exercise. Within a rational decision making framework, individuals seek to maximise utility, which is derived from their preference for sports and exercise and other goods, subject to budget and time constraints. Optimal quantity of sports and exercise is attained when the perceived benefits of participating in sports and exercise equals the costs of participation. Hence, participation in sports and exercise is determined by, inter alia, associated costs and perceived benefits; increasing the perceived benefits or decreasing costs (holding each other and other things constant) would encourage sports and exercise behaviour (11,19). This framework, whose operationalisation was also informed by knowledge from psychological models, for the specification of perceived benefits, was identified as the most suitable for explaining sports and exercise behaviour (20).

2.2 Data

Data were collected for analysis from an illustrative face-to-face interview survey conducted in November-December 2008 using a purposive sample of 60

staff and students of Brunel University in West London. Respondents were recruited via emails asking them to participate in this survey that were sent, on the authors' behalf, by managers of the schools in the university. There were 63 returns of which 60 individuals were interviewed.

A questionnaire was developed to capture both costs and perceived benefits of sports and exercise based on literature reviews. The interview schedule covered: indicators of sports and exercise behaviour; money and time costs, and perceived benefits of participation; and socio-economic and demographic details. Indicators of sports and exercise captured the level of participation in those activities during the four weeks prior to survey date. Money costs covered fixed cost (membership fees; joining fees; purchase of apparel, equipment, nutritional supplements; maintenance cost of equipment; insurance premiums; cost of medical care) and variable cost components (entrance, class, competition charges; costs of refreshment, equipment hire, and transport ticket). Time cost was captured as travel time (mins.) to do sports and exercise. The questions asked provided data on costs per unit of activity as well as total costs of participation during the past four weeks. Perceived benefits of sports and exercise were measured by asking respondents to score each item on a list of 13 benefits (Box 1) from 1 to 5 (1=not at all; 5=great deal) with 6 as 'don't know'. The scores were to reflect how much the person thinks sports and exercise could help him/her achieve the 13 items respectively. In addition, the relative importance placed on perceived benefits was measured by asking respondents to score the same 13 benefits to reflect their own views of importance.

The range of socio-demographic and economic variables collected included those that in previous research had been shown to correlate with sports and exercise: gender (11,16,21-26), age (16,18,24,25,27-31) income (12,21,22,24,25,30), educational qualification (16,24,25,27,28,30), employment status (12,21,22,25), working hours (16,24,30,30) and household characteristics such as number of children in the household (12,24,25,30) and number of adults in the household (24,30).

To ensure valid and reliable data, questions that had been developed and administered in UK were used in the interviews. For example, questions on indicators of sports and exercise were taken from the Health Survey for England (2006) while those on perceived benefits of sports and exercise participation (and importance placed on them) and were taken from the Health Education Authority Survey of Activity & Health (1991). The questions on money and time costs of sports and exercise participation were developed and pre-tested using standard techniques such as expert evaluation, cognitive interviews, and respondent debriefing to assess their validity and reliability.

2.3 Methods of analysis

2.3.1 Descriptive analysis

Descriptive statistics provided means and median (inter quartile ranges- IQR) of continuous data such as costs, age, frequency and duration of participation in sports and exercise, working hours, and number of children or adults in the household. For ordinal data such as perceived benefits, only median (IQR) was provided while proportions were provided for nominal or binary data like participation or not, meeting the recommended level of participation, educational qualification, income, employment status, gender and completion rate for survey.

2.3.2 Regression models

Count, linear, and probit regression models were fitted for number of days, total time spent, and meeting the recommended level of participation or not, respectively. Negbin variant of count models were used as the estimated alpha parameters were greater than zero (0.185; 0.075) and highly significant ($p<0.001$; $p=0.003$); and, both dependent variables had low zero observations. The observed data for the 'level of sports and exercise participation, given participation' may not have been random since it is conditioned on the participation in sports and exercise. A sample selection bias was therefore likely but could not be accounted for given the small number of observations.

Demand curves, which show the relationship between time price, money variable price (unit costs) and the quantity demanded of sports and exercise correspondingly, were constructed based on the predicted quantities demanded at

different prices, *ceteris paribus*. Such predictions were based on the most appropriate models that passed all diagnostic tests as described below.

Model diagnostics covered testing specification errors and goodness of fit using the linktest and Hosmer Lemeshow test respectively. The validity of the assumptions of OLS model was examined with Breusch-Pagan/Cook-Weisberg test for heteroskedasticity and Shapiro-Francia test for normality (32). In addition, the collinearity of independent variables was assessed to ascertain whether they lie within tolerance ranges (33,34). Marginal effects were computed for each independent variable. Emphasis is placed on reduced models in presenting regression estimates because they showed better specification and fit and results were similar to base models. Statistical significant levels were set to 10%, and all statistical analyses were conducted using Stata version 10.

The simulations based on model coefficients provided an opportunity to investigate a potential mitigating effect of perceived benefits on the relationship between costs and sports and exercise behaviour. This was explored by investigating the number of days doing sports and exercise, given participation, when cost increases but perceived benefit is constant and low, compared with when both cost and perceived benefit increases. To do this, the following steps were undertaken. First, three differing scenarios were assumed based on potential variant interactions between cost and perceived benefit. The scenarios were created for when cost is specified as variable cost or as travel time given that these variables could best exemplify the offsetting effect of costs: (a) Scenario 1: if cost is low (based on median value) and perceived benefit is also low (b) Scenario 2: if cost is high but perceived benefit is low (c) Scenario 3: if cost is high and perceived benefit is also high. Second, number of days doing sports and exercise given participation, was predicted for these scenarios based on regression estimates. Third, averages were calculated for the predicted events and compared. Using scenario 1 as the comparator, the average number of days doing sports and exercise predicted for scenario 2 and 3 were compared respectively with the former.

2.3.3 Dependent variables

Indicators of sports and exercise participation were characterised in five ways: (a) participation or not (binary); (b) number of days doing sports and exercise (count); (c) total amount of time spent doing sports and exercise (continous); (d) meeting the recommended level of sports and exercise participation (done sports and exercise of vigorous intensity for a minimum of 20 minutes on 3 days) or not (binary); and (d) number of days doing vigorous sports and exercise at recommended duration (each day of activity lasting for at least 20 minutes) (binary).

2.3.4 Independent variables

Costs

Given the low sample size, individual unit cost variables were collapsed into 3 variables, in line with the literature (11,12,17,35): fixed money cost, variable money cost and travel time; with each specified as average cost per sport.

Perceived benefits

For perceived benefits, only the significant ones from bivariate analysis (used Kendall rank correlation test, and Mann Whitney U test) involving the dependent variables were selected. In addition, the equivalent 'relative importance placed on perceived benefit' variables of the significant perceived benefits were included in the regression models. Given the small number of observations, the perceived benefits and 'relative importance placed on perceived benefits' were each collapsed into binary that takes the value of one if the observed score lies between 3 and 5 but zero otherwise.

Control variables

Similar to the perceived benefits, only significant control variables via the bivariate analysis (used Kendall rank correlation test, t-test, Mann Whitney U test, Pearson correlation test, chi-squared test and Fischer exact test – depending on nature of variables) were included in the regression models. Income was however an exception given its theoretical importance to demand analysis and hence it was included in the regression models regardless of the significance (or not) of the bivariate analysis.

3 Results

3.1 Description of sample

Sixty-three individuals expressed interest to participate in the survey but 60 people were finally interviewed due to time constraints. Hundred percent completion rate of survey was recorded with no missing observations. The sample was predominately highly educated with 75% (n=45) having degree level qualifications and the remaining 15% holding either 'A' or 'O' level qualification. Of the sample, 60% (n=36) were male. The mean age of the sample was 27.2 years, half were employed and the majority (72%; n=43) had a personal net income ranging between £400 and £2899 per month. For detailed descriptive statistics of the sample, see Table 1.

3.2 Descriptive statistics of dependent variables

Most respondents (78.3%; n=47) participated in some sports and exercise, as shown in Table 2. Those people tended to be older (mean age: 29.8), more likely to be female (61.5%) or employed (53.9%) but likely to undertake paid work for fewer hours (average of 19.7 hours per week). These differences though were not statistically significant except for gender. Given participation in sports and exercise, 34% met the recommended level of sports and exercise participation for vigorous activity. On average, given participation in any sports and exercise, people exercised on 11 days during the past four weeks but exercised vigorously at the recommended duration on 9.3 days during that same period. An average of 6923 minutes (11.5 hours) were spent doing any sports and exercise given participation during the last 4 weeks prior to the survey date (Table 2). Half of the respondents, who exercised, spent 8 hours doing sports and exercise with one spending 56 hours while five spent an hour. Half of those, who exercised, did so on 11 days but vigorously (at the recommended duration) on 8 days.

3.3 Observed costs

Table 3 provides a summary of the money costs (in 2008 £ sterling) related to sports and exercise participation, given participation. Individuals spent £27.41 related to sports and exercise participation on average, and the median amount spent was £19.50. The maximum amount spent on sports and exercise

participation during the last four weeks was £84.40 (n=1) while the minimum was zero (n=6). Of the average total amount spent on sports and exercise participation, £21 was spent on fixed costs. On average, membership fees contributed most to total spending (£9), followed by entrance charges (£4.83). Hiring sports equipment contributed least to total spending (£0.03). Consideration of median values did not change findings. Regarding travel time, people spent an average of 19.8 minutes travelling back and forth per occasion of sports and exercise participation, with half spending 14 minutes and one person spending one and half hours.

3.4 Observed perceived benefits

The median score for the entire list of 13 items of perceived benefits was greater than 2 indicating that the respondents would expect all these benefits from sports and exercise participation. 'To stay in good shape physically', and 'to improve or maintain your health' were the most expected (median (IQR):5(4, 5)), and 'to feel independent' the least (median (IQR): 3(1.5, 4)). All the 13 item 'relative importance on perceived benefits' also had median scores greater than 2.

3.5 Findings from regression models

Effects of costs

The demand for sports and exercise decreases with increases in time (time cost) and money price (variable cost), but less than proportionately. For example, at the mean time price of 19.8 minutes, a 10% percent increase in time price is associated with individuals reducing the time and days spent doing sports and exercise by 6.4% and 4.7% correspondingly (all things being equal) (see Table 4). Increases in time price also led individuals to decrease the number of days spent doing vigorous sports and exercise by 3.6% but they were more than ten percent (20.2%) less likely to meet the recommended level. For money (variable) price, a 10% percent rise led to a 2.4% reduction in number of days doing sports and exercise. Figures 1-2 show the demand curves, which demonstrate a negative relationship between price and sports and exercise ceteris paribus, with the steepness of these curves reflecting price inelastic demand. For example, if average money price increases from £1.90 to £2.10 (10% rise), the number of days doing sports and exercise decreased from 9 to 8.8 (2.5% fall).

In terms of fixed costs, a ten percent increase resulted in 3% rise in the time spent doing sports and exercise, and 2% increase in the number of days doing vigorous sports and exercise (Table 4). Individuals were also 10.1% more likely to meet the recommended level of participation given a ten percent increase in fixed cost.

Effects of perceived benefits

Only 'to relax, forget about your cares' and 'to look good' were found to have a statistically significant correlation with sports and exercise behaviour; as expected it was positive. Individuals who had high awareness that sports and exercise could help them 'relax and forget about their cares' did more than 3 additional days of sports and exercise than those who had lower awareness (all things being constant). People with higher awareness about 'to look good' did more than 6 extra days of vigorous sports and exercise.

Mitigating effect of perceived benefit

Perceived benefit attenuates the relationship between cost (either as variable cost or travel time) and sports and exercise participation. As expected, the change in the number of days doing sports and exercise when cost increases, is negative and observed either way: when perceived benefit is constant and low or when it increases. However, the negative effect of an increase in cost on sports and exercise participation is lesser when perceived benefit increases, compared with when is constant and low. Figure 3 present the average number of days doing sports and exercise per scenario.

As shown in Figure 3, when variable cost increased but perceived benefit was constant (i.e. high cost low PB vs. low cost low PB), as represented by the middle bar vs. the first bar (bars in check), the decrement in average number of days doing sports and exercise was from 9.7 to 2.1 days. This implies an absolute difference of -7.6 (represented by the first plain bar). On the other hand, when both cost and perceived benefit increased (i.e. high cost high PB vs. low cost low PB), middle bar vs. the last bar (bars in check), the decrement in average number of days doing sports and exercise was from 9.7 to 9.5 days, indicating a lower absolute difference of -0.2 (shown by second plain bar). A similar trend emerges

when cost is specified as travel time, with increases in cost and perceived benefits (i.e. high cost high PB vs. low cost low PB) showing a lower absolute difference (-6 days) than when cost increases but perceived benefit remains constant (i.e. high cost low PB vs. low cost low PB) (-2.4 days).

Control variables

Income had a positive influence on demand for sports and exercise as 'high income earners' (between £830 and £2899 personal income) did 2 more days of sports and exercise compared with 'low income earners' (below £829 personal income). Older Age was negatively correlated (ME=-0.54) with number of days one did sports and exercise. People who expected extra benefits from participation in sports and exercise did 3 more days of sports and exercise compared with those who did not. Males also spent more 4 more days doing vigorous sports and exercise than females.

4 Discussion

The results suggest that if we were to reduce the time and money price (cost per occasion of participation) of sports and exercise, we could increase demand. Price elasticity for the variants of demand was inelastic except for the meeting of the recommended level of participation, which was highly responsive to changes in time price. This may be expected given that time requirement for the latter is higher as it does not just involve increasing either duration or frequency of participation but a combination of both. Perceived benefits also play an important role as having higher awareness about these benefits promotes participation in sports and exercise, and also mitigates the relationship between uptake and costs. These findings whose robustness could be attributed to their consistency across variant models of demand support the predications of the theoretical framework underlying the empirical research.

Interestingly, the negative relationship between money price (cost per occasion of participation) and sports and exercise appear statistically significant only for 'number of days' of participation and not the other indicators of uptake. A plausible explanation is the offsetting responsiveness of frequency of

participation and the duration per occasion of participation to changes in money price. Though money price is inversely related to the frequency of participation, it is positively related (elasticity=0.43; $p > 0.05$) to the duration per occasion of participation. Still, the total effect of price increases on sports and exercise emerges as negative because the negative impact response of frequency of participation overpowers the positive response of duration per occasion. For example, while a 10% increase in price, from £1.90 to £2.10 leads to a 2.5% fall in number of days (9 to 8.8), it results in a lesser increase in average time spent per occasion, 0.3% (from 3.98 to 3.99 mins).

These findings, however, needs to be treated with caution for two reasons. First, the small sample size and the bias with respect to some control variables in the analyses may have affected the precision of estimates (36). However, this was an exploratory study with limited resources and therefore we recommend that future studies should address these issues adequately. Second, not accounting for selection bias could have led to biased estimates because the observed sample (participants in sports and exercise) may have been systematically different from the unobserved (non-participants in sports and exercise). Still, some confidence could be drawn from the findings because the characteristics of both samples were generally found not to be significantly different. This, however, is not evidence of similarities between the two groups just that the sample used in this study did not show any differences. Even so, if such differences exist, the sample size may not have been large enough to detect them, and hence future studies using a larger sample may provide definitive results on existence (or not) of sample selection bias.

The relationship between the findings and those of previous research is mixed. In terms of perceived benefits, both sets of results point to a positive impact on sports and exercise behaviour. For costs, there are differences as the findings literature show a positive impact of time cost while no effect was found for money cost. A potential reason for this difference could be attributed to the measurement of time and money costs; time costs were measured via proxies in the literature (11,12) while money costs were specified as only entrance charges (18). Exploring the impact of time and money costs and perceived benefits in this

study, offers an improvement in knowledge as it provides new indicative evidence on the influence of these factors on sports and exercise participation and hence informs policies as to how demand responds to changes in either factor. In addition, it provides a policy relevant framework of analysis indicating how the impact of costs and perceived benefits could be conducted in the future using a bigger representative sample.

This study, however, does not provide the impulsion to establish the differential impacts of individual components of money costs as they were all collapsed into either fixed or variable costs. Second, given the potential heterogeneity of cost regarding different types of physical activity (12) it is unknown whether the observed effect of cost relates to activities such as housework and occupational activity or even different types of sports and exercise. Attempts to shed light on the issue of heterogeneity regarding the latter by investigating the relationship between costs and 'workout in the gym' though showed similar effects of costs. However, the investigation was limited to only one activity and thus cannot provide strong evidence to fill that void in knowledge. Thirdly, it is difficult to claim whether the observed impact of costs and perceived benefits on sports and exercise behaviour given participation applies to participation or not as well. There may be the urgent need to fill these gaps in knowledge, as encouraging uptake or level of participation given uptake may require different strategies for various costs and even so for different activities as well.

Although not generalisable, the findings do indicate some interesting implications for policies to improve sports and exercise participation in England. National health agencies intending to promote participation may need to reduce both the time and money cost per occasion of participation. So, price is potential policy variable, but how much cheaper in price does sports and exercise have to be, to increase uptake? The mostly inelastic nature of price elasticity, suggests that large subsidies rather than for instance 'mini-vouchers' may be most effective. Consider an illustration with two price reduction policies aimed at increasing the current number of days on which sports and exercise is undertaken: policy 'A' aims at a 25% percent subsidy and policy 'B', 100%. In money price terms, the former could lead to people doing an additional half a day

of sports and exercise and the latter two and half additional days. With full subsidies, sports participants in England would do about 13 days of sports and exercise per month indicating that they would be exercising sufficiently enough to meet the recommended level of participation (given intensity), which is the target of current government policies. The pattern is similar for time price, though the benefit of the full 'subsidy' is more profound, leading to an increase of more than 5 days. For time price, full 'subsidy' strategies may involve providing people with personal sports equipments so they would not have to travel to do sports and exercise. Such a strategy could lead to a more than 200% increase (i.e. from 0.20 to 0.65) in the probability to meet the recommended level of participation. Given that 34% of the population currently meets that level, it may be deduced that sports participants in England would attain such levels if that strategy is adopted. The question as to how these subsidies should be implemented is beyond the scope of this paper and future studies should look into that.

While the benefits of full subsidies may be enormous, concerns could be raised about its cost effectiveness given the financial demands. Resolving this concern is not within the scope of this study. Even if they are not cost-effective, our findings indicate that alternative policies may still be pursued. For example, price (money) discrimination interventions may be adopted to apply full subsidies to sections of the population who are less likely to do sports and exercise. From the findings, potential target groups could be females or older people. Such an intervention would be in line with the on-going government strategy which makes swimming free to over 60 year olds in England (1). Given the attenuating effect of perceived benefits on the relationship between cost and sports and exercise, an alternative intervention could be to increase awareness about benefits from sports and exercise via for example GP advice schemes. The focus, as our findings suggest, could be on 'non health' benefits like 'to relax and forget about cares' and 'to look good'. Such interventions have been shown to be cost effective though their delivery could improve by incorporating the preferences of individuals (37). In terms of fixed costs, however, there could be arguments for and against subsidies given that, as expected, people do more exercise as they incur more of the latter because as rational consumers they are likely to base their

purchases on rational expectations about consumption. Another plausible argument is that people may be morally obliged to exercise more after spending much money on it. Thus, a cost recovery policy may be adopted whereby the government could increase fixed cost and use revenue from that to offset the full subsidization policy recommended for variable and time costs. Alternatively, fixed costs may still be subsidised as a way of attracting 'moral weight' which could encourage people to participate. Future studies may be able to judge the effectiveness of such economic incentives.

FIGURES, BOX, & TABLES

Figures 1&2: Demand curves for no. of days doing sports and exercise (PA)

Figure 1: using money price

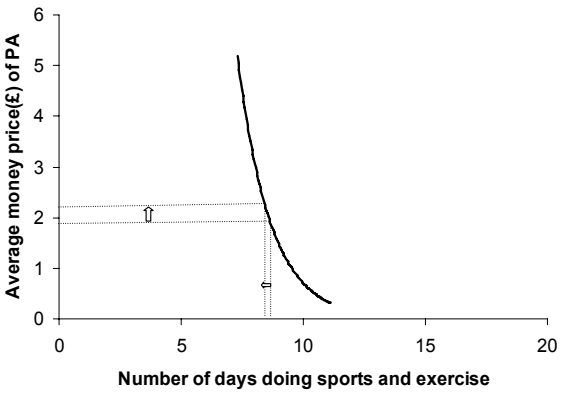


Figure 2: using time price

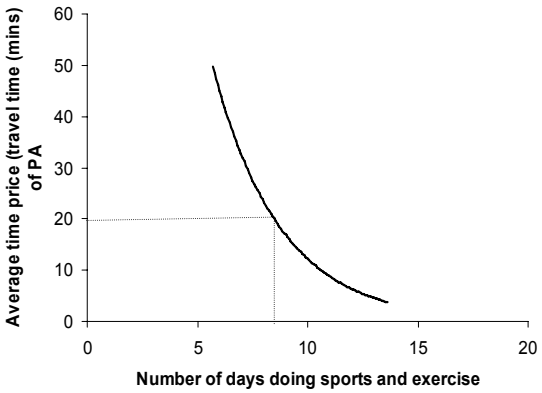
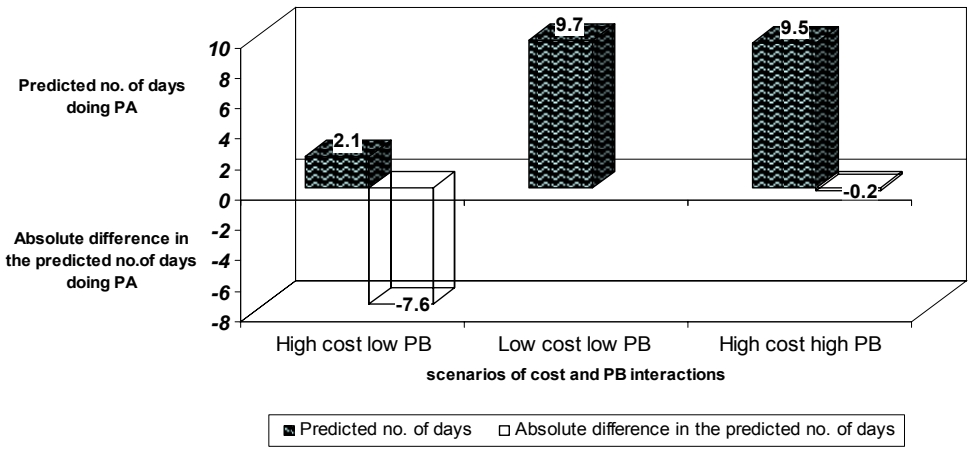


Figure 3 Average no. of days doing sports and exercise (PA) given participation by scenarios of cost and perceived benefit (PB) interactions (where cost is variable cost)



Box 1 List of benefits

The question for perceived benefits was: *….'tell me how much you would say sports and exercise could help you in the following things:*

1. *To relax and forget about your cares*
2. *To get together and meet other people*
3. *To have fun*
4. *To get out of doors*
5. *To feel a sense of achievement*
6. *To feel independent*
7. *To feel mentally alert*
8. *To feel in good shape physically*
9. *To learn new things*
10. *To look good*
11. *To control or lose weight*
12. *To seek adventure and excitement*
13. *To improve or maintain your health*

Table 1 Descriptive statistics of respondents

Variables	Whole sample (n=60)				
	Obs.	**Mean(SD) / %**	**Median (IQR)**	**min**	**max**
Age	60	27.2(6.5)	25.5(23,30)	18	46
Size of household	60	3.6(2.8)	3(2,5)	1	15
No. of children in h'hold	60	0.5(0.8)	0(0,1)	0	4
No. of adults in h'hold	60	3.1(2.7)	2(2,4)	1	15
Personal income					
Under £399	17	28.3			
£400-£1,249	28	46.7			
£1,250-£2,899	15	25			
Gender					
Male	36	60			
Female	24	40			
Employment status					
Employed	30	50			
Not employed*	30	50			
Working hours	30	23.5(13.2)	21.3(13,37.5)	6	45
Educational qualification					
Degree level	45	75			
Below degree level	15	15			

*All unemployed were students but not all students were unemployed

Table 2 Descriptive statistics of dependent variables

Variables	**Obs.**	**Mean(SD) / %**	**Median(IQR)**	**min**	**max**
Participate in sports and exercise (PA)					
No	13	21.7			
Yes	47	78.3			
If yes,					
No. of days on which PA was undertaken	47	11.0 (7.4)	10(4, 16)	1	28
Total time (mins) spent on PA	47	692.6(720.6)	480(180, 970)	60	3360
Meet recomm'd level of PA (vig.)					
Yes	16	34			
No	31	66			
No. of days on which vigorous PA at recommended duration was undertaken	47	9.3 (7.5)	8(2, 16)	0	28

Table 3 Descriptive statistics of costs (n=47)

Cost	Mean(SD)	Median(IQR)	Min (n)	Max (n)
Total cost	27.4(25.5)	19.5(9.2,47)	0(6)	84(1)
Total fixed cost	21.0(25.4)	10(0,42)	0(19)	80(1)
Total variable cost	6.4(10.1)	2.0(0,10.5)	0(19)	45(1)
Components of fixed costs				
Membership fees	9(14.6)	0(0,17)	0(30)	50(2)
Joining fees	1.0(6.7)	0(0,0)	0(46)	46(1)
Cost of Apparel	4.2(11.3)	0(0,0)	0(39)	57(1)
Cost of equipment	2.9(11.4)	0(0,0)	0(42)	60(1)
Maintenance cost of equipment	0.2(1.5)	0(0,0)	0(46)	10(1)
Cost of nutritional supplements	2.1(7.5)	0(0,0)	0(43)	31(1)
Cost of medical care	0.3(2.2)	0(0,0)	0(46)	15(1)
Cost of insurance	0.1(1.0)	0(0,0)	0(46)	7(1)
Other	1.1(6.0)	0(0,0)	0(44)	40(1)
Components of variable costs				
Entrance charges				
Unit cost	1.3(1.8)	0(0,2.8)	0(27)	8(1)
Total cost	4.4(8.6)	0(0,6)	0(27)	45(1)
Competition charges				
Unit cost	0.04(0.3)	0(0,0)	0(46)	2(1)
Total cost	0.2(1.2)	0(0,0)	0(46)	8(1)
Classes charges				
Unit cost	0.06(0.4)	0(0,0)	0(46)	3(1)
Total cost	0.06(0.4)	0(0,0)	0(46)	3(1)
Cost of refreshment				
Unit cost	0.4(0.7)	0(0,0.7)	0(31)	3(1)
Total cost	1.6(3.5)	0(0,1.5)	0(31)	16(1)
Cost of equipment hire				
Unit cost	0.01(0.1)	0(0,0)	0(46)	0.5(1)
Total cost	0.03(0.2)	0(0,0)	0(46)	1.5(1)
Cost of transport ticket				
Unit cost	0.1(0.4)	0(0,0)	0(45)	2(1)
Total cost	0.1(0.6)	0(0,0)	0(45)	4(1)
Travel time (mins)	19.8(17.8)	14(7.5, 30)	2.5(2)	90(1)

Table 4 Estimation results of regression models of dependent variables

INDEPENDENT VARIABLES	DEPENDENT VARIABLES							
	Number of days		**Total time**		**Meet recommended level**		**No. of days (vigorous activity)**	
	Reduced model		*Reduced model*		*Reduced model*		*Reduced model*	
	Coef. [a]	***ME (Elas'ty)*** [b]	***Coef.*** [a]	***ME (Elas'ty)*** [b]	***Coef.*** [a]	***ME (Elas'ty)*** [b]	***Coef.*** [a]	***ME (Elas'ty)*** [b]
Unit costs								
Fixed cost	0.00	0.04 (0.09)	0.01**	0.01 (0.30)	0.03**	0.01 (1.05)	0.01**	0.07 (0.20)
Variable costs	-0.13***	-1.14 (-0.24)	-0.05	-0.05 (-0.09)	-0.02	-0.00 (-0.04)	-0.00	-0.03 (-0.01)
Time cost (travel time)	-0.02***	-0.21 (-0.47)	-0.03***	-0.03 (-0.64)	-0.07**	-0.02 (-2.15)	-0.02**	-0.13 (-0.36)
Perceived benefits								
To relax, forget about your cares	0.44**	3.41	0.40	0.40	0.83	0.18	0.15	1.02
To feel a sense of achievement	-0.48	-5.29	-0.19	-0.19			-0.71	-7.05
To learn new things	-0.11	-0.98	0.13	0.13				
To control or lose weight					-0.64	-0.90	0.35	2.27
To look good							1.40**	6.71
Control variables								
Personal income (high)	0.30*	2.76	0.19	0.19	0.77	0.19	0.03	0.20
Age	-0.06***	-0.54 (-1.60)						
Gender (male)			0.69**	0.69			0.65**	4.33
Existence of other PB (Yes)	0.29**	2.78						
No. of observations	47		47		47		47	
Constant	3.75		5.71		-2.02		1.55	
Linktest	p=0.20		p=0.95		p=0.36		p=0.39	
Goodness of fit					p=0.66 [d]			
Test for heteroskedasticity			p=0.44 [c]					
Normality test			p=0.43					
R squared			0.38					
Pseudo R squared	0.18				0.41		0.14	

[a] Significance level of 1%(***), 5%(**) , 10%(*) [b] Marginal effects (Elasticity -calculated for only continuous variables) [c]Chi-square(1)=0.58 [d] Chi-square(8)=5.90 *Variables indicating the equivalent values placed on perceived benefits were accounted for in the regression models ** Average VIF for the independent variables was 1.5, and average tolerance levels were 0.7

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