

The psychological and physical impacts of spending time in forests: a case study of two forests in Ireland

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Abstract

The overall aim of this study was to investigate the psychological and physical health/well-being effects of spending time in forests, and the role that the species composition of the forests plays in these effects. The effects were assessed by a simple questionnaire survey to 179 visitors to two adjacent forests; a conifer plantation forest and a broadleaf plantation forest. The immediate psychological effects from spending time in forests were also assessed by a mood test, and the longer-term psychological and physical health impacts of forest use were explored by comparing the results of the survey of forest visitors with that of a national survey. The results indicated that the main psychological well-being benefits experienced by forest users were “mental relaxation” and “enjoyment and fun”. Significant improvements in mood immediately after a walk in the forest were exhibited by the respondents, but the species composition of the forests was not shown to influence the improvements. It was also revealed that forest visitors engaged in greater levels of physical activity than the general population, but there was no correlation found between forest users’ physical activity level and frequency of forest use. It was recommended that further research should aim to make use of large-scale surveys of a random sample of the population including visitors and non-visitors to forests.

Key words: *Health benefits of forests, mood tests, forest therapy, species composition of forests, longer-term physical and psychological health impacts.*

Introduction

Globally, forests and trees are believed to supply a wide range of services which benefit human health and well-being. In developed societies, research into the benefits of forests for human health and well-being has focused on the provision of psychological restoration and enhancement of physical activities and social interaction due to an increasing number of social needs such as increasing levels of obesity, chronic lifestyle-related diseases, mental illness and disorders such as anxiety and depression (Hartig et al. 2014). The restoration effects have become the target of research interests since the 1970s with the establishment of two main theories; Attention Restoration Theory which focuses on the elimination of mental fatigue and the improvement of cognitive functions by contact with nature (Kaplan 1983, Kaplan and Kaplan 1989) and Stress Reduction Theory which focuses on a human’s positive emotional and psychological reactions to nature (Ulrich 1983, Ulrich et al. 1991).

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Several empirical studies have been conducted to explore the psychological and physiological effects of exposure to nature. The evidence suggests that spending time in green spaces such as forests and urban greens, or even viewing a landscape from a window has restorative effects on people. These effects include improvement in mood and emotional status (e.g. Peacock et al. 2007), increase in concentration and attention (e.g. Berman et al. 2012), strengthened immune systems (e.g. Li et al. 2008), and lowered blood pressure and stress hormone levels (e.g. Tsunetsugu et al. 2013). However, little is known about the health benefits gained from spending time in forests compared with those experienced from spending time in other natural environments such as urban parks, hills, grassland or agricultural land (Bowler et al. 2010).

Some studies have also reported that accessible green spaces could improve people's physical health by enhancing people's motivation for physical exercise (e.g. Richardson et al. 2013). Other studies found that exposure to wood essential oils, "phytoncides", increased the number and the activity of natural killer cells which are an important component of the human immune system (e.g. Li et al. 2008).

In some countries, forests are actually used as a part of health care in collaboration with medical institutions. For example, in Germany, nature walks are included in the traditional therapy, "kur" ("course of treatment") along with herbal remedies and mud baths (Maretzki 1987). In Japan, "forest bathing" (spending time in forests) is regarded as preventive medicine, with medical professionals recommending forest walks to people who have been diagnosed as overstressed or with symptoms such as high blood pressure or high cholesterol (Forest Therapy Society 2013).

In the UK, there have been a number of health projects initiated by the Forestry Commission, local councils or local communities including projects targeting the sedentary, disabled, elderly, minority groups, the socially deprived and those with mental health problems. For example Forestry Commission Scotland (2015) currently has a WIAT (Woods in and around towns) programme which aims to tackle the barriers people face visiting woodlands. In Ireland, several health promotion programmes have been run in tandem with the establishment of walking routes. Coillte (The Irish Forestry Board) provides more than 150 recreation sites across the country and also runs pilot programmes including a forest walk for people who are experiencing mental ill-health (Iwata et al. 2016).

In spite of the range of previous research and case studies, a full understanding of the mechanisms by which people experience the psychological effects from contact with green spaces, including forests, has yet to be established. For example, little is known about the elements or condition of forests, the kind of activities and frequency of use, or the types of users which would lead to, or experience, the greatest benefits. Also, most previous studies have focused on short-term effects, and longer-term effects have not been properly assessed (Bowler et al. 2010). Furthermore, perceptions

toward forests and the relationship between forests and people could differ between different countries and cultures so that they might have different effects. With this in mind, we note that there have been no studies conducted in Ireland to investigate the relationship between people's health and spending time in forests with the exception of Iwata et al.'s (2016) study which explored the benefits for people suffering from mental ill-health of spending time in forests.

In this context this study was initiated with the aim to investigate whether forest visitors in Ireland experience short-term and long-term psychological and physical benefits from spending time in forests and to determine whether the species composition of forests influences these benefits.

Materials and methods

A survey of visitors to two adjacent forests, the Hell Fire Club and Massy's Estate was conducted. The Hell Fire Club¹ comprises a conifer plantation, mainly of Sitka spruce (*Picea sitchensis* (Bong.) Carr.) and larch (*Larix decidua* L.), although a small amount of beech (*Fagus sylvatica* L.) is present. There are about 4.5 km of forest roads and trails present on the site. The forest is situated on a hill and there is a view of Dublin city from an altitude of 383 m. A car park, situated beside the entrance of the trail, has parking spaces for approximately 60 cars. Massy's Estate is predominately a broadleaved plantation including species such as beech (*Fagus* spp.), oak (*Quercus* spp.), lime (*Tilia* spp.), horse chestnut (*Aesculus hippocastanum* L.), sycamore (*Acer pseudoplatanus* L.) and ash (*Fraxinus excelsior* L.) with a rich ground flora in the understorey. It has about 1.5 km of forest trails. Other features found on the site include a stream, small waterfalls and ponds. The two forest sites are located 14 km from the centre of Dublin. Both forests are owned by Coillte, and information about them can be found on the Coillte Outdoors official website as well as other tourist guides. The sites were chosen for study as they are known to be very popular sites for visitors (Magner 2011) and they differ in their species composition. Also, their close proximity to each other meant that they had the same characteristics in terms of accessibility, distance from the city centre and availability of facilities such as a car park.

Questionnaire survey

A survey of visitors to the two sites was conducted on three Sundays in October (2013), November (2013) and January (2014) (Table 1). On the first two dates the survey took place in a car park beside the Hell Fire Club which is also used by visitors to Massy's Estate. Two surveyors waited at the car park, and asked visitors to complete a questionnaire at their cars. The surveyors attempted to approach as many visitors as possible before they

¹ A ruin on top of the hill, which was originally a hunting lodge, became infamous in the 18th century for being used as a base for the Dublin branch of the Hell Fire Club; a club where "wild young Dublin gentlemen" would congregate for "drunken revelry" (Magner 2011, p. 207).

started to walk, but because of the numbers of visitors and need to explain and collect the survey sheets, some of the visitors were missed. Also some of the visitors refused to participate, especially those who had small children with them (Table 1). As fewer questionnaires were collected from people visiting Massy's Estate during the first two survey days, the third survey was conducted at the entrance to Massy's Estate.

The questionnaire addressed the following themes:

Visitation pattern

Respondents were asked to identify the forest they planned to visit on the day of the survey. They were also asked to identify how often they visited the forests and the distance they travelled to do so.

Forest features of importance

Respondents were asked to rank the importance to them of nine features of the forest they planned to visit (i.e. Conifer trees, Great view, Ruin of Hell Fire Club, Size of the forest, Parking area, Broadleaf trees, Stream, Plants and animals, Smells and atmosphere) from 1 (Not at all) to 6 (Extremely). Data from those who visited both forests and those who answered "Not sure" were excluded from the analysis in order to investigate the differences between the two forest sites.

Well-being benefits

The well-being benefits gained from a forest visit were also determined. The benefits listed in the questionnaire were those identified by O'Brien and Morris (2014) in a previous study of the well-being benefits that people can gain from trees, woods and forests.

Mood change

Immediate mood changes in the visitors arising from a forest walk were assessed using the Positive and Negative Affect Schedule (PANAS). PANAS is a frequently

Table 1: Survey details including prevailing weather conditions and the response rate achieved.

	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>
Date	26 th Oct 2013	3 rd Nov 2013	19 th Jan 2014
Weather	Cloudy, some rain, some sunshine	Sunny	Sunny
Temperature	10-12 °C	7-9 °C	5-6 °C
Survey time	10:00 ~ 17:30	10:00 ~ 15:00	10:00 ~ 17:00
Survey site	Hell Fire Club car park	Hell Fire Club car park	Massy's Estate entrance
Questionnaires completed	72	53	54
Response rate	70%	55%	90%

used methodology to indicate mood changes after a treatment (Watson et al. 1988) and it has been used in some studies related to the psychological effects of spending time in nature (e.g. Berman et al. 2008, 2012). In this study, the forest visitors were asked to fill in a one-page worksheet for the PANAS mood test before and after the walk. The PANAS worksheet typically consisted of words that describe different feelings and emotions, in which some were for measuring Positive Affect (PA) and others for measuring Negative Affect (NA) (Table 2). Each word was scored on a 6-point scale ranging from 1 (not at all) to 6 (extremely) to indicate the extent to which the participant was experiencing this feeling when they were completing the sheet.

High PA was defined as a state of “high energy, full concentration, and pleasurable engagement” and low PA is a state of “sadness and lethargy”. High NA was characterised by “subjective distress and unpleasurable engagement that subsumed a variety of aversive mood states, including anger, contempt, disgust, guilt, fear, and nervousness” and low NA was a state of “calmness and serenity” (Watson et al. 1988 p. 1063).

Socio-demographic characteristics

Some socio-demographic characteristics of respondents were recorded including their age; employment status; family status; education level and marital status.

Level of physical activity

Respondents were asked a number of questions relating to their involvement in physical activity in the seven days prior to the survey. These questions were the same as those included in the International Physical Activity Questionnaire Short Form (IPAQ 2005). This is a standardized method which facilitates the quantitative measurement of physical activity levels by computing a continuous measure of the volume of activity computed by weighing each type of activity by its energy requirements, i.e. MET-min per week². The level is categorised into Low, Moderate and High based on criteria outlined in IPAQ (2005). The results for the forest visitors were compared to those recorded by Barry et al. (2009) who applied a similar methodology to a sample of the general population of the Republic of Ireland and Northern Ireland in their Survey on Lifestyle, Attitudes and Nutrition (SLÁN) in Ireland conducted in 2007.

Table 2: Words used to indicate mood changes experienced by the visitors arising immediately after a forest walk (after Watson et al. 1988).

Positive affect (PA) words	Negative affect (NA) words
Interested; Excited; Strong; Enthusiastic; Proud; Alert; Inspired; Determined; Attentive; Active.	Distressed; Upset; Guilty; Scared; Irritable; Ashamed; Nervous.

²The metabolic equivalent of task (MET), or simply metabolic equivalent, is a physiological measure expressing the energy cost of physical activities. MET-min per week = MET level x minutes of activity/day x days per week; typical MET levels: walking = 3.3 METs, moderate intensity exercise = 4.0 METs, vigorous intensity = 8.0 METs.

An estimate of the amount of exercise conducted by each respondent in different settings was calculated by multiplying the value of MET-minutes per week, by the proportion of the time each respondent spent exercising in the different settings. This made it possible to investigate the relative importance of forest settings for their exercise.

Mental health and social well-being

The mental health status of forest visitors and that of the general population of the Republic of Ireland and Northern Ireland was compared to determine if there were longer-term benefits of spending time in forests on human mental health. To do this, the same questions as used in the SLÁN study of 2007, referred to above, were used to assess the mental health and social well-being of respondents. Using the answers to these questions, mental health was assessed under two headings: positive mental health using an Energy and Vitality Index (EVI) (Ware et al. 1993) and psychological distress using a Mental Health Index-5 (MHI-5) (Ware et al. 1993).

Data analysis

A number of statistical tests were used to address the objectives of the study. To assess whether there was a significant change in mood arising from a forest visit a paired-sample t-test in SPSS v20 (IBM Corp. 2011) was conducted. The changes in the positive mood and negative mood were investigated separately, as is the norm (Watson et al. 1988). Additionally a one-way ANOVA in SPSS was used to investigate whether the extent of the mood changes varied significantly according to the forest that the respondent visited.

A chi-square test (Microsoft Excel) was used to investigate whether the level (three categories) of physical activity of the respondents to this survey and that of the Irish population differed significantly. Independent t-tests (Microsoft Excel) were conducted to determine whether the mental health (i.e. mean EVI and mean MHI-5) of the respondents to this survey and that of the Irish population differed significantly. A multiple regression analysis in STAT software (SAS Institute 2011) was used to investigate the most influential predictor variables for the level of physical activity and mental health status and to investigate the significance of frequency of forest use to these activity levels. The continuous variables of MET-min per week for the level of physical activities and EVI and MHI-5 for the mental health status were used as dependent variables. As independent variables, categorical variables including the frequency of forest use and socio-demographic characteristics (age, employment, number of children, education, income and marital status) were used. Many of the categories for these independent variables were re-coded as they had small numbers (Table 3). A Tukey-Kramer post-hoc test was conducted for the variables that were shown to be significant.

Table 3: *Socio-demographic characteristics used as independent variables in a multiple regression analysis to investigate the most influential predictor variables for the level of physical activity and mental health (figures in parenthesis refer to % of respondents).*

Variables	Code	Original categories
Age (years)	0	18 – 24 (3%), 25 – 34 (28%)
	1	35 – 44 (31%), 45 – 54 (22%)
	2	55 – 64 (13%), 65 – 74 (3%), 75 + (1%)
Employment status	0	Working full-time 30 hrs+week ⁻¹ (73%), Working 8-29 hrs week ⁻¹ (10%)
	1	Working less than 8 hrs week ⁻¹ (2%), Unemployed (2%), Home maker (2%), Other (2%)
	2	Retired from full-time job (5%)
	3	Student (4%)
No of children under 18	0	0 (56%)
	1	1 (10%), 2 (24%), 3+ (10%)
Level of education	0	Primary or equivalent (4%), Leaving Cert or equivalent (16%)
	1	Diploma or Certificate (25%), Postgraduate Higher Diploma / Masters (50%), PhD (4%)
Annual household income	0	<€190 wk ⁻¹ , €800/m or €10,000 yr ⁻¹ (1%), €10,000 – €19,000 yr ⁻¹ (4%), €20,000 – €29,999 yr ⁻¹ (8%), €30,000 – €39,999 yr ⁻¹ (9%), €40,000 – €49,999 yr ⁻¹ (7%)
	1	€50,000 yr ⁻¹ or more (37%)
Marital status	0	Married / in a civil partnership (69%)
	1	Separated (2%), Divorced (1%), Widowed (1%), Never married (27%)

Results

Pattern of visits to the Hell Fire Club / Massy's Estate

The Hell Fire Club and Massy's Estate are located immediately next to one another, hence the visitors could easily walk to both of the forests on the same day. On the day(s) the survey was completed 44% of the respondents planned to visit the Hell Fire Club and 47% planned to visit Massy's Estate, and the remainder were not sure.

The questionnaire conducted in Massy's Estate on the third day contained an additional open-ended question asking whether respondents had a particular reason(s) for choosing to walk in Massy's Estate instead of the Hell Fire Club. As shown in Table 4, some people valued the features of the natural environment such as the deciduous trees and river; whereas other people valued its topography compared to that of the Hell Fire Club which made walking easier especially for little children. Some made the choice based purely on habit.

The average straight-line distance between the respondent's residential area and the car park of the Hell Fire Club was 8.3 km, and the average estimated time taken for travel was 15 minutes. The majority of the respondents lived within 5 to 10 km of

the forests which would require 11-20 minutes driving. Respondents visited the forest with family members (41%), friends (23%) or dogs (17%). Only a few respondents (9%) visited on their own.

Comparison of important features in the Hell Fire Club and Massy’s Estate

The features which scored highest in both forests were “Smells and atmosphere”, “Size of the forest” and “Broadleaf trees” (Figure 1). The “Great view” was considered an important feature in the Hell Fire Club (a coniferous plantation). Also “Parking area” and “Conifer trees” were scored relatively highly compared to those who visited Massy’s Estate. In contrast, the visitors of Massy’s Estate scored “Stream” relatively high compared to those who visited the Hell Fire Club. There seem to be some confusion among forest visitors as to what was a conifer/broadleaf species. For example, “Broadleaf trees” were rated as a highly important feature of the Hell Fire Club even though there are very few broadleaved trees in the forest, especially along the walking route.

The respondents were asked to choose the five most important well-being benefits of their visit to the forest on the survey day from a list of 16 choices. The benefits that were more frequently mentioned for both forests were “Physical well-being”, “Mental relaxation”, “Escape and freedom”, “Enjoyment and fun” and “Enjoying landscapes”, respectively. Benefits such as “Physical well-being”, “Enjoyment and

Table 4: Reasons respondents chose to walk in Massy’s Estate instead of the Hell Fire Club. (Figures in parenthesis refer to the number of respondents).

Category	Answers
Environmental features	Deciduous trees (3) / River (4)
Topography	Easier walk, Hell Fire Club too steep (3) / Easier for children (5)
Familiarity/ Habit	Familiarity (3) / Nearby (1)
Others/comments	Dog friendly (3) / Less people (2) / Well maintained trails (1) / Cleaner (1) / “Not mad on building at Hell Fire Club” (1)

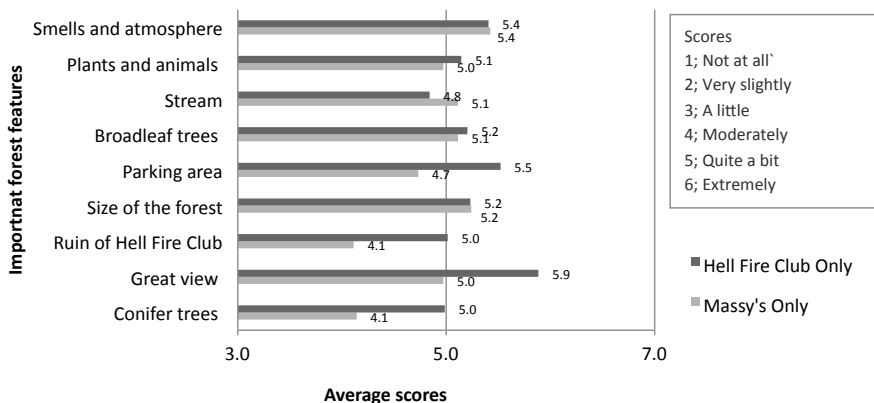


Figure 1: Ranking of importance of forest features in the Hell Fire Club and Massy’s Estate.

fun” and “Enjoying landscapes” were chosen more frequently by visitors to the Hell Fire Club. Conversely, “Mental relaxation”, “Escape and freedom”, “Gathering with friends/ family” and “Feeling sense of place” were ranked higher by visitors of Massy’s Estate (Figure 2).

Comparison of the mood changes following visits to the Hell Fire Club and Massy’s Estate

The visitors to the Hell Fire Club showed an average improvement of 4.9 in their Positive Affect (PA) scale following their walk (Table 5). The visitors to Massy’s Estate also showed an improvement in their PA scale after the walk, exhibiting an average increase of 4.0 (Table 5). The changes in PA scales did not differ significantly between forest sites ($p = 0.602$).

Table 5: *The changes in Positive Affect (PA) scale after walking in the Hell Fire Club compared with Massy’s Estate.*

		Positive affect scale			Paired t-test
		n	Mean	SD ^a	
The Hell Fire Club	Before	37	39.2	7.6	t = 3.57, p = 0.001
	After	37	44.1	8.6	
	Average change		+4.9	8.3	
Massy’s Estate	Before	45	40.7	7.4	t = 4.02, p <0.001
	After	45	44.7	8.7	
	Average change		+4.0	6.7	

^a Standard deviation.

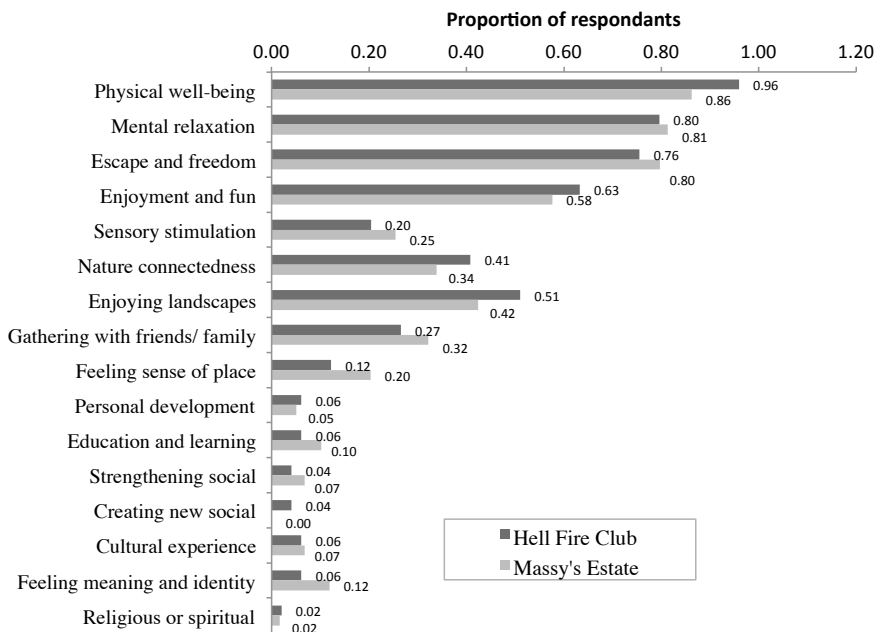


Figure 2: *The well-being benefits provided by the Hell Fire Club and Massy’s Estate by proportion of respondents.*

On average, visitors to the Hell Fire Club experienced a statistically significant decrease in their Negative Affect (NA) scale (i.e. -1.8). Visitors to Massy's Estate also experienced a statistically significant decrease in their negative mood (i.e. -1.1) (Table 6). Similar to the results for PA, the changes in the NA scales were independent of the forest site visited ($P = 0.398$).

The longer-term physical health impacts of spending time in forests

Figure 3 compares the levels of physical activity engaged in by the respondents of this survey with those of a national survey, SLÁN 2007 (Barry et al. 2009). In both surveys the highest proportion of the respondents were categorised as engaging in moderate levels of physical activity (above 45%). However, a higher proportion of the respondents to this survey were categorised as engaging in high levels of physical activity compared to that of the national survey. Chi-square analysis confirmed that the distribution of respondents according to physical activity level differed significantly between both surveys ($\chi^2 = 21.6$, $p < 0.0001$).

Table 6: *The changes in Negative Affect (NA) scale after walking in the Hell Fire Club compared with Massy's Estate.*

		Negative Affect scale			Paired t-test
		n	Mean	SD ^a	
The Hell Fire Club	Before	44	9.9	3.8	t = -3.00, p < 0.005
	After	44	8.1	1.8	
	Average change		-1.8	3.9	
Massy's Estate	Before	47	9.2	3.5	t = -2.33, p < 0.05
	After	47	8.1	2.3	
	Average change		-1.1	3.3	

^aStandard deviation.

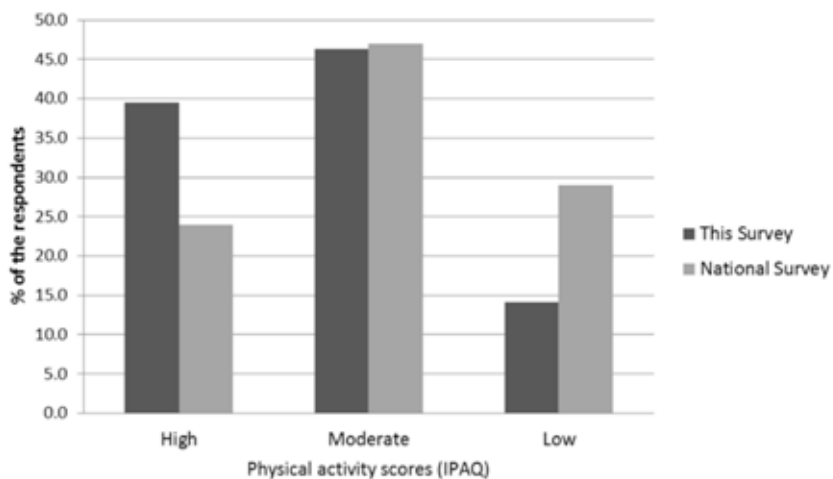


Figure 3: *Comparison of physical activity scores (IPAQ) of the respondents to this survey with those of a national health survey, SLÁN 2007.*

The settings where respondents most commonly exercised were gyms or swimming pools (Figure 4). Only 13% of the respondents' exercise was undertaken in forests.

Regression analysis found that among a number of socio-demographic characteristics, only employment status was shown to be significantly related to the level of physical activity undertaken (Table 7). A Tukey-Kramer post-hoc test indicated that the level of physical activity (the mean MET-minute per week) of non-paid/part-time workers (working less than 8 hrs week⁻¹, unemployed, home maker, other) was significantly higher compared to that of full-time/semi-full-time workers (working full-time 30 hrs + week⁻¹, working 8-29 hrs week⁻¹) (p <0.05). The analysis also showed no significant relationship between the respondent's level of physical activity and frequency of forest visits.

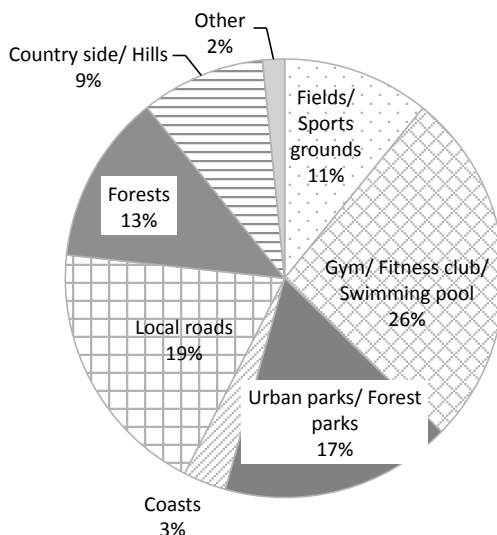


Figure 4: The proportion of respondent's exercise time spent in various settings.

Table 7: Summary of a multiple regression analysis investigating relationships between a series of socio-demographic characteristics and the level of physical activity engaged in by the respondents.

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Frequency of forest visits	2	3981246	1990623	0.20	0.8173
Age	2	33555062	16777531	1.70	0.1872
Employment	3	84984082	28328027	2.88	0.0399 ^a
Education	1	13293672	13293672	1.35	0.2480
Income	1	11164028	11164028	1.13	0.2895
Marital status	1	4931608	4931608	0.50	0.4808
No. of children under 18	1	7746.85	7746.85	0.00	0.9777

^a p <0.05

The longer-term psychological impacts of forest use

Positive mental health

The overall mean score of the Energy and Vitality Index for the respondents in this survey was 60 (SD = 23), which was significantly lower than the mean score of 68 (SD = 19) reported in the SLÁN 2007 survey ($p < 0.05$). Figure 5 shows that the majority of the forest visitors answered “most of the time” or “sometimes” to the positively worded questions, which was similar to that of SLÁN 2007. It also indicates that the forest visitors in this survey endorsed less of the “very positive” categories (e.g. feeling full of life “all of the time”) and less of the “very negative” categories (e.g. feeling tired “never”) compared to that of SLÁN 2007.

Psychological distress

In general the responses to the positively worded and negatively worded questions related to psychological distress levels measured by a Mental Health Index-5 (MHI-5) were similar in this and the SLÁN surveys (Figures 6 and 7). However, the overall mean score of MHI-5 for forest visitors was 76 (SD = 23), which was significantly lower than the mean score of 82 (SD = 16) in SLÁN 2007 ($p < 0.05$) suggesting that forest visitors exhibited higher levels of psychological distress than the general population. A score of 52 or less of psychological distress indicates that a respondent has a probable mental health problem (Lavikainen et al. 2006). Five percent of the forest visitors exhibited such low scores. A slightly higher percentage (i.e. 7%) of respondents to the SLÁN 2007 survey scored 52 or less.

Regression analysis found a relationship between employment status and Energy and Vitality Index ($p < 0.05$). A Tukey-Kramer post-hoc test indicated that

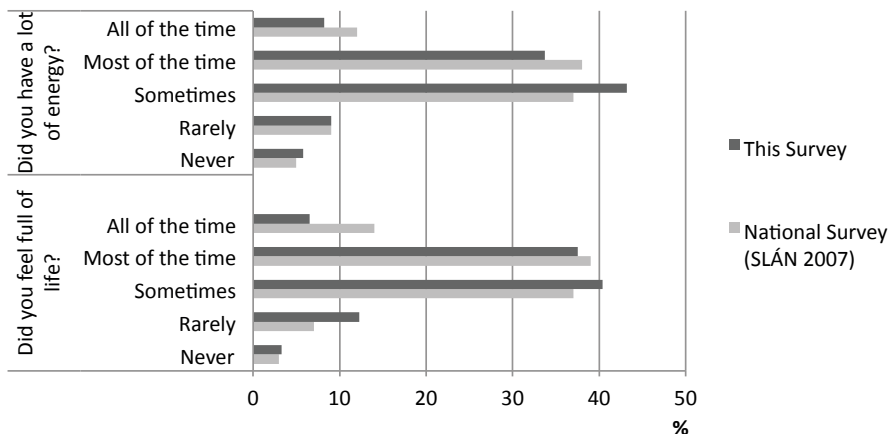


Figure 5: Comparison of the responses given in this survey and the national survey, SLÁN 2007, to two positively worded items of the Energy and Vitality Index (EVI) by % of respondents.

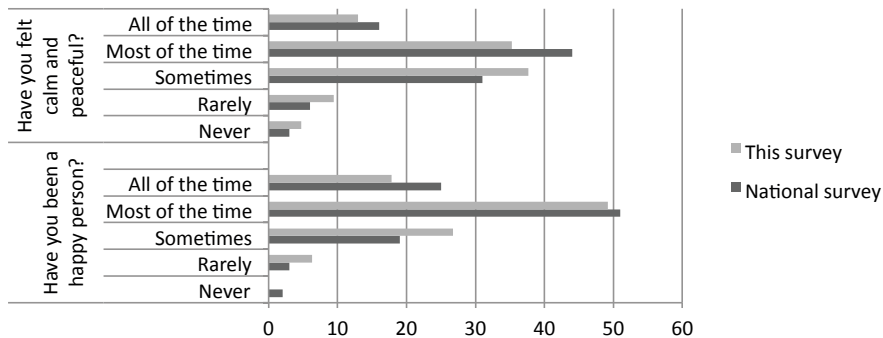


Figure 6: Comparison of the responses given in this survey and the national survey, SLÁN 2007, to two positively worded items of the Mental Health Index (MHI-5), by % of respondents.

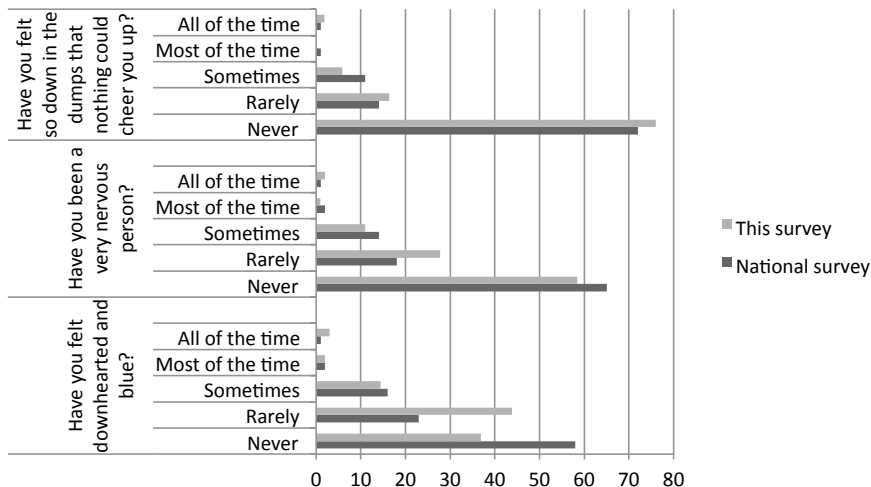


Figure 7: Comparison of the responses given in this survey and the national survey, SLÁN 2007, to negatively worded items of the Mental Health Index (MHI-5), by % of respondents.

the mean EVI score of retired individuals was significantly higher than that of full-time/semi-full-time workers ($p < 0.05$). There was also a moderate relationship between the level of physical activity and Energy and Vitality Index ($p = 0.077$). The analysis showed no significant relationship between the respondent’s level of Energy and Vitality Index and their frequency of forest visits.

A similar analysis was run to investigate the relationship between the level of psychological distress measured by the Mental Health Index-5 (MHI-5). None of the variables were shown to be significantly related to the MHI-5 scores.

Discussion

The psychological impacts of spending time in forests

A range of psychological health and well-being benefits of spending time in the natural environment have been recognized in previous studies. These include immediate psychological impacts such as improvement of mood, concentration and attention (e.g. Tsunetsugu et al. 2013) as well as longer-term psychological well-being effects such as reduced levels of chronic stress in deprived communities (Ward Thompson et al. 2012).

Based on these previous findings, an attempt was made to identify the psychological and physical well-being benefits experienced by Irish forest users through a questionnaire survey in this study. The results showed that “physical well-being” and “mental relaxation” were the most commonly experienced well-being benefits in this study.

By using Kaplan and Kaplan’s Attention Restoration Theory, it is possible to explore the mechanisms through which forest users may have experienced “mental relaxation” with consideration of other well-being benefits chosen by them. First, many of the respondents in this study chose “escape and freedom” as one of the benefits from their forest visits, which supports their experience of a sense of “being away” proposed as one of the restoration processes by Kaplan and Kaplan (1989). Another restoration mechanism recognised in ART is “fascination”, which could be reflected in the popular choices of “smells and atmosphere”, “plants and animals” and “sensory stimulation” as benefits from the forest visit. Also, the “great view” which was rated highly by the visitors to the Hell Fire Club could be classed as an element of “fascination” (Kaplan and Kaplan 1989). The well-being benefit of “enjoyment and fun” was experienced by many participants. That visitors obtained enjoyment from their visit is further supported by the fact that 71% of the respondents in this study indicated that they visit forests with family, friends or others. It is important to note that others have found that visitation patterns to forests varied according to the day the study was conducted, with families more likely to visit on Sunday (Arnberger and Eder 2007).

Assessments of mood immediately after spending time in forests

In addition to identifying the perceived well-being benefits from forest visits, a more quantitative assessment of the immediate psychological effects of spending time in forests was made using a mood test (PANAS). The results showed that visitors’ positive mood improved while their negative mood declined after spending time in a forest. However, whether the same respondents would experience similar changes in mood by walking in a different environment could not be assessed in this study. Nevertheless others have addressed this issue by conducting experiments involving participants walking for a similar length of time in both natural and synthetic

environments. Their results have shown that participants experienced greater mood improvements by walking in natural environments compared to urban settings (e.g. Hartig et al. 2003, Berman et al. 2008), laboratories (Plante et al. 2006), or indoor environments (Peacock et al. 2007, Thompson et al. 2011).

It is also important to note that these positive impacts cannot be attributed solely to the exposure to the forest but are likely to develop from a combination of effects arising from increased social interaction and regular exercise. As others have noted (e.g. Berman et al. 2012) these effects are difficult to separate, and could be considered as cumulative.

The effects of species composition of forests on visitors' psychological health/well-being

One of the aims of this study was to investigate whether the species composition of forests influenced the psychological health/well-being gained from spending time in them. Previous studies in Ireland have found that the general public have a preference for broadleaf forests and mixed forests in comparison to conifer-only forests (Clinch 1999, Upton et al. 2012). It was interesting therefore to investigate where such preferences translated into greater well-being benefits for visitors to broadleaf forests compared to coniferous forests. To address this issue surveys of forest visitors were conducted in two forests: a conifer plantation (the Hell Fire Club) and a broadleaf plantation (Massy's Estate). Only those that visited Massy's Estate were directly asked why they chose that site rather than the Hell Fire Club. Only a very small number referred to the species composition. Further, the ranking of the importance of species among the forest features suggested some confusion among forest visitors as to what constituted a conifer/broadleaf species. For example, "broadleaf trees" were rated as a highly important feature of the Hell Fire Club, yet there are very few broadleaf trees in the forest, especially along the walking route.

It should be noted that the two sites had many other distinctive characteristics in addition to species composition. For example, the Hell Fire Club has a steep incline toward the top of hill with an altitude of 383 m, and a ruin on top of the hill, whereas Massy's Estate has relatively flat relief, and has a stream which people can walk along. Hence many people who visited the Hell Fire Club chose the "Great View" as one of the most important features of the site while some people chose to visit Massy's Estate because it is an easier walk, especially for small children. The presence of a river in Massy's Estate was also classed as important for some. Previous studies have identified the psychological effects of spending time near a water body. For example, MacKerron and Mourato (2013) found in their study of more than 20,000 people that, on average, people felt happier outdoors in all-green or natural habitat types than they felt in urban environments; among the green or natural habitats, happiness scores were highest in marine environments and coastal margins. Völker and Kistemann

(2011) also noted that there is a relationship between inland surface waters (referred to as “blue spaces”) and human health and well-being. Such findings highlight the complexity of segregating the components of any natural environment that influence well-being. In the case of forests it is even more complex with aspects such as the density of forest, the diameter and height of trees being shown to influence visitors’ reactions to a greater extent than species composition (Oishi et al. 2003).

The longer-term physical impacts of spending time in forests

Quantifying the significance of the extent of forest use to forest visitors’ longer term physical well-being is an ambitious objective and in reality would require a more in-depth study than was conducted here. Nevertheless, an attempt was made to do so using a simplistic approach which involved a comparison of the self-reported levels of physical activity among forest visitors and those of the general population. This showed that forest visitors in this study engaged in greater levels of physical activity than the general population. In an effort to understand whether these higher levels could in fact be attributed to the time they spent in the forests, the relationship between their physical activity levels and their frequency of forest use was investigated. This analysis did not find that the frequency of forest use was related to their activity levels and similarly no significant relationships were found between a number of socio-demographic characteristics and physical activity levels. Only the employment status of the respondents was shown to be significantly related to the level of physical activities, with non-paid/part-time workers engaging in higher levels of physical activity than full-time/semi-full-time workers. It is also important to note that when correlating frequency of forest use with levels of physical activity that only those who spent some time in a forest were included as only forest visitors were surveyed.

Longer-term psychological impacts

Longer-term psychological impacts of spending time in forests are harder to assess and would require longitudinal studies of visitors. In this study, an attempt was made to assess these impacts by comparing the mental health status of visitors, as measured using a number of indicators, to that of the general population. Somewhat surprisingly this comparison showed that forest visitors had significantly poorer mental health, on average, than the general population (their EVI score measuring positive mental health, and their MHI-5 scores, measuring psychological distress, were lower than that of the general population). However, as highlighted earlier, the study also showed that many people identified mental relaxation and recovery from mental stress as a well-being benefit from visiting forests. These findings suggest that people who are feeling stressed might use forest environments as a means of relief. A deeper exploration of the responses showed that forest visitors expressed less extreme answers to both positive and negative questions included in the EVI suggesting they experienced less

extremes in mental health. No statistical correlation was found between the frequency of forest visits and the level of positive mental health and psychological distress.

It is also important to note that the national survey that is being used as a point of comparison here, i.e. the SLÁN 2007 survey, recorded mean scores of EVI that were higher than any recorded in previous Irish studies (e.g. Blake et al. 2000) and higher than those recorded for Ireland in a Eurobarometer 58.2 survey (European Commission 2006). The timing of the study could be relevant as it was conducted during the economic boom in Ireland. The recession and austerity measures that were being experienced in Ireland at the time the forest visitor survey was conducted might also account for the lower than expected relative EVI and MHI-5 values that were recorded among the forest visitors. As further support to this, a significant correlation between employment status and the level of mental health was noted in this study. Also, it should be noted that this survey was conducted in winter time (November and January). This might have influenced the mental health of respondents as other studies have shown that people generally feel happier in the summer time when the average temperature is greater (MacKerron and Mourato 2013).

Conclusions

This study attempted to investigate the psychological and physical impacts of spending time in forests in Ireland by conducting a questionnaire study targeted at visitors to Irish forests. Unfortunately, the resources which were available limited the data collection to a once-off survey of a sample of forest visitors. Nevertheless the results suggested that forest visitors experience psychological well-being benefits such as “mental relaxation” and “enjoyment and fun”. They also experienced significant improvements in mood immediately after spending time in a forest. The role of the species composition of the forest visited appeared to be less important than other features such as the topography and the view.

The mental health of forest visitors was shown to be poorer, on average, than the general population, although walking in the forests was shown to improve their mood. This finding highlights that where long-term links between health and use of environments (such as forests) are studied, the direction of causation may run either way. No causative link can be attributed with certainty between the number of forest visits and the health of the visitors in this study.

Overall the findings of the study suggest that there are benefits to be gained by improving accessibility to forests in Ireland provided the sites are well managed. The sites are likely to attract more people if there are several attractions such as scenic views and water bodies, in addition to facilities such as car parks.

Further research on the longer-term health benefits of forests should be conducted and should involve large-scale longitudinal studies of visitors and non-visitors to a

range of forests. Surveys of forest visitors that would be undertaken as part of these studies should take place over a range of days and months to account for temporal trends in visitation patterns to forests.

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References

- Arnberger, A. and Eder, R. 2007. Monitoring recreational activities in urban forests using long-term video observation. *Forestry* 80: 1–15.
- Barry, M.M., Van Lente, E., Molcho, M., Morgan, K., McGee, H., Conroy, R.M., Watson, D., Shelley, E. and Perry, I. 2009. *SLAN 2007: Survey of Lifestyle, Attitudes and Nutrition in Ireland*. Mental health and social well-being report, Department of Health and Children. The Stationery Office, Dublin.
- Berman, M.G., Jonides, J. and Kaplan, S. 2008. The cognitive benefits of interacting with nature. *Psychological Science* 19: 1207–1212.
- Berman, M.G., Kross, E., Krpan, K.M., Askren, M.K., Burson, A., Deldin, P.J., Kaplan, S., Sherdell, L., Gotlib, I.H. and Jonides, J. 2012. Interacting with nature improves cognition and affect for individuals with depression. *Journal of Affective Disorders* 140: 300–305.
- Blake, C., Codd, M.B. and O'Meara, Y.M. 2000. The short form 36 (SF-36) health survey: normative data for the Irish population. *Irish Journal of Medical Science* 169: 195–200.
- Bowler, D.E., Buyung-Ali, L.M., Knight, T.M. and Pullin, S. 2010. A systematic review of evidence for the added benefits of health and exposure to natural environments. *BMC Public Health* 10: 456–466.
- Clinch, J.P. 1999. *Economics of Irish Forestry: Evaluating the Returns to Economy and Society*. COFORD, Dublin.
- European Commission. 2006. *Mental Well-being. Special Eurobarometer 248/Wave 64.4 – TNS Opinion and Social*. European Commission, Brussels. Available at: http://ec.europa.eu/public_opinion/archives/ebs/ebs_248_en.pdf [Retrieved September 2013].
- Forestry Commission Scotland. 2015. *A Strategic Framework, Wood in and Around Towns (WIAT) Programme 2015–2020: Phase 4 sustaining delivery*. Available at: <http://scotland.forestry.gov.uk/images/corporate/pdf/wiat-framework.pdf> [Retrieved July 2016].
- Forest Therapy Society. 2013. Available at: <http://www.fo-society.jp/quarter/chubu/agematsu.html> [Accessed, in Japanese, September 2016].

- Hartig, T., Evans, G.W., Jamner, L.D., Davis, D.S. and Gärling, T. 2003. Tracking restoration in natural and urban field settings. *Journal of Environmental Psychology* 23(2): 109–123.
- Hartig, T., Mitchell, R., de Vries, S. and Frumkin, H. 2014. Nature and health. *Annual Review of Public Health* 35: 207–228.
- IBM Corp. 2011. *IBM SPSS Statistics for Windows*, Version 20.0. IBM Corp., Armonk, New York.
- IPAQ (International Physical Activity Questionnaire) 2005. *Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire (IPAQ): Short and Long Forms*. Retrieved from <http://www.ipaq.ki.se/scoring.pdf> [Accessed October 2013].
- Iwata, Y., Ní Dhubháin, Á., Brophy, J., Roddy, D., Burke, C. and Murphy, B. 2016. Benefits of group walking in forests for people with significant mental ill-health. *Ecopsychology* 8: 16–26.
- Kaplan, R. 1983. The role of nature in the urban context. In Altman, I. and Wohlwill, J.F. (Eds.), *Behavior and the Natural Environment*, Plenum Press, New York, pp. 127–162.
- Kaplan, R. and Kaplan, S. 1989. *The Experience Of Nature: A Psychological Perspective*. Cambridge University Press, Cambridge,
- Lavikainen, J., Fryers, T. and Lehtinen, V. eds. 2006. Improving mental health information in Europe. Proposal of the MINDFUL project. Helsinki: STAKES. Available at: www.stakes.fi/pdf/mentalhealth/Mindful_verkkoversio.pdf [Retrieved June 2013].
- Li, Q., Morimoto, K., Kobayashi, M., Inagaki, H., Katsumata, M. and Hirata, Y. 2008. Visiting a forest, but not a city, increases human natural killer activity and expression of anti-cancer proteins. *International Journal of Immunopathology Pharmacology* 21: 117–28.
- MacKerron, G. and Mourato, S. 2013. Happiness is greater in natural environments. *Global Environmental Change* 23: 992–1000.
- Magner, D. 2011. *Stopping by Woods. A Guide to the Forests and Woodlands for Ireland*. The Lilliput Press, Dublin
- Maretzki, T.W. 1987. The Kur in West Germany as an interface between naturopathic and allopathic ideologies. *Social Science and Medicine* 24: 1061–1068.
- O'Brien, L. and Morris, J. 2013. Well-being for all? The social distribution of benefits gained from woodlands and forests in Britain. *Local Environment: The International Journal of Justice and Sustainability* 19(4): 356–383
- Oishi, Y., Kanehama, S., Hiyane, A. and Taguchi, H. 2003. Comparison of forest image and mood: Psychological examination in a forest environment using profile of mood states and semantic differential method. *Japan Forestry Society* 85 (1): 70–77. [In Japanese.]

- Peacock, J., Hine, R. and Pretty, J. 2007. The mental health benefits of green exercise activities and green care. Report for MIND 2007. Retrieved from: www.psykinfo.regionsyddanmark.dk/dwn109161.pdf [Accessed August 2013].
- Plante, T.G., Cage, C., Clements, S. and Stover, A. 2006. Psychological benefits of exercise paired with virtual reality: outdoor exercise energizes whereas indoor virtual exercise relaxes. *International Journal of Stress Management* 13: 108–117.
- Richardson, E.A., Pearce, J., Mitchell, R. and Kingham, S. 2013. Role of physical activity in the relationship between urban green space and health. *Public Health* 127: 318–24.
- SAS Institute Inc. 2011. *Base SAS® 9.3 Procedures Guide*. Cary, NC: SAS Institute Inc.
- Thompson, C.J., Boddy, K., Stein, K., Whear, R., Barton, J. and Depledge, M.H. 2011. Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors? A systematic review. *Environmental Science and Technology* 45: 1761–1772.
- Tsunetsugu, Y., Lee, J., Park, B.J., Tyrväinen, L., Kagawa, T. and Miyazaki, Y. 2013. Physiological and psychological effects of viewing urban forest landscapes assessed by multiple measurements. *Landscape and Urban Planning* 113: 90–93.
- Ulrich, R.S. 1983. Aesthetic and affective response to natural environment. In Altman, I. and Wohlwill, J.F. (Eds.), *Behavior and the Natural Environment*, Plenum Press, New York: pp. 85–125.
- Ulrich, R.S., Simons, R.T., Losito, B.D., Fiorito, E., Miles, M.A. and Zelson, M. 1991. Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology* 11: 201–230.
- Upton, V., Ní Dhubháin, Á. and Bullock, C. 2012. Preferences and values for afforestation: the effects of location and respondent understanding on forest attributes in a labelled choice experiment. *Forest Policy and Economics* 23: 17–27.
- Völker, S. and Kistemann, T. 2011. The impact of blue space on human health and well-being – Salutogenetic health effects of inland surface waters: a review. *International Journal of Hygiene and Environmental Health* 214: 449–460.
- Ward Thompson, C., Roe, J., Aspinall, P., Mitchell, R., Clow, A. and Miller, D. 2012. More green space is linked to less stress in deprived communities: evidence from salivary cortisol patterns. *Landscape and Urban Planning* 105: 221–29.
- Ware, J.E., Snow, K.K., Kosinski, M. and Gandek, B. 1993. SF-36 *Health Survey Manual and Interpretation Guide*. Boston, MA, New England Medical Center, The Health Institute.
- Watson, D., Clark, L.A. and Tellegan, A. 1988. Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology* 54: 1063–1070.