An examination of undergraduate student health behaviours during

their first year at two Scottish Universities

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This thesis is the result of the author's original research. It has been composed by the author and has not been prviously submitted for examination which has led to the award of the degree.

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Abstract

The first year University experience has a significant impact on student's mental health and physial activity behaviours as identified in the findings from these two mixed method studies. Both studies collected data to measure depression, anxiety and quality of life as well as self-report and accelerometer assessed physical activity levels. Data were collected at two Scottish Universities: Heriot Watt University is a rural, campus-based University located on the outskirts of Edinburgh and the University of Strathclyde is a city-centre based university in Glasgow. Study one examined the prevalance of symptoms of mental health and physical activity levels as well as the relationship between these among a sample of students in their second Semester of first year (n = 32, M = 18.6, SD = 0.9 years old). Results suggested that first year male University students (n = 19) were engaging in higher intensities of physical activity associated with better mental health than their female counterparts. It was also apparent that very vigorous intensity physical activity was closely related to lower levels of depressive symptoms. Study one also incorporated semi-structured interviews on a sub-sample of study participants (n = 6). University was identified to have had a negative impact on student's health behaviours which incorporated a negative impact on physical activity levels and dietary behaviours compared to previous behaviours at secondary school. A key finding identified in the qualitative aspect of study one was the perceived reduction in the intensity levels of their physical activity during first year. Students recalled school physical activity levels to be more structured and of a higher intensity. The findings from study one represent student health behaviours at one time point in first year, however research suggests student health behaviours change over time in first year at University; therefore, the aim of study two was to examine the change in mental health and physical activity levels over two time points in first year at University. Participants were recruited at the beginning of Semester 1 of their first year for phase one of data collection (n = 48, M = 18.3, SD = 0.9 years old) and the study had full retention of study participants at the second phase of data collection, which commenced at the beginning of Semester 2 of first year. Findings from this longitudinal study identified significant changes in male and female students' body composition to include increased waist and hip circumference. It was also evident that during Semester 1 of first year at University, students experienced heightened levels of anxiety in comparison to Semester 2, where anxiety levels reduced over the period of first year. This could suggest that intital entry and the transition to the University environment is an anxiety provoking time. Living environment significantly affected students' mental health and physical activity levels where those students who lived in on-campus accommodation had reduced levels of physical activity and mental health than those who lived in off-campus accomodation. The findings from study one and two contribute towards the growing evidence surrounding the physical activity levels and mental health behaviours of young adults, specifically looking at the Scottish University student population. Thus providing researchers and health care professionals with the appropriate information in order to implement suitable interventions to encourage better health behaviours among this specific population.

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For you Mum x

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Definitions of Common Terminology

Student; describes a person engaged in academic learning at University.

First year; describes the first academic year a student is enrolled at University.

Semester; describes the division of the academic year into two Semesters.

Semester 1; describes the first Semester from September to December in a first year University academic year.

Semester 2; describes the second Semester from January to May in a first year University academic year.

On-campus; describes students who live in University Halls of Residence.

Off-campus; describes students who live in any other type of accommodation that is not University associated Halls of Residence.

Chapter 1: Introduction

Participation in regular moderate to vigorous physical activity is identified to significantly contribute towards enhanced levels of health among the general population (World Health Organisation, 2010). The benefits associated with regular physical activity participation have shown to reduce the risk of various diseases related to inactivity. These include cardiovascular disease, diabetes, obesity, as well as aspects related to mental health such as a reduced risk of developing symptoms of depression or anxiety (World Health Organisation, 2010). Therefore, the UK government recommends a minimum of 150 minutes of moderate intensity physical activity over the period of one week to achieve the associated health benefits (Department of Health, 2011). However regardless of these physical activity recommendations and the associated health benefits, physical inactivity remains a worldwide problem, contributing to 6% of worldwide deaths (WHO, 2010). In Scotland, 62% of adults are currently identified as physically active (Scottish Health Survey, 2012), this finding therefore suggests that currently 38% of the Scottish adult population are not meeting the recommended physical activity guidelines for health benefits and are therefore identified as physically inactive.

Physical inactivity not only has a harmful impact on the overall health of the population but it also has a huge economic cost to the National Health Service (NHS) each year. Physical inactivity has been reported to cost the NHS in Scotland approximately £94.1 million from 2010-2011. This highlights physical inactivity related diseases in Scotland to represent 17% of overall NHS costs (Foster & Allender, 2012), emphasising the importance of tackling this significant physical inactivity issue among specific populations.

The adult population relates to those who are aged 16 and over, which includes the ever-increasing University population typically aged between 18 – 24 years old. UK reports from 2010 identified over 2 million students to have gained a University or Higher Education

place, illustrating the significant size of this population. The Annual Population Survey in 2008 also identified 20.7% of the Scottish student population to be physically inactive, this percentage of inactivity significantly increased four years later where 23.1% of Scottish students were physically inactive (Annual Population Survey, 2012). This is a worrying finding suggesting increasing physical inactivity levels among the growing student population. University is seen as an important phase in life that prepares individuals for adulthood and their future careers (Bayram & Bilgel, 2008). Buckworth and Nigg (2004) provide further evidence to support the decline in physical activity levels during adolescence and young adulthood at University. It was identified that the older students had the least physical activity levels due to their higher computer use than the younger entry-level students. This therefore stresses the importance of promoting positive health behaviours among first year University students.

The benefits associated with physical activity also relate to more favourable mental health and well-being benefits such as reduced stress, anxiety and depression levels and enhanced mood, as well as significiantly increased levels of self-esteem (Buckworth & Dishman, 2002). The Department of Health (2004) acknowledges the importance of improving mental health as a significant aspect to better overall health, however in the UK mental health issues have become an area of increasing concern. The National Health Service (NHS) estimates that one in four British adults will experience mental health problems over the period of a year (Singleton, Bumpstead, O'Brien, Lee, & Meltzer, 2001). Mental health issues can exist in a variety of ways where depression, anxiety and stress are the three key mental health concerns most commonly experienced and can hugely change the way individuals think as well as affect their mood or behaviour.

The increasing prevalence of mental health problems has also been identified among the student population through increased student referrals to University Health Services (Andrews & Wilding, 2004). Recent research has also identified a significant increase in the level of mental health problems among the student population (Bewick, Koutsopoulou, Miles, Slaa, & Barkham, 2010). Findings illustrate that 29% of symptom free students develop either anxiety or depression two years into their undergraduate degree (Andrews & Wilding, 2004). These findings share similarities with other recent research (King, Garrett, Wrench, & Lewis, 2011) where first year students who relocated into an on-campus living environment displayed a 60% decline in their mental health. This compares to the 38% decline in those who did not relocate and remained in their pre-University living environment. These findings support the need for further up-to-date research into Scottish University students' physical activity levels and mental health behaviours. This will therefore provide Universities with the appropriate knowledge and understanding of the health behaviours experienced by the student population after enrollment in first year. The identification of the key factors and stages in first year that negatively affect student physical activity levels and mental health behaviours will assist researchers and health professionals develop and implement appropriate physical activity promotion interventions.

The overall aim of this research thesis was to increase the knowledge and understanding of first year University students' health behaviours. In order to do so an initial study examined the relationship between physical activity and aspects related to mental health in first year University students in their second Semester. A second study was then undertaken to explore the changes in students' mental health and physical activity levels over two time points in first year at Unviersity.

Chapter 2: Literature Review

2.1 Physical Inactivity in Adults

Physical activity is defined by the US Department of Health and Human Services as, 'any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above basal (resting) level' (USDHHS, 2008). A majority of the population's daily physical activity is formed through every day light-intensity tasks such as walking from place to place and domestic duties such as vacuuming, dusting or climbing stairs. These low-intensity incidental activities are incorporated into the broader definition of physical activity and are often insufficient for individuals to gain the significant health benefits more closely associated with moderate intensity activities (Kotecki, 2011). However the term 'exercise' indicates pre-planned physical activity that is structured with the intent to improve or maintain physical fitness or performance and gain the associated health benefits. These activities, for example swimming, jogging and exercise classes, tend to demand more effort and are higher in intensity than everyday light-intensity tasks (Kotecki, 2011). The health benefits associated with a physically active lifestyle have been widely researched with findings indicating lower occurrences of various chronic health conditions including coronary heart disease, obesity, diabetes and depression (Bravata, et al., 2007; Foster, Hillsdon, & Thorogood, 2005).

The most up-to-date physical activity recommendations in the United Kingdom for adults summarise different types of activities into a frequency-duration scale, which accounts for the time and number of days spent being physically active over the previous week. In order to meet the current physical activity recommendations an accumulation of 150 minutes of moderate intensity physical activity over a week in bouts of 10 minutes or more is required. Alternatively this recommendation can also be met through 75 minutes of vigorous intensity physical activity a week or through a combination of both moderate and vigorous intensity

physical activity (MVPA). Those classified as inactive are identified as accumulating less than 30 minutes of moderate intensity physical activity a week or less than 15 minutes a week of vigorous intensity physical activity (Department of Health, 2011).

The current physical activity levels reported in Scotland from the Scottish Health Survey in 2012 identified 62% of Scottish adults categorised as over the age of 16 to be active at the recommended level of 75 minutes of weekly vigorous intensity physical activity, with men participating in increased levels of physical activity (67% of Scottish males meeting recommended guidelines) when compared to their female counterparts (58% of Scottish females meeting recommended guidelines) (Scottish Health Survey, 2012). Physical inactivity is not only increasing and threatening the health of the Scottish adult population but evidence has highlighted physical inactivity to cost the NHS in Scotland approximately £94.1 million from 2010-2011 which represents 17% of the overall costs for physical inactivity related diseases in Scotland (Foster & Allender, 2012). Research suggests that future adult behaviours and attitudes towards physical activity and dietary behaviours are adopted during late adolescence and early adulthood (Buckworth & Nigg, 2004). This represents a similar age range for typical University age entry (18 – 24 years old). However previous research identifies a reduction in physical activity participation in the progression from adolescence to adulthood (Sallis, 2000; Zick, Smith, Brown, Fan, & Kowaleski-Jones, 2007). Sallis (2000) conducted a review of the literature of previous cross-sectional and prospective studies. It was identified that the steepest decline in physical activity was between the ages of 13 to 18 and the decline was generally greater in males compared to females. Sallis (2000) did not specially look at University students but identified that the crucial age range prior to University entry had declining physical activity levels, highlighting the need to further investigate the University population at entry to University in an attempt to reduce the physical inactivity levels of future adult generations. It is also important to note that these

studies included in the Sallis (2000) review may now be dated and may not represent the current physical activity levels and patterns of the population and therefore more research is required to represent the current behaviours and specifically look at the University student population.

2.1.1 Physical inactivity in students

The number of students registering for University or Higher Education courses has drastically increased in recent years, with figures from 2010 reporting over two million students gaining University or Higher Education places across various UK institutions (Ayoubi & Massoud, 2012). University is seen as a time of great change for many individuals, it is an important phase in life that helps prepare individuals for adulthood and their future careers (Bayram & Bilgel, 2008). Statistics from the Annual Population Survey in 2012 identified 23.1% of the inactive population in Scotland to represent the student population. This is a significant finding highlighting an increase from findings in 2008, which identified inactivity in students to represent 20.4% of the Scottish population. This increasing prevalence of physical inactivity among this ever-increasing student population is a significant issue, which requires appropriate attention and interventions in order to change these negative physical activity levels from continuing and contributing to further decreases in adult physical activity levels in Scotland.

2.2 Physical Activity Assessment

Reductions in physical activity levels highlight the importance of reliable assessment of physical activity among specific populations in order to accurately assess the behaviours and inform researchers of where these reductions occur. When assessing physical activity it is important to take into consideration the components that make up physical activity as well as distinguish the domain in which physical activity levels occur, this will allow identification of the contributing factors towards physical inactivity and appropriately guide suitable physical activity interventions.

2.2.1 Components of physical activity

There are four components of physical activity including frequency, intensity, time (duration) and type (mode) also known as the FITT principle. Frequency principle relates to how often per day or per week an individual takes part in physical activity, sessions of more than 30 minutes are recommended for health benefits (Townsend et al., 2012). Intensity refers to the rate of energy expenditure of the activity, which can identify the metabolic demand, this can be assessed through objective measures such as heart rate monitoring, accelerometers or subjectively though rate of perceived exertion tests. The time or duration of the activity is usually measured in either hours or minutes and relates to the length of time of the activity. The type of activity can be specifically described such as jogging or cycling, or in physiological terms as aerobic or anaerobic exercise. These components of physical activity are important to take into consideration for a reliable assessment of total physical activity (Strath et al., 2013).

2.2.2 Classification of physical activity

In order to further understand the occurrence of physical activity it is important to recognise that physical activity can be incidental or structured. Physical activities that are unintentional are considered to be incidental, often evident in many daily work-related tasks; domestic

activity includes housework, gardening and daily errands; transport-related activity such as walking or cycling. Structured physical activities evident through leisure time activities are organised activities to encourage health benefits through exercise such as exercise classes or an organised game of football (Caspersen, Powell, & Christenson, 1985). It is important to assess all of these aspects of total physical activity in order to gain a broader understanding of individual physical activity levels (Strath et al., 2013).

2.2.3   Considerations for physical activity assessment

Physical activity is generally assessed through either subjective or objective methods, where a common issue among physical activity researchers is deciding what method to use. This decision is dependent upon various internal and external factors including the purpose of the research, the target population, age range, gender, anticipated sample size, participant burden as well as the resources available and the predicted time frame of the study (Dollman, Okely, Hardy, Timperio, Salmon, & Hills, 2009). These key factors should be taken into consideration before selecting the appropriate physical activity assessment methods.

2.2.4   Subjective physical activity assessment

Subjective methods to assess physical activity are based on the participant's opinion and self-perception of their physical activity levels (Doyle & Iland, 2004). Methods include the use of activity diaries or physical activity questionnaires.

2.2.4.1 Physical activity diaries

This method yields detailed daily activity accounts of participant's physical activity or sedentary behaviours through regular diary entries. The key information required is the type and intensity of the activity being undertaken and the time in which it began and ended. This physical activity assessment method is extremely cost effective and eliminates poor recall limitations, however requires a high level of participant adherence and is more generally used

among smaller research study samples due to the more detailed nature and time needed for interpretation (Dollman et al., 2009).

Physical activity diaries have previously been used by Racette and colleagues (Racette, Deusinger, Strube, Highstein & Deusinger, 2005) to investigate subjective physical activity levels among the University student population. The researchers monitored the changes in physical activity patterns from first year to second year among a student population using a self-report diary to measure changes in aerobic, strength and stretching exercises. Findings from this study identified overall self-reported exercise participation did not change between the two time points, aerobic exercise declined and strength training increased. It is important to highlight that the questionnaire used did not capture small increases in exercises which might be significant to physical activity behaviour changes.

2.2.4.1.1 Ecological Momentary Assessment

Ecological momentary assessment (EMA) self-report diaries have the ability to capture subjective physical activity levels, where participants report their current behaviours at specified time intervals. The detail of the diary can vary depending on the research interest where environmental and social behaviours can be identified, this allows correlates of physical activity levels to be identified. The EMA method has been reported in previous physical activity research as a reliable approach to assess subjective physical activity levels in adolescents (Dunton, Whalen, Jamner, & Floro, 2007; Dunton, Whalen, Jamner, Henker, & Floro, 2005; Gorely, Marshall, Biddle, & Cameron, 2007). Rouse and Biddle (2010) examined 84 undergraduate University students' (66% first year undergraduate students) subjective physical activity levels through EMA diaries, which required participants to write down the main behaviour they were currently undertaking every 15 minutes over a 2-day period. However the study did acknowledge the burden of this highly participant reliant procedure where participant compliance was difficult. This highlights that this assessment

method is a reliable instrument to assess University students' physical activity levels however requires a large amount of participant compliance in order to represent accurate physical activity levels.

2.2.4.2 Physical activity questionnaire

Questionnaires are a traditional and inexpensive method, which can be easily applied to large population samples through manual or electronic self-report means. Self-report questionnaires have the ability to determine the intensity of the activity and the domain in which the activity occurred during a pre-determined amount of days as a way to capture regular physical activity levels, usually ranging from 1 to 7 days of monitoring. Research suggests questionnaires have better recall potential for vigorous intensity physical activity than intensities such as light and moderate (Ainsworth, Richardson, Jacobs, Leon, & Sternfeld, 1999; Jacobs, Ainsworth, Hartman, & Leon, 1993; Strath, Bassett, & Swartz, 2004). Regardless of this issue, questionnaires are acknowledged to successfully differentiate between those who perceive themselves as physically active or inactive among a study sample (Wareham & Rennie, 1998).

2.2.4.2.1   International Physical Activity Questionnaire

The International Physical Activity Questionnaire (IPAQ) is a commonly used self-report recall questionnaire, the long version comprises of 27 items assessing the physical activity levels over the previous 7-days. The long questionnaire assesses five domains of physical activity, which include occupational, transportation, household, leisure time physical activity and sedentary behaviours (Craig et al., 2003). A short version of the IPAQ exists incorporating only 4 items, recommended for use in nationwide research, provides information on four physical activity intensity levels from sitting to vigorous intensity physical activity. Scores on the IPAQ can be converted into a MET (Metabolic Equivalent)

value, which is determined by multiplying the self-reported intensity (walking, moderate or vigorous), duration (minutes) and frequency (days/week) of the activity.

The IPAQ has also been established as a reliable and valid measure for estimating physical activity levels in numerous populations, including University students (Celis-Morales et al., 2012; Craig et al., 2003; Dinger & Behrens, 2006; Dyrstad, Hansen, Holme, & Anderssen, 2013). Irwin (2004) completed a systematic review on the prevalence of physical activity in University students and suggested the IPAQ should be considered for future physical activity assessment studies due to its effectiveness in measuring population wide physical activity levels in 18 to 65 year olds. A study in 2010 by Gow, Trace and Mazzeo also used the IPAQ to assess changes in physical activity levels in first year University students. Previous research confirms the IPAQ to have good construct validity to assess an individual's frequency, intensity and duration of physical activity levels, further endorsed when used alongside objective physical activity monitors (Hagstromer, Oja, & Sjostrom, 2006).

2.2.5 Objective physical activity assessment

Objective methods to assess physical activity levels are observational and therefore not affected by personal opinions, where advances in technology have led to vast improvements in accurately assessing physical activity levels in all age groups (Downs, Van Hoomissen, Lafrenz, & Julka, 2013). Objective physical activity observations have become researcher's preferred physical activity assessment tool predominantly through the use of pedometers and accelerometers (Trost, Pate, Freedson, Sallis, & Taylor, 2000).

2.2.5.1 Pedometers

Pedometers are small motion sensitive devices that provide researchers with an accurate account of objective walking, usually worn close to the waistband (Strath et al., 2013). Although pedometers are relatively cost effective allowing application to large population samples, they do not have the ability to measure intensity and duration therefore limiting

accurate energy expenditure estimation (Strath et al., 2013). Pedometers have been a reliable physical activity assessment method used in previous research studies examining the student population (Kemper & Welsh, 2010; Mestek, Plaisance, & Grandjean, 2008; Sisson, McClain, & Tudor-Locke, 2008).

2.2.5.2 Accelerometers

Accelerometers are one of the most modern technological advances in objective physical activity assessment in children and adults, first examined in the 1950s as a way to assess speed (Saunders, Inman, & Eberhart, 1953). Subsequent research by Morris in 1973 assessed the use of accelerometers in measuring human movement. Currently considered as the gold standard, researchers endorse accelerometers as a valid and reliable method to assess physical activity (Downs et al., 2013). Accelerometers have the capacity to record up to 20 days of data reporting activity counts, steps taken, as well as the intensity, frequency and duration of the physical movement. Depending on the accelerometer model, accelerations can be measured as a uniaxial (vertical plane), biaxial (vertical and either mediolateral or anterior-posterior planes) or in the preferred tri-axial model which has the ability to measure three axes of accelerations (vertical, mediolateral and anterior-posterior planes).

2.2.5.2.1   ActiGraph Accelerometers

ActiGraph accelerometers have been used in research as valid and reliable activity monitors in both studies investigating the physical activity levels of children and adults (deVries, Bakker, Hopman-Rocks, Hirasing, & van Mechelen, 2006). The GT1M, is an example of a uniaxial accelerometer that measures step counts, activity levels and energy expenditure. The latest tri-axial accelerometer (GT3X+) was developed by Sasaki, John and Freedson in 2011, capable of distinguishing accelerations in three planes (vertical, mediolaterial and anterior-posterior) to more accurately measure physical activity.

2.2.5.2.2 Monitor Position

The placement of the accelerometer device is an important aspect to consider because incorrect positioning can result in unreliable assessment. Research has examined various body part placements including the lower leg/ foot, upper leg, lower back, hip, lower arm/wrist and upper arm (Bouten, Sauren, Verduin, & Janssen, 1997). Research comparing different monitor placements suggests accelerometers should be positioned on a participant's hip (right iliac crest) worn on an elastic strap for the most effective recording of whole body physical movement (Trost, McIver, & Pate, 2005).

2.2.5.2.3 Epoch Length

ActiGraph accelerometers are initialised before wear time and downloaded after wear time using the corresponding ActiLife Software. The raw accelerometer data that is produced due to the accelerations and decelerations of body movements is documented as activity 'counts' in either seconds, minutes or total daily counts. These activity counts are calculated over specific time intervals known as an 'epoch', which usually ranges from 10-second epochs to 60-second epochs. This determines how often data is recorded and can be adjusted to suit the needs of the population being examined. Previous research suggests the shorter sample rate of 10-second epochs more accurately record irregular, short bursts of physical activity common in young people when compared to the longer 60-second epoch sample rate (Crouter, Churilla, & Bassett, 2006; Reilly, Penpraze, Hislop, Davies, Grant, & Paton, 2008; Trost, McIver, & Pate, 2005). The total of the activity counts over an epoch is associated with the activity intensity, for example an increased number of activity counts relates to increased intensity. This can then be classified based on the selected intensity cut-points used (Freedson, Melanson, & Sirard, 1998; Matthews, 2005; Troiano, Berrigan, Dodd, Masse, Tilbert, & McDowell, 2008).

2.2.5.2.4 Cut-points

The data collected from an ActiGraph accelerometer device categorises the data into a specific intensity level where cut-points identify whether the participants' physical activity is considered to be light, moderate, vigorous or very vigorous intensity, to provide a better understanding of a participant's energy expenditure. In 2011 Sasaki, John and Freedson examined a sample of adults (19 years old and above) and confirmed the validity of the Freedson Adult VM3 (2011) cut-points using the GT3X+ accelerometer. The cut-points identified light intensity physical activity as 0 to 2690 counts per minute (CPM), moderate activity from 2691 to 6166 CPM, vigorous activity considered as 6167 to 9642 CPM and any activity above 9643 CPM falls into the very vigorous intensity activity category. To put these adult cut-points into context, the cut-points recommended for use with younger populations, Pulsford Children (2011) recommends a sedentary cut-point of 0 to 99 CPM and light activity to be 100 – 2240 CPM, moderate activity as 2241 – 3840 CPM and vigorous activity as 3841 and above counts per minute (Pulsford, Cortine-Borja, Rich, Kinnafick, Dezateux & Griffiths, 2011). This highlights the differences in cut-points for intensities higher than moderate intensity physical activity and the need for careful consideration of the cut-points used depending on the population being examined. It is important to note that there are numerous cut points for both adults and children and to date there has been no universal agreement on which cut points are best to use. The accelerometer data can also be converted into energy expenditure units such as kilocalories or Metabolic Equivalents (METs) and therefore the specific time spent in light (<3 METs), moderate (3-5.99 METs) and vigorous intensity activity (>6 METs) can also be identified.

2.2.5.2.5 Wear time

Wear-time refers to the amount of days the participants need to wear the accelerometer device in order for a reliable account of their daily average physical activity levels. In order to gain a

reliable representation of an individual's habitual physical activity both weekdays and weekends should be included where previous research suggests a minimum of 7 days wear-time (Cain & Geremia, 2011; Troiano et al., 2007; Trost et al., 2005; Van Coevering et al., 2005). This 7 day recommendation takes into consideration participant burden, accelerometer memory capacity and battery life. Accelerometer wear-time also takes into account the amount of daily time the participant needs to wear the device for in order for a valid wear-day. Wear-time of 10 hours (600 minutes) a day is recommended to accurately gain an insight into participant's characteristic physical activity levels (Cain & Geremia, 2011; Hagstromer et al., 2007; Troiano et al., 2007; Troped et al., 2007). Cain and Geremia (2011) recommend at least 8 hours (480 minutes) of recorded wear time on at least one weekend day to be included as a valid wear time day. The inclusion of the initial day of measurement can be incorporated if the wear time period accumulated is a minimum of 383 minutes (Troped et al., 2007). In contrast to these wear-time periods, research by Trost and colleagues has previously suggested a minimum data collection of 8 hours (480 minutes) per day over a period of only 4 days (Trost, Pate, Freedson, Sallis, & Taylor, 2000) however the purpose of the study by Trost and colleagues was to measure the objective physical activity levels in children where a time of 8 hours would adequately identify school and after-school behaviours. However due to the more un-structured nature of a University day it would be beneficial to implement the longer wear time in order to accurately gauge University students' daily physical activity levels.

2.2.6 Physical activity assessment interviews

Qualitative interviews within the area of sport science has been a widely used assessment method to help provide a more thorough understanding of individual's previous experiences and gain an insight into their motivations and barriers towards taking part in physical activity (Thomas, Nelson, & Silverman, 2005). Interviews can provide detailed information when

there is a lack of previous research in that particular topic area or population group, through gaining a deeper understanding of the participant's point of view and listening to the participant's responses and feedback (Creswell, 2003). Interviewing is a very common technique often used in many small-scale research studies due to its flexible nature and its suitability for an extensive range of research purposes. Interviews are commonly recorded where transcription of the recorded data allows the researcher to completely immerse themselves in the data allowing them to gain a further understanding of each participant's previous experiences. The benefit of incorporating the interview aspect for research purposes provides the researcher with a deeper understanding of the research findings, allowing interaction between the researcher and the interviewee. While it can be a reflective and stimulating process for the participant, it can also allow the researcher to capture body language and explore reasons behind specific behaviours. Research suggests that qualitative research is generally more comprehensive and undertaken with fewer participants than quantitative research; therefore it has been recommended when possible to use both types of research, where qualitative research is used as a follow-up to the quantitative data collection in order to confirm some of the key findings (Drever, 2003). Milroy and colleagues (2012) used a qualitative approach as a way to gain a further understanding of physical activity promotion within the student population. Twenty-two University employees were interviewed using a semi-structured interview approach where results confirmed that the responses to the interview questions provided the researchers with a broader understanding of student physical activity promotion. This study also concluded that through the qualitative aspect three key themes emerged; key personnel responsible for promoting physical to students, actual physical activity promotion efforts implemented and factors that influence student physical activity promotion. These themes demonstrate the importance that this type of research holds (Milroy, Wyrick, Bibeau, Strack, & Davis, 2012). Various types of interview approaches

exist to include structured, unstructured and semi-structured interviews. Typically the most common approach used in understanding physical activity levels is a semi-structured interview.

2.2.6.1 Semi-structured interviews

The semi-structured approach allows the interviewer to create a general interview outline and determine the main questions or topics that are to be covered in the interview. This allows the interview structure to progress throughout the interview allowing the participant to respond in as much detail as they like. If expansion or clarification is needed on certain questions the interviewer can elaborate by incorporating prompts or follow-up questions to gain further understanding of the answer allowing a more interactive approach (Drever, 2003). Semi-structured interviews are best suited to research that requires a further understanding of specific research areas of interest but also provides the opportunity to gain a deeper interviewee perspective on the research topic of interest through appropriately allowing topical trajectories in conversation. However it is not uncommon for methodological limitations to exist within qualitative research interviews, where it can be evident that the interviewee will respond in a way they think the interviewer wants to hear, if the interviewer's own views subtly come across it can often influence the participant's responses. It is also common for participants to want to portray themselves in a better light, this is known as 'social desirability' where participants may answer how they think they should answer and be unreliable for the research. It is also evident that due to the more detailed nature that interviews possess, make them a more time-consuming technique to employ, where a 45-minute interview can often take 4-5 hours to transcribe, which is why it is often more common in research to apply a mixed-method approach and interview a sub-sample of the population sample.

2.2.7 Physical activity assessment in University students

Dinger and Behrens (2006) compared the reliability of subjective and objective physical activity assessments in 123 University students. Objective accelerometer data was compared with subjective IPAQ self-report physical activity data, where results illustrated student participants to subjectively report higher levels of moderate and vigorous intensity physical activity when compared with corresponding accelerometer data. This finding suggests that previous self-report studies examining University student's physical activity levels may have overestimated these physical activity levels (Bray & Born, 2004; Downs & Ashton, 2011), therefore highlighting the importance of incorporating both subjective and objective physical activity assessments.

A similar finding of this over-estimation of self-report physical activity levels was evident in research by Downs, Van Hoomissen, Lafrenz and Julka (2013) who investigated the implications of objective accelerometer based data using the GT3X+ and subjective self-report data using the IPAQ in college students. Findings from this study identified participants to report significantly higher levels of moderate-vigorous intensity physical activity (MVPA) when compared to the objectively recorded MVPA accelerometer data. This finding was evident in both males (Males $M = 82.85$, $SD = 63.83$ IPAQ MVPA minutes/day) and females ($M = 53.09$, $SD = 48.9$ IPAQ MVPA minutes/day), where self-report physical activity levels were significantly higher than the corresponding objectively-measured accelerometer data for males ($M = 24.22$, $SD = 20.71$ Accelerometer MVPA minutes/day) and females ($M = 15.82$, $SD = 14.4$ Accelerometer MVPA minutes/day). These findings highlight this sample of students to be self-reporting more than three times MVPA than that objectively recorded by accelerometers. This study highlights the limitations of solely using subjective physical activity data to measure students' physical activity levels, however it is important to include subjective assessment as it provides researchers with data based on

students' perception of their behaviours. This is an important aspect to identify when planning appropriate interventions to implement in a University setting. It also illustrates the importance for future research to incorporate both subjective and objective physical activity assessment methods in order to gain a greater understanding of student physical activity levels.

A recent UK study examining physical activity levels in University students, measured subjective activity data from the self-report Leisure-Time Exercise Questionnaire (LTEQ) and the IPAQ and compared the data with objective assessment methods using a combined accelerometer and heart rate monitor measure (Loney, Standage, Thompson, Sebire, & Cumming 2011). Conclusions identified both self-report questionnaires to be useful in assessing individual's perceptions of their physical activity levels as opposed to their actual physical activity, which can be more accurately assessed through objectively-measured physical activity where actual intensity, frequency and duration of activity can be recorded (Reilly, Penpraze, Hislop. Davies, Grant, & Paton, 2008). Hasgstromer, Oja and Sjostroom (2006) further advocate self-report methods to assess physical activity when used alongside objective physical activity assessment methods.

2.2.8 Physical activity assessment summary

Physical activity can be assessed through various subjective and objective measures and it is evident that these measures can help researchers identify those populations who are physically inactive. Through the various assessment methods researchers can therefore effectively employ appropriate intervention strategies in order to encourage increased physical activity levels among those who are inactive. A key advantage subjective physical activity assessments have over other objective measures is their ability to illustrate the specific domain of the physical activity levels being undertaken such as housework or active travel, which can be extremely useful when trying to implement intervention strategies among

a specific population. However objective physical activity assessment tools have been found to be valuable for use in intervention studies to encourage increased physical activity participation and more accurately measure actual physical activity level. This highlights the importance of combining both subjective and objective physical activity assessments to provide rich data on the physical activity levels in a student population.

2.3   Physical Activity Levels in University Students

There is a current lack of Scottish physical activity research examining the University student population, however previous longitudinal research by Irwin (2007) looked at physical activity maintenance in a sample of 392 University students using the Physical Activity Guidelines for Health (PAGH) questionnaire over the period of one month. Findings from this study identified only 35% of students maintained the recommended physical activity guidelines of a minimum of 30 minutes moderate intensity physical activity on five or more days a week. A key limitation of this study is that it does not describe what year or time of year the one month period of data collection took place, however this study highlights the significant negative impact the University experience can have on the physical activity levels of the student population, where effective interventions are essential in order to increase physical activity levels in students to the levels required for health benefits. Research in the US by Mailey and colleagues (2012) examined female students' self-report and accelerometer measured physical activity levels (n = 164) from baseline, measured upon entry to first year at University and compared these levels with follow-up data collected at the end of first year. Findings from this study identified a significant reduction in both subjectively and objectively-measured physical activity levels from entry to University to those measured at the end of first year. The self-report findings identified a reduction in GLTEQ score (Godin Leisure Time Exercise Questionnaire; Godin & Shephard, 1985) from baseline (M = 79.8, SD = 46.3 MET min/week) to follow up (M = 70.9, SD = 43.6 MET min/week) indicating that female students perceived a reduction in their physical activity levels over the course of first year at University. This reduction was also apparent in students' objectively-measured physical activity levels assessed through accelerometry upon entry (M = 84.1, SD = 38.5 MVPA/min) until the end of first year (M = 74.3, SD = 31.1 MVPA/min). These findings highlight the significant change in female students' physical activity levels over the course of

first year at University, suggesting more research needs to be conducted in order to further identify the impact first year has on male students' physical activity levels. More recently, Rouse and Biddle (2010) examined physical activity levels among a sample of University students across all undergraduate years using physical activity diaries (Ecological Momentary Assessment). The findings identified that female students (n = 38, M = 19.5 years old) were not currently meeting the recommended physical activity guidelines of 30 minutes or more on 5 days of the week for health benefits (M = 21.7, SD = 37.1 minutes) compared to the male student sample (n = 46, M = 20.2 years old) who were successfully meeting the guidelines (M = 38.8, SD = 68.5 minutes). This highlights the University undergraduate student population to be an at risk population for reduced physical activity levels, specifically among the female population. This suggests a need for interventions to be put into place in University campuses in order to reduce the risk of further physical activity reductions among this population. Various factors can affect the health behaviours of students who enter University as a first year student, the most common can exist within gender differences where male and female students demonstrate different physical activity habits upon entry to the University environment.

2.3.1 The effect of gender on student physical activity levels

The issue of gender differences in relation to physical activity levels is not a new finding and previous research has identified males to generally be more physically active than females (Casperson, Pereira, & Curran, 2000; Dinger & Behrens, 2006; Ozdol, Ozer, Pinar, & Cetin, 2012; Rouse & Biddle, 2010; Trost et al., 2002). Findings have identified school age gender differences with evidence that boys are more active in school curriculum physical education classes compared to girls (Health Survey England, 2012). Research into the student population has identified that these behaviours have continued into later life, with research findings identifying the male student population to be more physically active than their

female counterparts (Dinger & Behrens, 2006; Ozdol, Ozer, Pinar, & Cetin, 2012; Rouse & Biddle 2010). Down and colleagues (2013) identified a significant difference between male and female student physical activity levels using both subjective and objective physical activity measurement methods. Male students reported significantly higher self-report moderate-vigorous intensity physical activity (MVPA) levels using the IPAQ ($M = 82.85$, $SD = 63.83$ IPAQ MVPA minutes/day) compared to the female student sample ($M = 53.09$, $SD = 48.90$ IPAQ MVPA minutes/day). These findings corresponded with the accelerometer data collected, illustrating male students to be participating in higher levels of MVPA ($M = 24.22$, $SD = 20.71$ Accelerometer MVPA minutes/day) than female students ($M = 15.82$, $SD = 14.40$ Accelerometer MVPA minutes/day). These findings not only highlight the significant gender differences evident at University where the study sample had a relatively even distribution of male (n = 37) and female (n = 35) student participants, but also the vast difference evident between subjective and objective findings, highlighting the importance of incorporating both measurement methods within research when possible. These objective physical activity findings also highlight this student sample not to be meeting the recommended 30 minutes of moderate intensity physical activity required for health benefits, further highlighting the student population to be at risk for further reductions in physical activity levels.

Another recent study looking at the self-report physical activity levels of 2,630 University students using the IPAQ identified gender differences in 'high' intensity levels of physical activity considered as >1,500 MET min/week over a minimum of 3 days a week of 30 minutes. Findings identified females (31.4%) to have lower levels of 'high' intensity physical activity compared to their male counterparts (48.8%) (Bergier, Kapka-Skrzypczak, Bilinski, Paprzycki, & Wojtyla, 2012). The study also identified only 20.8% of the student participants to be partaking in low levels of physical activity, categorized as <600 MET min/week. These findings suggest that not only the student female population to be describing their physical

activity levels to be lower than male students but as a whole this sample were reporting low levels of physical activity. Reinforcing this population to be an at risk population for increased levels of physical inactivity.

Longitudinal research by Irwin (2007) investigating University students physical activity levels at two-time points (1-month between baseline and follow-up) identified significant gender differences between those students who were insufficiently active (n = 150) at follow-up. Findings identified 66% of the female student sample to be insufficiently active one month after baseline compared to the lower percentage of 34% for insufficiently active males. These finding demonstrate that student females have more prevalent levels of insufficient activity compared to their male counterparts. However findings still indicate a third of the student male sample to have insufficient physical activity levels, further endorsing the need for appropriate physical activity interventions to promote increased levels of physical activity specifically among the female population whilst continuing to encourage increased physical activity among the male population. The change in living environment apparent at University can also have a significant effect on students' physical activity levels. For example those students who relocate to on-campus accommodation in first year may demonstrate different physical activity levels to those students who remain living at home or choose to live in off-campus accommodation.

2.3.2   The effect of living environment on student physical activity levels

In addition to the gender differences associated with physical activity levels it is also apparent that living environment can significantly impact on students' physical activity levels. The most common living environment evident in the transition to University in first year is living in on-campus accommodation known as Halls of Residence. This type of accommodation is convenient for those students who are relocating to attend University or are from overseas. The alternative option for students if applicable is to remain living at home or organising

alternative accommodation off-campus. A study by King, Garrett, Wrench and Lewis (2011) examined the impact of student's change in living environment in the transition to University in a sample of 132 first year University students using an online survey. The surveys were completed in student's second Semester of first year (2010) and comprised of closed demographic questions with open-ended questions related to students' perceptions of and the factors that affect physical activity levels during the transition to University. It was identified that 33% of the student sample relocated and experienced changes in their living environment in the transition to first year at University. Findings identified a larger reduction in physical activity levels in those students who relocated (M = -47% physical activity reduction) compared to those who did not relocate (M = -33% physical activity reduction). However it must be taken into consideration that these findings came from an Australian University where a different quality of life and University experience could be evident. However these findings still highlight the significant negative impact relocating and living in on-campus accommodation could have on University students' physical activity levels.

Irwin (2007) looked at the maintenance of sufficient physical activity levels for health benefits in a sample of University students (n = 82). Findings from this study identified 86.6% of students who lived in off-campus accommodation maintained sufficient physical activity levels, which was significantly higher than those students who lived in on-campus accommodation (13.4%). This suggests that living in on-campus accommodation can have a detrimental effect on student physical activity levels. However it must be noted that these findings are illustrated from subjective physical activity questionnaire data, and therefore for a more reliable and accurate comparison of on- and off-campus living environments it would be beneficial to incorporate objective physical activity measurement.

Mailey and colleagues (2012) looked at the physical activity changes in first year female University students who resided in on-campus University accommodation. Physical activity

was assessed subjectively through a self-report questionnaire (Godin Leisure-Time Questionnaire; Godin & Shephard, 1985) and also included objective physical activity measures using Actigraph accelerometers. Baseline data were collected in students' first week on campus and identified a significant reduction in both subjectively and objectively-measured physical activity compared to follow-up, which took place at the end of students' first year. Findings identified a significant reduction in not only subjectively-measured self-report physical activity levels (M = -8.87, SD = -2.74 MET min/week) but also a reduction in objectively-measured physical activity levels (M = -9.89, SD = -9.37 MVPA min/week). These findings highlight the negative impact living in on-campus accommodation can have on first year University students' physical activity levels. The impact of changing living environment in the progression to University has also identified induced levels of smoking, alcohol consumption and less favourable dietary behaviours in those students living in independent living environments evident in halls of residence compared to those living at home (Beasley, Hackett & Maxwell, 2004).

2.3.3 The effect of University on the physical characteristics of students

The prevalent increase in obesity levels could suggest overweight children and adolescents are likely to become obese as adults, leading to the increased risk of developing the associated diseases such as diabetes or heart disease (Freedman et al., 2009). This concern is heightened through research indicating negative changes in the student populations' physical activity levels and the adoption of unhealthy dietary habits, which are the characteristic health behaviours that contribute towards unfavorable changes in body composition and weight gain.

Previous research has identified the transition into first year at University to be a crucial time for unhealthy weight gain. In America this topic of weight gain during first year is known as the 'Freshman 15' (Brown, 2008) which suggests first year University students ('Freshman')

gain 15 pounds (lbs.) related to changes in behaviours to include increased food intake and reduced physical activity levels (Hoffman, Policastro, Quick, & Soo-Kyung, 2006). This idea has been heavily researched among American Universities to identify the prevalence of weight gain among this population. Although a majority of the related research does identify an increase in weight in the transition to University, no study has identified a weight gain equivalent to the suggested 15lbs., which equates to 6.8kg (Pullman et al., 2009). Previous research has identified an average weight gain of up to 2.3kg over the course of first year, which is considerably lower than the concept of the 'Freshman 15' (Anderson et al., 2003; Delinsky & Wilson, 2008; Hoffman et al., 2006; Racette et al., 2005).

Pullman and colleagues (2009) examined the weight gain during first year at University in a sample of male students (n = 108) at three time points to include prior to University entry, Semester 1 and Semester 2. Findings from this study identified an increase from data collected prior to University in students' BMI (M = +0.8, SD = 0.0 kgm^2), waist circumference (M = +3.0, SD = 0.1 cm) and hip circumference (M = +1.3, SD = 0.1 cm) to the data collected in Semester 2 of first year. These findings were also evident when the data is compared from Semester 1 to Semester 2 of first year, where increases were identified in BMI (M = +0.4, SD = 0.0 kgm^2), waist circumference (M = +1.0, SD = 0.1 cm) and hip circumference (M = +1.3, SD = 0.1 cm). This highlights first year to be a time of changing body composition and weight gain, although this study principally examined the first year male student population where it would be beneficial to identify the prevalence of this issue among the female student population in order to identify gender differences at the three time points in University.

Gropper and colleagues (Gropper et al., 2011) investigated the changes in body composition in both male and female students upon entry to the University environment. Data were collected at the beginning of first year and compared with the data collected in the same

sample of students at the beginning of second year. Findings identified an overall increase in waist circumference in the total sample of students (M = +0.9, SD = 4.0 cm) from first year to second year at University. Further findings into this study sample identified males to have a higher change in waist circumference (M = +2.4, SD = 2.8 cm) compared to their female counterparts (M = +0.2, SD = 4.3 cm) over the two time points of data collection. These findings emphasise that the first year University population do experience negative changes in their body composition during the transition to University, with further analysis specifically indicating the male population to be have higher weight gains and changes in body composition compared to the female population. The current lack of Scottish research evidence reporting the weight gain of the student population highlights the need for further research in order to identify the prevalence rates among this population, this will provide researchers with more accurate information regarding the male and female student population and help implement appropriate interventions to reduce these levels.

2.3.4 Interventions to increase student physical activity levels

The evident reduction in physical activity levels in University students has prompted the implementation of various physical activity promotion interventions as a way to change these behaviours. Melton, McDaniel and Langdon (2013) developed a Physical Activity Passport (PAP) as an intervention to increase student's physical activity levels through combining student life with academics. The PAP intervention was implemented as a University assignment where printed physical activity logs recorded physical activity levels that were signed off by fitness class instructors or sports captains, with the aim to increase physical activity levels outside academic study. Findings identified that those students who took part in the PAP intervention attended four times as many group fitness classes (M = 6.98, SD = 0.38 number of fitness classes/week) than those students who were in the control group (M = 1.48, SD = 0.26 number of fitness classes/week). Findings from this study highlight the

positive changes in physical activity levels through the implementation of a low-cost intervention to promote participation in physical activity. The findings from this study can be used to help researchers develop future interventions to encourage positive physical activity levels outside academic learning.

Similarly, a study by Melynk, Kelly, Jacobson, Arcoleo and Shaibi (2012) implemented an intervention to improve physical activity and mental health among first year University students. The intervention was known as Freshman 5 to Thrive: COPE (Creating Opportunities for Personal Empowerment)/ Healthy Lifestyles. Those in the COPE intervention group were enrolled on a course that taught students skills on how to be successful at University and in their general lives. Emphasis was put on appropriate nutrition and physical activity promotion through pedometer logs and organised weekly physical activity sessions as well as encouragement for engaging in additional sessions. The control group did not receive the Healthy Lifestyle intervention course but all participants completed the same questionnaires at baseline (first year) and post intervention (second year) to include the Beck Youth Inventory (BYI; Beck, Beck, Jolly, & Steer, 2005). Additionally, the intervention group received pedometers to measure their physical activity changes. The findings from this study identified those students who took part in the COPE intervention reported decreases in depression ($M = 48.3$, $SD = 6.8$ BYI depression score) and anxiety from baseline ($M = 50.0$, $SD = 8.5$ BYI anxiety score) to post intervention ($M = 46.28$, $SD = 6.8$ BYI depression score; $M = 45.2$, $SD = 6.0$ BYI anxiety score). There was also an evident increase in physical activity levels in the intervention group in weekly steps taken which increased from baseline ($M = 62,892$, $SD = 24,409$ weekly steps taken) to post intervention ($M = 92,000$, $SD = 44,557$ weekly steps taken). However in order to more accurately identify the impact of the physical activity intervention it would have been useful to provide the control group with pedometers at both time points in order to fully identify the difference

between the control and intervention groups. It must also be noted that the study had a low student participation rate of only 36 first year students (n = 29 COPE intervention students) at a large US University. This intervention would benefit from incorporating a larger proportion of the student body in order to more accurately assess, as well as promote, positive physical activity and mental health behaviours. These interventions provide an insight into the positive impact appropriate physical activity interventions can have on not only students' physical activity levels but also contribute towards better mental health and healthier lifelong behaviours.

2.3.5 Student physical activity levels summary

On consideration of these previous research findings it is apparent that University students are an at risk population for reduced physical activity levels upon entry to the University environment. Unlike the compulsory Physical Education classes incorporated into the highly structured Secondary school curriculum, the more unstructured nature of University life allows students to make more independent choices about their physical activity levels. However the lack of Scottish physical activity data among University students highlights the need for further research into this specific population, where it is important to identify the key factors associated with these reduced physical activity levels. The identification of the key factors that affect student physical activity will assist researchers and health professionals to develop and implement appropriate physical activity promotion interventions as a way to increase student physical activity levels. Further research into the Scottish student population is needed in order to reduce the prevalence of these physical inactivity behaviours of our future adult generations and attempt to reduce increases in physical inactivity related illnesses and encourage a better physical and mental health associated with physical activity participation.

2.4 Student Mental Health and Mental Well-being

Mental health issues in the UK have become an area of increasing concern in recent years, with reports from the National Health Service (NHS) estimating that one in four British adults will experience mental health problems over the period of a year (Singleton, Bumpstead, O'Brien, Lee, & Meltzer, 2001). As previously mentioned physical activity relates to more favorable physical health benefits but is also related to the mental health and psychological well-being benefits associated with regular physical activity participation.

It has also been reported that UK mental health is significantly poorer than the rest of Europe (Jessop, Herberts, & Solomon, 2005). Buckworth and Dishman (2002) identified the positive effect physical activity has on stress, anxiety, mood and depression, as well as increased levels of self-esteem. Research has also identified a prevalent increase in the level of student mental health problems among this ever-increasing population (Bewick, Koutsopoulou, Miles, Slaa, & Barkham, 2010). This cause for concern is heightened as research indicates student mental health symptoms significantly increase throughout the period of their degree course when compared to previous mental health symptoms. This indicates the need for further research within the UK into the factors that cause psychological distress within the student population, as well as looking into the methods used for measuring student mental health.

2.4.1 Mental health and well-being

'Mental health' is a term commonly used to describe mental well-being, mental illnesses or disorders, as well as all other states of mental health (UK Faculty of Public Heath, 2010). The WHO first described mental health in 1948 as, 'a state of well-being in which every individual realises his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community'

(WHO, 2005). The awareness of mental health has vastly increased over recent years, where the UK government has placed priority on mental health initiatives. The Department of Health (2004) released a statement to highlight the importance of improving mental health as an essential aspect to good overall health. This issue has also become an area of concern among the student population due to the increasing prevalence of student referrals to University Health Services (Andrews & Wilding, 2004).

2.4.2 Types of mental illness

The term mental illness incorporates all diagnosable mental disorders (USDHHS, 1999), which lead to impaired functioning due to changes in our thinking, mood or behaviour. Depression, anxiety and stress are the three key mental health concerns commonly experienced by students in their early years of study at University (Bayram & Bilgel, 2008).

2.4.2.1 Depression

Depression is an increasingly common type of mental illness, which is evident when someone demonstrates a negative mood change. Kotecki (2011) describes that everyone will experience a depressive phase in his or her life due to difficult experiences such as a close friend or family member dying or personal suffering from an illness. These feelings can be expressed as sadness or hopelessness and usually decrease over time, however it is when these feelings exist for a prolonged period of time that causes serious concern (Kotecki, 2011). A chronic but mild form of depression exists as dysthymia (dysthymic disorder), which can be apparent for anything beyond two years, often leading to increased vulnerability to major depression disorder (MDD). Major depression is a serious illness identified as one or more major depressive experiences over a period of two weeks due to the inability of an individual to function properly and can possibly lead to suicide. Bipolar disorder is another form of depression also known as manic depression, which can be identified by occurrences of unusually prominent irritable mood followed by signs of reduced self-esteem, fatigue and

an unfocussed nature. The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) is a manual used by mental health professionals to classify mental disorders, major depressive disorder (MDD) and other forms of depression. Many individuals will experience the depressive effect due to bereavement or towards adjustment when someone has clinically significant symptoms but does not meet the criteria for a mood or anxiety disorder (Brosse, Sheets, Lett, & Blumenthal, 2002).

2.4.2.2 Anxiety

Anxiety is a common emotion felt by everyone at some point in life in situations of fear or dread, however it can have a beneficial effect on people as an incentive to do something. This effect is known as the 'fight or flight' physiological response, an acute response of worry or tension due to a fear-producing situation. However when prolonged periods of these fearful feelings exist that begin to interfere with work or personal life, this is when an individual would be clinically diagnosed as having generalised anxiety disorder (GAD). GAD is a common form of anxiety evident in 1 in 20 adults over a lifetime, often more predominant among women (NHS Direct, 2006). Anxiety can exist as either state or trait anxiety. State anxiety (transitory) is identified as temporary feelings of fear or nervousness due to a situation, whereas trait anxiety (enduring) is characterised by regular daily feelings of stress and worry over a longer period of time (Spielberger & Sydeman, 1994).

2.4.2.3 Stress

Stress is a normal feeling experienced throughout life when challenges are presented or in times of change. Stress includes both a mental reaction known as a stressor, which can exist in the form of financial concerns, academic pressures, social situations or life events. The physical reaction to a stressor is known as a stress response, which is how we manage and adjust to stress and stressful situations, an essential aspect that can impact on our mental and physical health and well-being. The extent to which these stressors affect an individual is

determined by the personality and emotional strength of that individual as well as the techniques they use to cope (Monk & Mahmood, 1999). Stroebe and Stroebe (1995) identified social support to have a beneficial effect on stress control in individuals, highlighting the need to remove the stigma attached to mental health conditions. The Department of Health (2004) identified stress to be the most common reported form of sickness among the population, highlighting the importance of prioritising mental health initiatives across the UK.

2.4.3   Assessment of mental health

Mental health has become an area of increased concern in recent years, therefore it is important to have reliable assessment methods, which exist in the form of questionnaires and interview protocols. The DSM-IV is a commonly used manual by health professionals to provide the main criteria for classifying a mental disorder (American Psychiatric Association [APA], 1994).

2.4.3.1   Questionnaires

Questionnaires are a useful tool to gain a high response rate and can be a quick and easy method for researchers to employ as they can be easily distributed to masses of individuals through the post or more recently distributed electronically via email.

2.4.3.1.1   Hospitality Anxiety and Depression Scale

A frequently used questionnaire to assess clinical anxiety and depression is known as the Hospitality Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983). It is a self-report questionnaire comprising of seven items relating to anxiety (e.g., I get a frightened and feel like I have butterflies in my stomach) and seven questions relating to depression (e.g., I have lost interest in my appearance). Answers consist on a four point Likert scale; 0= not at all, 1= not often, 2= quite a lot, 3= definitely. Scores are calculated where a score of 0-7

signifies no presence of clinical symptoms, 8-10 indicates mild symptoms whereas a score of 11-14 would demonstrate moderate symptoms of depression and anxiety and a score of 15-21 indicates severe symptoms. Crawford, Henry, Crombie and Taylor (2001) published UK norm data for HADS depression as 3.68 and HADS anxiety as 6.14 out of a maximum score of 21. Previous research suggests that the HADS is a widely used and valid measure of depression and/or anxiety among the student population (Andrews & Wilding, 2004; Mailey et al., 2012; Tyson et al., 2010).

2.4.3.1.2 Depression Anxiety and Stress Scale

The Depression Anxiety and Stress Scale (DASS-42) has successfully been used among a student population (Bayram & Bilgel, 2008) and can be used as an effective way of measuring all three aspects with questions relating to depression (e.g., I couldn't seem to experience any positive feeling at all), anxiety (e.g. I had a feeling of faintness) and stress (e.g., I tended to over-react to situations). The 42 item self-report questionnaire has a Likert scale of 0 (Did not apply to me at all) to 3 (Applied to me very much/ most of the time). The scores of the three subscales are totaled and the severity rating of the individual is identified. A 'normal' score equates to 0-9 for the depression scale, 0-7 for anxiety and 0-14 for stress, whereas 'extremely severe' scores are identified as 28+ for depression, 20+ for anxiety and 34+ for stress (Lovibond & Lovibond, 1995).

2.4.3.1.3 Beck Depression Inventory

The Beck Depression Inventory originates from 1961 and consists of 21 items with a Likert scale ranging from 0 (I do not feel sad) to 3 (I am so sad I can't stand it) and is used to measure clinical depression in individuals (Beck, Ward, Mendelsohn, Mock, & Erbaugh, 1961) where a score of 0-9 indicates minimal depression and a maximum score of 30-63 represents severe depression.

### 2.4.3.1.4	Quality of Life Short Form-12

Quality of life can be assessed in individuals through the Short-Form-12 (SF-12), a four-week recall 12-item self-report questionnaire developed by Ware, Kosinki and Keller (1996) used to assess aspects of overall health-related quality of life, including an individual's physical and mental health. The SF-12 is a shorter version of the SF-36, where previous research confirms the SF-12 as an appropriate method for assessing health-related quality of life (Gandek et al., 1998; Ware, Kosinki, & Keller, 1996). The SF-12 is a 12-item scale with six questions relating to the Physical Component Score (PCS) for example, 'Does your health limit you in moderate activities such as climbing several flights of stairs? If so how much?' with a Likert scale that varies for each question, for example, 'All of the time, Most of the time, Some of the time, A little of the time or None of the time'. Six questions are related to the Mental Component Score (MCS), for example, 'How much of the time during the past 4 weeks have you felt calm and peaceful?' The scoring of the twelve questions related to the Physical and Mental Health are calculated and range from 0% to 100% where a Total Average Score (%) is calculated, a higher % score on the SF-12 represents a higher level of physical and psychological health. Previous research by Adler, Raju, Beveridge, Wang, Zhu and Zimmermann (2008) identified the SF-12 to have good reliability and validity for assessing health related quality of life among the student population.

### 2.4.3.2	Interviews

Qualitative research incorporating interviews by a trained professional such as a psychologist or psychiatrist are known as the gold standard in the clinical assessment of major depressive disorders and the differentiation from associated mood disorders (Brosse et al., 2002). The Structured Clinical Interview for DSM-IV (SCID) is a commonly used semi-structured interview (First et al., 1995) and the Composite International Diagnostic Interview (CIDI) developed by the World Health Organisation (WHO) in 1990 is a frequently administered

fully structured interview established for implementation in extensive epidemiological studies (Brosse et al., 2002). Fox (1999) confirms the validity of the use of interviews as a way to assess depression in individuals. Clinician-rated scales have been created to allow identification of the severity of depression in an individual ideally after observation and interviews such as the Hamilton Rating Scale for Depression (HRSD). The scale consists of 21 items to include items related to depressed mood, anxiety psychological, anxiety somatic and paranoid symptoms where scores are rated from 0 to a maximum of 4, where a higher total score relates to a severer case of depression (Hamilton, 1960).

2.4.4 Transition to University

University students encounter numerous obstacles and experience a huge amount of change when they progress from the highly organised and controlled setting of secondary-school to the more relaxed and self-motivated environment apparent at University (MacNamara & Collins, 2010). Schlossberg's Model for Analysing Human Adaption to Transition identifies three key transition factors to include; *individual* factors, *awareness* of specific transition and the main features of the *pre- and post- transition* situations (Schlossberg, 1981). This model can be used to link the transition a student goes through when registering at University. The individual factors that influence the transition adaption include the qualities the student possesses to include their gender, age, psychosocial competence and their previous experience with a similar transition situation (e.g., previously moved homes and changed schools) will gauge how well they transition into the University environment. The characteristics related to the awareness of the transition include aspects of role change, duration and degree of stress. Lenz (2001) describes the transition Secondary school students experience in the transition into young adulthood to include role change, the duration of the transition is one of temporary nature and the degree of stress experienced is largely dependent

on the key individual factors and the pre- and post- transition changes. The pre- and post-transition describes the environment evident before the transition and the environment evident afterwards as the interpersonal support system, which includes close family and friend relationships. This also includes the change in the physical environment, evident in the change in living environment where many move away from home into on-campus halls of residence (Lenz, 2001).

MacNamara and Collins (2010) identify the transition from school to University to be considered more as a process rather than a single event. This is due to the significant changes students are experiencing through the common relocation from home, as well as the increased level of freedom experienced at University compared to the more structured environment evident at secondary-school level. An earlier study by Fisher and Hood (1987) looked at the short-term emotional distress levels experienced by students upon entry to University; they compared distress levels measured by a series of self-report psychological well-being questionnaires two months prior to University entry to the levels recorded six weeks after registration to include the Middlesex Hospital Questionnaire (MHQ; Crown & Crisp, 1966), Cognitive Failures Questionnaires (CFQ; Broadbent, Cooper, Fitzgerald, & Parkes, 1982) and the College Adaption Questionnaire (CAQ; Crombag, 1968). Results showed a significant increase in distress levels after commencing University with students reporting missing home as a key reason for these increased levels, as well as adjusting to new surroundings and social groups (Lowe & Cook, 2003). These findings suggest that mental health is changeable and once students are more comfortable in their new surroundings these negative mental health feelings may reduce over time.

2.4.5 Factors influencing the mental health of students at University

Research has identified a variety of different internal and external factors that can impact on a student's mental health whilst at University. It is important to identify these factors in order

for University practitioners and health services to be able to adequately deal with these situations and implement appropriate interventions to try and eliminate or reduce these identified pressures.

2.4.5.1   Financial concerns

Financial concerns are a major problem in many students' lives; with the removal of grants and the introduction of tuition fees putting increasing pressure on students, alongside challenges associated with their course. Many self-supporting students may have had to resort to bank loans or overdrafts forcing them further into debt and increasing the possibility of dropping out from University or Higher Education (Edmundson & Carpenter, 1995). Financial problems are not only a problem for current students but exist as a barrier for many individuals who are deciding whether to pursue or return to Higher Education, increasing the likelihood of these individuals developing anxiety or depression (Roberts, Golding, Towell, Reid, & Woodford, 2000; Sands & Richardson, 1984). In 2010 the National Union of Students (NUS) Scotland released the report 'Silently Stressed', a survey into Scottish students' mental wellbeing. A key finding from this report identified 'having enough money for day to day living' was a main stress factor for nearly 70% of students. This is a worrying finding alongside reports by the Scottish Association of Mental Health (SAMH) which identified individuals facing financial concerns were eight times more likely to pursue help for anxiety or depression.

In 2005 a study recorded data on student health behaviours from the UK and compared it with data from Finland where results found higher debt levels and financial issues among the British sample of students (Jessop et al., 2005). Finnish students also reported more favourable mental health scores ($M = 76.74$ SF-36 Score) than British students ($M = 62.34$ SF-36 Score) where a higher score represents better overall health (Ware, Kosinki, Dewey, & Gandek, 2000). These results could be due to the fact that Finnish students are not required to

pay tuition fees and are eligible for financial grants with further allowances for living expenses. However in recent years this is a comfort that UK students no longer have. This study along with numerous others confirms that financial difficulties could have a negative impact on various aspects of student mental health.

Andrews and Wilding (2004) identified the key factors that affected depression and anxiety in a sample of 351 UK undergraduate students over two time-points. Initial data collection took place one month prior to University entry (2000) with follow-up in the middle of the second academic year (2002) in a UK University. The Hospitality Anxiety and Depression Scale (HADS) was the measure used to assess anxiety and depression among this student sample. Findings from this study identified financial difficulties were reported by 21% of the student sample, where financial difficulties were closely related to the presence of depressive symptoms. The association between financial difficulties leading to feelings of depression predicted a significant decrease in exam performance from first year to second year. This is a key finding highlighting the need for interventions to be put in place to reduce these heightened financial pressures during University study which could hugely negatively impact students' academic studies. However it is important to look at the demographics of the students included in the study in order to gain a better idea of where these results came from. This study received a response rate of 75% from female students suggesting that results from this study are a better indicator of the female population where further research is needed in order to more accurately explore the student male population.

Previous research identified that students who experienced financial difficulties while at University could display lower levels of achievement in their academic work with higher cases of depression (Hodgson & Simoni, 1995). A recent study also found that financial difficulties and depression had a negative impact on student's academic performance

(Andrews & Wilding, 2004). These findings highlight the need for more financial support for students as well as financial advice about budgeting from the beginning of their University experience in order to reduce the risk of their academic studies being negatively affected.

2.4.5.2   Academic pressures

Academic pressures are a large part of the University experience to include coursework deadlines, exams and assessments. The NUS Scotland's 'Silently Stressed' report (NUS, 2010) identified 90.5% of students to believe exams and assessments to be 'reasonably' or 'very' stressful aspects of student life. It is a natural and expected finding that assessments would cause an increased amount of anxiety and pressure among the student population, however these high prevalence levels are concerning. These levels of pressure could lead to unwanted levels of heightened anxiety negatively affecting students' academic performance. Andrews and Wilding (2004) highlighted two key factors to be significantly related to exam performance, namely depression and financial difficulties. Further analysis identified this increase in depression led to a significant decrease in students' exam performance between first and second year at University. This suggests that academic performance is negatively affected by the presence of depression. Older evidence reports academic work to be a greater stressor for students compared to financial concerns, where exams reduced the amount of free time and quantity of work (Everly, Poff, Lamport, Hamant, & Alvey, 1994; Monk & Mahmood, 1999). This highlights the need for universities to identify increased times of academic pressures such as coursework deadlines and exam dates and communicate within departments in order to reduce overlaps in students' academic commitments.

2.4.6 Mental health and University students

Student mental health has become an area of increasing interest in recent years, but is not a completely new area of research. A number of UK studies reporting increased levels of distress within University students date back to more than 40 years ago (Furneaux, 1962;

Kelvin, Lucas, & Ojha, 1965). Many factors exist with regards to the mental health of students where it is apparent that University life can often intensify depressive feelings due to increased academic demands or social pressures. Research also suggests that female students more commonly suffer from anxiety and depression when compared to male students (Eisenberg, Gollust, Golberstein, & Hefner, 2007). University students can study for up to four years for an Undergraduate degree in the UK, and over this time period students with no previous mental health issues could develop these over the course of their degree due to various external factors related to University life. A study by Andrews and Wilding in 2004 found that 29% of symptom free University students prior to starting University in 2000 developed either anxiety or depression by mid-course in 2002. Another notable finding in that same study was that 36% who were diagnosed as having a prior condition at pre-entry when reassessed at mid-course were found to have recovered during that time frame, this highlights mental health to be changeable among the student population throughout University.

A recent UK longitudinal study from 2006 compared student psychological health and the progression through University (Cooke et al., 2006). The data were collected from the UNIversity Quality of Life and Learning (UNIQoLL) survey, which recorded data at seven time points during students' University experience. The GP-CORE questionnaire (General Population Clinical Outcomes in Routine Evaluation; Sinclair et al., 2005) was used to measure aspects of subjective well-being anxiety, depression and physical problems where a higher GP-CORE score represents a lower level of well-being. Data were initially collected prior to University registration, with follow ups conducted every year for three years in Semester 1 and Semester 2 of the students' undergraduate degree course at University. The results from this study identified a significant reduction in psychological well-being from pre-registration ($M = 10.22$, $SD = 5.29$ GP-CORE General Score) to the end of the degree course in year three Semester 2 ($M = 21.77$, $SD = 2.95$ GP-CORE General Score). The findings from

this study identified anxiety levels were the highest in Semester 1 of year 1 when compared to any other time point across the three years with notable reductions in anxiety after this time point. This is evident in the findings reported on the GP-CORE Anxiety Score on the questionnaire which identified anxiety to be higher in year 1 Semester 1 ($M = 16.09$, $SD = 10.84$ GP-CORE Anxiety Score) when compared to Semester 2 ($M = 14.30$, $SD = 11.26$ GP-CORE Anxiety Score). This was further highlighted in year 2 Semester 1 with a higher GP-CORE Anxiety Score ($M = 20.29$, $SD = 11.19$ GP-CORE Anxiety Score) compared to the lower anxiety levels measured in Year 2 Semester 2 ($M = 15.02$, $SD = 11.06$ GP-CORE Anxiety Score). Year 3 also identified a reduction in anxiety levels from Semester 1 ($M = 21.39$, $SD = 11.30$) to Semester 2 ($M = 19.18$, $SD = 13.55$ GP-CORE Anxiety Score). It is also important to note that apart from Year 1 Semester 2 GP-CORE Anxiety levels did not reduce to those levels measured initially at pre-registration ($M = 15.41$, $SD = 10.26$ GP-CORE Anxiety Score). To summarise these findings it was evident that anxiety increased over time over the three year period of University and for a majority of the data collected in each year, these heightened anxiety levels did not reduce to those recorded before University entry.

From the findings reported in this study it is evident that in this student sample anxiety was more predominant than feelings of depression, where depression scores were significantly lower than anxiety scores at each time point. However depression scores did increase steadily over the period of the three years with the highest depression levels recorded at the end of year three in Semester 2 ($M = 18.35$, $SD = 12.06$ GP-CORE Depression Score) which is nearly double that of the depression scores measured at pre-registration ($M = 10.27$, $SD = 9.03$ GP-CORE Depression Score). Overall the findings of the study demonstrate University to be a time that stimulates increased levels of anxiety, which could be due to the nature of assessments and exams that come with University education. The progressive levels of

increased depression among the student population are low but highlight the need for interventions in order to stop these increasing levels progressing into adulthood, possibly leading to more severe symptoms and cases of depression. However limitations for this study must be noted. The GP-CORE questionnaire used in this study to identify anxiety and depression levels among the student population incorporates only one anxiety item and one depression item on the questionnaire. Although this does provide us with an indication of student anxiety and depression levels among this sample, for a more comprehensive indication of anxiety and depression it would be advised to use a more accurate and standardised measure to better assess anxiety and depression among this specific population. Where previous studies specifically looking at depression and anxiety levels have used the Hospitality Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) and it has been shown to be a reliable questionnaire to assess anxiety and depression among the student population (Andrews & Wilding, 2004).

The findings from this study by Cooke and colleagues (2006) highlight the reduction in student psychological well-being, anxiety and depression over the course of their undergraduate degree with a majority of these levels not returning to those levels measured prior to University entry. These findings highlight the need for universities in the UK to acknowledge the increased levels of stress and anxiety placed on students at the beginning of each academic year and implement interventions in order to reduce these increasing levels. It is also worrying that the highest levels recorded in this sample of students are at the end of the University experience and typically before full-time employment which highlights the need for Universities to better prepare the student population for the transition after University in order to reduce these levels and therefore encourage enhanced mental health among our future adult generations.

Research identifies a significant prevalence of mental health problems among the student population, however it is also important to look at the persistence of these problems over a period of time in order to assess the magnitude of these changeable mental health levels. Zivan, Eisenberg, Gollust and Golbertstein (2009) investigated the prevalence of mental health problems among the student population at two-points over a two year period (2005 and 2007). Measures of the study included assessment of depression using the Patient Health Questionnaire-9 (PHQ-9; Kroenke et al., 2001) and anxiety using the PHQ anxiety scale. Findings identified that over the two-year period prevalence levels of anxiety increased in the sample of 763 students from 4.8% in 2005 to 7.0% in 2007, however it was interesting to find that prevalence of depression decreased, identified as 15.4% in 2005 to 12.9% in 2007. This suggests University to be a time of heighted and prevalent anxiety experienced by students rather than feelings of depression.

This finding shares similarities with more recent research by King, Garrett, Wrench and Lewis (2011) who used online surveys to identify the presence of mental health symptoms in a sample of first year University students. The surveys were completed in students second Semester of first year (2010) and comprised of closed demographic questions with open-ended questions related to students perceptions of and the factors that affect mental health during the transition to University. Mental health incorporated questions related to anxiety, depression, feelings of loneliness and social inclusion. It was identified that 33% of the student sample 'relocated' in the transition to first year at University (n = 132 first year students), this incorporated students who moved from their previous living environment evident at school including those who moved overseas. Those who 'did not relocate' incorporated students who remained living in the same living environment prior to University entry. Findings identified a significant decline in aspects related to mental health in those students who relocated (-60% mental health reduction) compared to those who did not

relocate (-38% mental health reduction). These findings highlight those who relocate and potentially move into on-campus accommodation reported a higher and more unfavorable decline in mental health symptoms compared to those students who did not relocate and potentially remained living in the same living environment experienced at school. These findings also highlight high percentages of mental health reduction evident in both living situations reinforcing the need for support services to be available and easily accessible for not only those who live in on-campus accommodation. As it is also evident that although those who live in off-campus accommodation suffer from less prevalent declines in mental health it is still evident that an unfavourable reduction in their mental health exists in the transition to first year at University.

These research findings highlight the significant increase in mental health issues among the UK student population. This emphasises the need for appropriate mental health interventions to be implemented at suitable stages in students' undergraduate degrees, in order to reduce these ever increasing and prevalent negative mental health levels among not only our current student population but also our future adult generation.

2.4.7 Mental health and non-University students

Although we are specifically interested in the University student population it is important to identify and compare the mental health of individuals of a similar age who choose not to pursue Higher Education or go onto University. This will identify whether the University population is an at-risk population with regards to mental health (Stallman, 2010) and allow researchers to ascertain the extent of the impact and the associated health behaviours adopted through University life. Stallman (2010) conducted a large web-based survey to identify psychological distress in two Australian Universities where a total of 6,479 undergraduate students took part. The data collected was then compared to general population data where students reported significantly higher distress levels (83.9%) when compared to general

population data (29%; Australian Bureau of Statistic, 2008). Findings from this research study highlight the undergraduate student population to be an at-risk population with recommendations suggesting interventions need to be implemented in the early stages of University life in order to eliminate the development of psychological distress and other associated mental health concerns (Stallman, 2010).

Earlier research evidence also illustrates University students to report higher unfavourable levels of psychological distress, where a study of 360 students reported lower levels of mental health when compared to the rest of the population of similar age and gender (Roberts, Golding, Towell, & Weinreb, 1999). Similar findings were evident in a study of over 1000 students, which surveyed students from three different Universities. The data collected for this study was compared with that of local community members of similar age, it was also apparent that student mental health scores were lower and less favourable than the local community members (Stewart-Brown, Evans, Patterson, Peterson, Doll, Balding et al., 2000). However in contrast to these findings, previous research also exists to illustrate no difference in mental health between the student and the non-student population. Blanco and colleagues (2008) looked at the prevalence of mental illnesses among college students and their age matched non-student counterparts, where findings reported a similar prevalence of mental illness between the two groups (Blanco, Okuda, Wright, Hasin, Grant, Liuet al., 2008). Further research by Hunt and Eisenberg (2010) also identified similar prevalence rates of mental illness in a sample of University students when compared to a sample of the general population of similar age.

Overall the research findings suggest that in comparison to the general population, the student population is suffering from heightened mental health issues throughout their degree course highlighting the need for further research into the mental health of the UK student population. Further research will allow researchers and practitioners to identify the key factors and time

points that negatively impact on students' mental health in order to construct appropriate interventions to reduce these prevalence levels among the student population. The vast size of University campuses and the potential for behaviour change through increased knowledge and information. If appropriately utilised University campuses can provide suitable support and information to a wide range and number of students.

2.5 Mental Health and Physical Activity Levels

Physical activity in any form has not only been found to improve physical benefits but previous studies have found that regular moderate-intensity physical activity can have mental health benefits, related to a state of decreased depression and an enhanced mood (Biddle & Mutrie, 1991; Morgan & Goldston, 1987). Fox (1999) reported that in comparison with individuals who do not exercise, those who do have greater levels of self-esteem and have overall enhanced levels of psychological functioning. Investigation into the types of exercise that improve mental health found aerobic exercise alone encouraged more favourable levels of anxiety, and combining aerobic and anaerobic exercises were found to reduce feelings of depression (Bouchard, Blair, & Haskell, 2007). A Finnish population study found a significant relationship between frequent participation in physical activity and reduced levels of depression and stress in those aged between 25 and 64 (Hassman, Koivula, & Uutela, 2000). This sample is representative of the typical post-University age range, and the findings highlight the benefits of regular physical activity. This finding should be used to encourage increased physical activity participation among the student population from the beginning of their degree course in order to continue to influence a positive impact on life-long physical activity levels.

The research surrounding the positive relationship between physical activity participation and more favorable mental health has increased in recent years and it is widely acknowledged that exercise improves general mental health (Tyson, Wilson, Crone, Brailsford, & Laws, 2010). It is important to note the other benefits that exist in relation to physical activity participation, such as the social element of meeting new people and forming new friendships and social groups (Crone, Smith, & Gough, 2005), as well as the aspect of personal achievement felt by many through physical activity participation (Fogarty & Happell, 2005). In 2010 a cross-sectional study was conducted in order to further understand the relationship between

physical activity and mental health in the UK student population, where increased physical activity levels were found to be related to reduced levels of anxiety and depression.

The HADS questionnaire (Zigmund & Snaith, 1983) was used to measure anxiety and depression levels and self-report physical activity levels were assessed using the Physical Activity Questionnaire (PAQ; Thirlaway & Benton, 1992). Scores on the HADS and PAQ identified a significant negative correlation between physical activity and depression (r = -.607) and physical activity and anxiety (r = -.588). These findings highlight that higher levels of physical activity intensity were associated with lower levels of both anxiety and depression among a University student population, suggesting University campuses need to promote higher levels of physical activity intensities in order for students to gain the associated mental health benefits.

As valuable as these cross-sectional studies are to the collection of research on the beneficial effects of physical activity on mental health there is still a need for longitudinal evidence in order to assess whether the transition to University has a persistent effect on physical activity levels and mental health. The existing evidence supports physical activity as a way of improving general mental health. Therefore it is essential that interventions are implemented within schools and universities in order for students to gain the mental health benefits associated with increased physical activity and exercise participation.

2.5.1 Mental health and physical activity in University students

There is a current lack of evidence examining physical activity levels and the mental health of students in Scottish Universities. However broader research has identified the progression to the University environment to pose a negative impact on students' previous physical activity levels and mental health. A study by Tyson and colleagues (2010) investigated the relationship between physical activity participation and mental health in a sample of undergraduate students at a UK University. The presence of anxiety and depressive symptoms

were measured using the Hospitality Anxiety and Depression Scale (HADS; Zigmund & Snaith, 1983) and physical activity was assessed using the Physical Activity Questionnaire (PAQ; Thirlaway & Benton, 1992). The findings from this study identified mild symptoms of anxiety ($M = 8.5$, $SD = 3.9$ HADS Anxiety Score) with an absence of depressive symptoms ($M = 3.6$, $SD = 2.7$ HADS Depression Score). Correlation analysis identified a significant negative correlation between scores on the PAQ and the HADS Depression Score with a large effect size ($r = -0.607$; $d = 1.5$). This significant negative correlation was also evident between scores on the PAQ and the HADS Anxiety Score ($r = -0.588$, $d = 1.4$). To highlight the key findings, this study identified those students who engaged in high levels of total physical activity had significantly lower levels of anxiety and depression when compared to those who were identified as taking part in low or medium levels of total physical activity. This highlights the need for Universities to positively promote and encourage higher levels of physical activity among the student population. However it must be noted that out of the 100 undergraduates that took part in the study a vast majority were female ($n = 80$), which would suggest that these study findings are a better representation of the student female population. It is important to gain a better understanding of the male student population's mental health and physical activity levels in order to further understand the gender differences in behaviours. This will help researchers identify whether the student male population are an at risk population for developing symptoms related to mental health conditions and whether they are currently meeting the recommended physical activity guidelines for health benefits. Future studies would benefit from increasing their male student inclusion rates and directing their recruitment techniques toward the male student population. The physical activity findings in this study by Tyson and colleagues (2010) are based solely on subjective questionnaire data and therefore represent students' own perceptions of their physical activity levels and don't necessarily represent their actual physical activity levels. Therefore research

into this area would also benefit from incorporating aspects of objective measurement into order to gain a more realistic and reliable assessment of physical activity levels in the student population.

Mailey and colleagues (2012) specifically examined changes in female first year University students' anxiety levels with changes in physical activity over two time points initially measured in students' first week in first year with follow-up conducted in the final weeks of students' first year. Physical activity levels were measured both subjectively using the self-report Godin Leisure-Time Exercise Questionnaire (GLTEQ; Godin & Shephard, 1985) and objectively-measured using a waist worn Actigraph accelerometer. Students' anxiety levels were assessed using the anxiety scale on the Hospitality Anxiety and Depression Scale (HADS; Zigmund & Snaith, 1983). Findings identified a negative change in students self-report physical activity levels from phase 1 ($M = 79.82$, $SD = 46.33$ MET min/week) to phase 2 ($M = 70.95$, $SD = 43.59$ MET min/week), as well as a reduction in accelerometer measured moderate-vigorous intensity physical activity from phase 1 ($M = 84.14$, $SD = 38.51$ MVPA average daily minutes) to phase 2 ($M = 74.25$, $SD = 31.14$ MVPA average daily minutes). There was also a significant reduction in students' anxiety levels from phase 1 ($M = 7.40$, $SD = 3.30$ HADS Anxiety Score) to phase 2 ($M = 7.06$, $SD = 3.80$ HADS Anxiety Score) highlighting Semester 1 to be a time of increased anxiousness among the female student population which favorably reduced by the end of first year. These findings suggest first year at University to be a time that negatively impacts student physical activity levels and aspects related to student mental health. It is important to note that the study sample were self-selected and had to meet specific inclusion criteria before being included in the study, those students who smoked, were underweight (BMI <17.5 kg/m^2) or overweight (BMI >31.5 kg/m^2) were excluded from the study, which could lead to a misrepresentation of the evidently diverse student population. It was also evident that all students included in the study

lived in on-campus accommodation during first year, this is useful in order to identify the impact campus living has on physical activity and mental health behaviours. However in order to fully understand this impact future research would benefit from incorporating students who live in off-campus accommodation during first year in order to accurately compare and contrast the differences between these two living environments.

These findings in addition to those researched by Bray and Born (2004) examined the transition from high school to University and the effect it had on students' vigorous intensity physical activity and psychological health (anxiety and depression). Subjective measures were used in this longitudinal study, which initially assessed students' high school physical activity and psychological health two months prior to University entry with follow-up two months post University entry in Semester 1. Vigorous intensity physical activity was assessed using the vigorous physical activity scales on the 1995 Youth Risk Behaviour Survey and 1995 National College Health Risk Behaviour Survey (US Department of Health & Human Services, 1996). Those students considered as 'active' reported taking part in 3 or more vigorous intensity sessions of 20 minutes or more a week and those students who did not meet this criteria were considered 'insufficiently active'. The physical activity findings from this study identified a significant reduction in participation of vigorous intensity physical activity sessions from high school (M = 3.32, SD = 2.12 average weekly sessions) to University (M = 2.68, SD = 2.24 average weekly sessions). Depression was assessed using scores on the Profile of Mood States – Adolescent (POMS-A; Terry, Lane, Lane, & Keohane, 1999) and anxiety was assessed using scores on the General Health Questionnaire-28 (GHQ-28; Goldberg & Hillier, 1979), where a higher score on both questionnaire scales represents less favorable levels of depression and anxiety. The relationship between vigorous intensity physical activity and depression in Semester 1 of first year identified undergraduate students' who were vigorously active also reported lower levels of depression (M = 3.37, SD = 2.62

POMS-A Depression Score) than those who were insufficiently active ($M = 3.60$, $SD = 3.28$ POMS-A Depression Score). This finding was also evident in the reduced levels of anxiety reported by those students who were identified as vigorously active ($M = 7.20$, $SD = 4.09$ GHQ-28 Anxiety Score) compared to those students considered as insufficiently active ($M = 7.72$, $SD = 4.33$ GHQ-28 Anxiety Score). This study took place in Canada with a sample of 145 Canadian undergraduate students, where differences in lifestyle would be evident compared to students in UK universities. This study also only looked at subjectively-measured levels of physical activity which provides researchers predominantly with an indication of physical activity levels based on participant's perceptions and recall of their behaviours. Incorporating objective physical activity assessment would allow researchers to gain a better understanding of students' physical activity levels. These findings highlight the significant relationship evident between increased intensities of physical activity and reduced levels of anxiety and depression. This research provides more evidence regarding University students' mental health and further highlights the importance for Universities and Higher Education institutions to promote increased physical activity with specific incorporation of moderate to vigorous intensities to encourage the associated mental health benefits among the student population.

2.5.2 Student mental health and physical activity summary

Student mental health has become an area of increasing interest, so in order to prevent increases in the numbers of those students diagnosed with a mental health condition, it is important to have up-to-date statistics on the current prevalence of mental health problems among the UK student population. Early detection of mental health conditions will encourage intervention strategies to help support and advise students with techniques on how to deal with various aspects of stress or anxiety. University campuses can also be used as a great opportunity to reach out and provide support to the extensive number of students at such a

critical point in their life, which could in turn eventually reduce the prevalence of adult mental health conditions. There is still a need for longitudinal evidence in order to assess what health behaviours individuals are adopting and experiencing when they initially enter University in first year and to what extent these behaviours influence their mental health. Once these health behaviours are identified it will contribute to the types of interventions implemented into Universities and Higher Education colleges across the UK.

2.6 Overall aims

The review has highlighted the physical inactivity and mental health issues evident among the University student population. Previous research has highlighted a reduction in physical activity participation in the progression from adolescence to adulthood, where Sallis (2000) conducted a review of the literature of previous cross-sectional and prospective studies. It was identified that the steepest decline in physical activity was between the ages of 13 to 18 and the decline was generally greater in males compared to females. Sallis (2000) did not specifically look at University students but identified that the crucial age range prior to University entry had declining physical activity levels. This finding highlights a gap in the research and the need to further investigate the first year University population upon entry to University in an attempt to reduce the physical inactivity levels of future adult generations. It is also important to note that these studies included in the Sallis (2000) review may now be dated and may not represent the current physical activity levels and patterns of the population and therefore more research is required to represent the current behaviours and specifically look at the University student population.

Physical activity participation is widely known to have a positive effect on mental well-being and with data highlighting the significant reduction in physical activity levels in University students it is important to look at whether this corresponds to a reduction in mental well-being. Previous research has identified anxiety levels to have increased over time after University entry and did not reduce to those recorded before University entry (Cooke et al. 2006). The findings from this previous research highlight the need to look into first year University students physical activity levels and mental well-being in order to implement physical activity interventions as early into the University experience as possible to eliminate these increasing levels of anxiety.

A majority of the current research into University physical activity levels and health behaviours originates from the United States where University lifestyle and environment can be hugely different to UK based University campuses. Therefore the aim of this research is to provide data on Scottish based UK Universities.

The aim of this research is to:

Study One: Examine the impact of first year at University on undergraduate student physical activity levels and mental health and identify the relationship between these behaviours.

Study Two: Examine the changes in students' physical activity levels and mental health over two time points in first year at University.

Chapter 3: Study One – An examination of student health behaviours during their first year at University

3.1 Aims

The aim of study one is to:

1) Identify the physical activity levels of students in their second Semester of first year at University.

2) Identify student mental health in their second Semester of first year at University.

3) Identify whether gender or living environment impacts students' physical activity levels and mental health in their second Semester of first year at University.

4) Gain an understanding of previous school physical levels and health behaviours compared to current University behaviours through the use of interviews.

3.2 Methods

This cross-sectional exploratory study used a mixed methods design incorporating both quantitative and qualitative approaches designed to strengthen the research and to gather rich data on physical activity and health behaviours in a student population upon entry to the University environment.

3.2.1 Participants

Participants (n = 32) were matriculated students in the first year of undergraduate degree programmes at either the University of Strathclyde or Heriot Watt University, recruited through poster advertisement in both University sites (Appendix A), email distribution lists and word of mouth. It must be noted that participants used in Study two were a different cohort of first year University students. The key inclusion criteria for participants were that they were in full-time first year study at either Higher Education Institutions and that they fully understood the requirements of the study. Written informed consent (Appendix B) was provided before data collection began with additional verbal information given to participants

on the first visit to the laboratory. The Participant Information Sheet (Appendix C) was to remind participants of their right to withdraw from the study at any point with no reason necessary and to remind them of the confidentiality and anonymity that would be maintained throughout the study. Data collection began in the second Semester of first year (January 2013) and was carried out over a period of eight weeks.

3.2.2 Measures

The study involved a maximum of three visits for participants to the laboratory where data collection took place. The same researcher conducted all of the data collection in order to maintain consistency throughout and develop a thorough understanding of each participant's health behaviours.

3.2.2.1 Demographic Variables

After written informed consent was given, participants were asked to complete a demographic questionnaire (Appendix D) to assess gender, age, ethnicity, undergraduate degree course and current living environment. Students who lived in University halls of residence were categorised as 'living on-campus' and those who remained living at home or lived in alternative accommodation were categorised as 'living off-campus'.

3.2.2.2 SF-12

The first of the psychological well-being questionnaires completed was the Short Form-12 (Appendix E). The Short-Form-12 (SF-12) is a four-week recall 12-item self-report questionnaire developed by Ware, Kosinki and Keller (1996) and is used to assess aspects of overall health-related quality of life, including an individual's physical and mental health. The SF-12 is a shorter version of the SF-36, and for the purpose of this study, the shorter version was used where previous research confirms the SF-12 as an appropriate method for assessing health-related quality of life (Ware, Kosinki, & Keller, 1996; Gandek et al., 1998). The SF-12 is a 12-item scale with six questions relating to the Physical Component Score

(PCS) and six questions related to the Mental Component Score (MCS) of well-being. The scoring of the twelve questions related to Physical and Mental Health are calculated and range from 0% to 100% where a Total Average Score (%) is calculated. A higher % score on the SF-12 represents a higher level of physical and psychological health. Previous research by Adler, Raju, Beveridge, Wang, Zhu and Zimmermann (2008) identified the SF-12 to have good reliability and validity for assessing health related quality of life among the student population.

3.2.2.3 Hospitality Anxiety and Depression Scale

The Hospital Anxiety and Depression Scale (HADS) (Appendix F) was developed by Zigmond and Snaith in 1983. It is a self-report questionnaire used frequently to assess anxiety and depression, which requires the participants to recall how they have felt in the previous week. The HADS comprises a 14-item scale with seven questions relating to anxiety and seven questions relating to depression. Answers consist on a four point Likert scale; 0= not at all, 1= not often, 2= quite a lot, 3= definitely. Scores are calculated where a score of 0-7 signifies no presence of clinical symptoms, 8-10 indicates mild symptoms, 11-14 demonstrates moderate symptoms of depression and anxiety and a score of 15-21 indicates severe symptoms. Crawford, Henry, Crombie and Taylor (2001) published UK norm data for HADS depression as 3.68 and HADS anxiety as 6.14 out of a maximum score of 21. Previous research suggests that the HADS is a widely used and valid measure of depression and/or anxiety within a population. In 2002, results from a review of 747 papers that utilised the HADS demonstrated its validity and reliability for use within the general population, in general practice and with psychiatric patients (Bjelland, Dahl, Haug, & Neckelmann, 2002).

3.2.2.4 Physical Assessments

Participants' systolic and diastolic blood pressures were recorded using an Omron 2 automatic blood pressure monitor, which was placed on the participant's relaxed left upper

arm. Height was then recorded using a Stadiometer (Model 225, Seca Ltd) and weight was assessed using precision scales (Model 770, Seca Ltd). Waist and hip circumferences were measured using a tape measure where waist circumference was measured around the participants' narrowest point from the mid-point between the inferior margin of the lowest rib and the iliac crest; hip circumference was measured around the widest point of the participants' hips. To ensure consistency in measurements, participants were asked to position their feet together.

3.2.2.5 International Physical Activity Questionnaire

Participants were asked to complete the International Physical Activity Questionnaire (IPAQ) (Appendix G) on their second visit to the laboratory, which is used to assess the physical activity levels of participants over the previous 7-days through a self-report questionnaire. The IPAQ was chosen for this study for its high validity and reliability in assessing an individual's frequency, intensity and duration of self-reported physical activity throughout the previous 7-day week. The questionnaire assesses five key aspects of physical activity: occupational, transportation, household and leisure time physical activity and sedentary behaviour (Craig et al., 2003). Previous research confirms the IPAQ to have good construct and validity when used alongside objective physical activity monitors and self-report diaries (Hagstromer, Oja, & Sjostrom, 2006).

3.2.2.6 ActiGraph Accelerometer

A 19g tri-axial accelerometer GT3X+ (ActiGraph, LLC, Pensacola, FL, USA) was used to assess the participants' objective physical activity levels through measuring frequency, intensity and duration of activity. The accelerometer was attached to an adjustable elastic belt and worn on the participant's right hip for 7 consecutive days. Each participant was provided with thorough instruction on how to wear the ActiGraph and asked to fill in a non-wear time

accelerometer log (Appendix H) to provide detail on when they removed the device throughout each of the 7 days.

3.2.2.7 Accelerometer Cut Point & Non- Wear time Analysis

The tri-axial accelerometer was recently developed by Sasaki, John and Freedson in 2011 to assess physical activity levels. The Freedson Adult VM3 (2011) cut points were used in this study to determine the intensity of the activity being undertaken measured as counts per minute (CPM). Recent research by Sasaki, John and Freedson (2011) confirm the validity of the cut points of the Freedson Adult VM3 (2011) where the same Actigraph monitor was used. Light exercise was considered between 0 to 2690 CPM, moderate exercise from 2691 to 6166 CPM, vigorous 6167 to 9642 CPM and very vigorous exercise was considered as 9643 CPM and above. Activity monitors were set to sample at 10-second time intervals, also known as 'epoch' length, where previous studies demonstrated shorter epochs to more accurately record irregular, short bursts of physical activity common in young people (Trost, McIver, & Pate, 2005; Reilly, Penpraze, Hislop, Davies, Grant, & Paton, 2008). Previous research in 2000 suggested a minimum of 8 hours monitoring per day over a period of 4 days was sufficient to evaluate habitual physical activity levels (Trost, Pate, Freedson, Sallis & Taylor, 2000) however for the purposes of this study we requested participants to wear the device for 7 consecutive days in order to fully identify a first year student's physical activity habits and to allow for non-wear time and measurement errors. In order for an accurate measurement of student daily activity levels, inclusion criteria for the study was a daily accelerometer recording of a minimum of 10 hours (600 minutes) set by the global reliability and validity study of the IPAQ (Craig et al., 2003). In accordance with previous research the first day of the measurement period was included if participants accumulated a minimum of 383 minutes (Troped et al., 2007). Research by Cain and Geremia in 2011 considered at least 8 hours on weekends as a valid wear time day also included in the inclusion criteria of the

current study. The data recorded using the accelerometers were analysed through the downloaded ActiLife computer software (ActiGraph, LLC, Pensacola, FL, USA).

3.2.2.8 Interview process

The qualitative aspect of the study invited a random sub-sample (6 participants) of those who gave written informed consent (Appendix I) on their initial visit to take part in a tape recorded one-to-one interview with the researcher. Interviews were conducted after the completion of the quantitative data collection and were designed to gain a further understanding of students' health behaviours in the transition from school to University. Participants were given a Recorded Interview Participant Information Sheet (Appendix J) to remind them of their right to withdraw from the study at any point with no reason necessary and to remind them of the confidentiality and anonymity that would be maintained throughout the study. Semi-structured interviews were chosen for the study because of their value in generating a deeper understanding of human experience (Bogdam & Biklen, 1992). Each interview lasted around 20-30 minutes and began with an introduction describing the purpose and rationale of the study along with assurances of confidentiality. All interviews were conducted in a quiet location with minimal disruptions and tape recorded with the participant's permission. A semi-structured interview guide (Appendix K) was developed based on previous literature identifying key concepts of student health behaviours. This allowed flexibility for the researcher, as depending on the participants responses prompts were used when elaboration on an answer was required (Patton, 2002).

3.2.3 Procedures

The study involved a maximum of three visits. On the initial visit to the University laboratory the participants were asked to confirm whether they understood the requirements of the study by reading through the information sheet provided and were given the opportunity to ask any questions prior to seeking informed consent. Participants were then asked to complete a

demographic questionnaire and a series of psychological well-being questionnaires (SF-12 and HADS). Participants' blood pressure, height, weight, waist and hip circumference were also assessed. Once participants completed all questionnaires and physical assessments, they were then fitted with a tri-axial accelerometer (GT3x Actigraph) and provided with instruction on how to wear it. Participants were asked to wear the accelerometer for 7 days to assess the frequency, duration and intensity of their activity and to complete an accelerometer wear time log to record when the accelerometer was attached and taken off each day. Participants were told to contact the researcher if they have any issues during the 7-day measurement period.

After the 7-day measurement period, the participant was asked to return to the laboratory to return the accelerometer and non-wear time diary. Self-report physical activity levels were also measured during this visit using the International Physical Activity Questionnaire (IPAQ). The optional qualitative aspect of the study was conducted after all the quantitative procedures had taken place to further discuss their health behaviours during their first year at University in a semi-structured recorded interview.

3.3   Data Analysis

SPSS software was used to descriptively analyse and report on quantitative data (SPSS; PASW Statistics 17.0 for Windows, SPSS Inc., Surrey, UK). Significance was accepted at $p < 0.05$.

3.3.1   Analysis of quantitative data

Accelerometer data were initially screened for any outliers to exclude any days that did not meet the inclusion criteria. All data were also screened for normal distribution using the Kolmogorov-Smirnov test (Field, 2009) and homogeneity of variance using Levene's test (Field, 2009) to determine the appropriateness of parametric analysis. When data recognised

as normally distributed the data were deemed to fulfill the assumptions of parametric testing.

3.3.1.1 Relationship between physical activity, depression, anxiety and psychological well-being

The relationship between both subjectively and objectively-measured physical activity and the psychological measures of anxiety, depression and psychological well-being was examined using a Pearson's Correlation Coefficient (r) test.

3.3.1.2 Differences between gender and Universities

To test for differences between subjectively and objectively-measured physical activity levels across gender and living environment, a two-way analysis of variance (ANOVA) with a Bonferroni post-hoc tests were performed where an interaction effect was observed. Effect sizes were estimated using Cohen's d interpretation guidelines of $d >= 0.2$ (small effect size), $d >= 0.5$ (medium effect size) and $d >= 0.8$ (large effect size) (Cohen, 1988).

3.3.2   Analysis of qualitative data

Analysis of health behaviours and physical activity in first year students at both Universities was conducted using an inductive approach (Thomas, 2003) to develop key themes relating to students' perceptions of their health behaviours during the transition to University. Each interview was read through several times and transcribed accurately. This allowed re-familiarisation with the material and allowed ideas and significant themes to emerge. This meant that specific topics could be extracted from the interviews and categorised into ordered themes to summarise and systemise the interview data. Data were categorised by the primary researcher and the researcher's MPhil supervisor into themes independently to demonstrate the reliability of theme categorisation for all of the transcripts. This procedure of credibility ensured trustworthiness in the data analysis, as established by Lincoln and Guba (1985), who suggested qualitative research should be judged on the foundation of trustworthiness.

3.4 Results

3.4.1 Descriptive statistics

A total of 32 participants ($M = 18.6$ years) studying at two Scottish Universities took part in this cross-sectional study. The physical assessment data collected at baseline for all the students is presented in Table 3.1, where mean height and weight for the entire cohort was 175.9cm and 71.7kg respectively and waist and hip circumference was 77.4cm and 97.7cm respectively. Participants' living environments are described in Table 3.2, as either living in on-campus University accommodation or living off-campus whilst in their first year at University. It is evident that a higher number of Heriot-Watt University students reside in on-campus student accommodation (89.5%) in comparison to the University of Strathclyde students (23.1%). A majority of the students (n = number) who took part in the study from the University of Strathclyde studied Sport and Physical Activity (n = 10) with two students studying Aero-Mechanical Engineering and one studying Biomedical/ Community health. A majority of the Heriot-Watt University students (n = 12) who participated in the study were from the Engineering department and the Science department (Chemistry, Biological sciences, Physics), with the remaining students studying Management and Languages (n = 4), Psychology (n = 2) and one student studying Actuarial Sciences.

The baseline measurements (Table 3.4) for study one included subjective depression and anxiety, where mean depression score was 5.1 for males and 6.9 for females and mean anxiety score was 2.0 for males and 2.9 for females. Psychological well-being was also measured and the mean score for physical well-being was 91.2% for males and 87.4% for females and the mean mental well-being score was 83.3% for males and 77.6% for females. Self-report weekly physical activity was measured at 58.3 METS-hours/week for males and 47.4 METS-hours/week for females.

Table 3.1: Summary of descriptive statistics for sample population

	University of Strathclyde				Heriot Watt University				All	
	Male (n=9)		Female (n= 4)		Male (n= 10)		Female (n= 9)		(n = 32)	
	M	SD	M	SD	M	SD	M	SD	M	SD
Age (years)	18.4	0.5	19.0	1.4	18.6	0.9	18.7	1.0	18.6	0.9
Resting Heart Rate (bpm)	75.6	6.7	74.3	6.9	74.6	10.8	79.4	10.8	76.2	9.2
Height (cm)	179.6	10.5	161.4	8.2	185.1	5.6	168.3	7.3	175.9	11.6
Weight (kg)	72.8	10.9	57.1	6.9	77.7	8.1	70.6	9.7	71.7	10.9
Systolic Blood Pressure (mmHg)	131.3	9.2	107.5	6.9	148.8	33.5	146.9	22.4	138.2	26.0
Diastolic Blood Pressure (mmHg)	75.3	6.3	71.3	8.7	93.7	24.2	95.3	7.9	86.2	17.6
Waist Circumference (cm)	75.6	5.1	74.1	9.9	80.0	5.7	77.9	7.9	77.4	6.8
Hip Circumference (cm)	94.6	6.4	93.9	3.8	97.6	4.9	102.7	5.2	97.7	6.1

(n = number)

Table 3.2: Living environment of sample

	University of Strathclyde		Heriot Watt University		All	
	Male (n=9)	Female (n= 4)	Male (n= 10)	Female (n= 9)	Male (n= 19)	Female (n= 13)
On-campus	2 (15.4%)	1 (7.7%)	9 (47.4%)	8 (42.1%)	11 (34.4%)	9 (28.1%)
Off-campus	7 (53.8%)	3 (23.1%)	1 (5.3%)	1 (5.3%)	8 (25.0%)	4 (12.5%)

3.4.2 Relationships between outcome variables

The following section illustrates the results of the correlational analyses between depression, anxiety, psychological well-being and physical activity, carried out to explore whether levels of depression, anxiety and psychological well-being were associated positively or negatively with levels of subjective and objectively-measured physical activity. Table 3.3 shows the Pearson's correlation coefficients between psychological measures of anxiety, depression, psychological well-being, subjectively and objectively-measured physical activity. This is followed by a section reporting analyses that investigated whether gender and living environment, and the interaction between these, had a significant effect on depression, anxiety, psychological well-being and physical activity.

3.4.2.1 The relationship between physical activity on depression and anxiety

Pearson's correlation coefficients indicated a significant negative correlation between objectively-measured very vigorous physical activity and the HADS depression score ($r = -.48$, $p < .01$). These correlation coefficients indicated that higher levels of very vigorous intensity physical activity were associated with lower levels of depression. However correlation coefficients indicated that physical activity of any intensity had no relationship with the HADS anxiety score, thus suggesting that very vigorous physical activity is associated with depression but not anxiety.

3.4.2.2 The relationship between physical activity on psychological well-being

Pearson's correlation coefficients indicated a significant positive correlation between the SF-12 Physical Component Score and objectively-measured light intensity physical activity ($r = .48$, $p < .01$) and moderate intensity physical activity ($r = .38$, $p < .05$). There was a significant positive correlation between light intensity physical activity and the SF-12 Mental Component Score (%) ($r = .58$, $p < .01$) and Total Average Score (%) ($r = .59$, $p < .01$).

Table 3.3: Pearson correlation coefficients for outcome variables.

	1. HADS Depression	2. HADS Anxiety	3. SF12 Physical Component % Score	4. SF12 Mental Component % Score	5. SF12 Total % Score	6. IPAQ weekly physical activity	7. Light daily PA (mins)	8. Moderate daily PA (mins)	9. Vigorous daily PA (mins)	10. Very Vigorous daily PA (mins)
1. HADS Depression	-									
2. HADS Anxiety	.63***	-								
3. SF12 Physical Component % Score	-.14	-.18	-							
4. SF12 Mental Component % Score	-.25	-.37*	.73**	-						
5. SF12 Total % Score	-.18	-.28	.92**	.94**	-					
6. IPAQ weekly physical activity	-.33	-.16	.09	.18	.15	-				
7. Light daily PA (mins)	.02	.04	.48**	.58**	.59**	-.08	-			
8. Moderate daily PA (mins)	.14	.15	.38*	.24	.34	.14	.22	-		
9. Vigorous daily PA (mins)	-.06	-.16	.14	.13	.13	-.06	.07	.35	-	
10. Very Vigorous daily PA (mins)	-.48**	-.22	.12	.21	.17	.46	.38*	.39*	.38*	-

* Correlation significant at 0.05 level
** Correlation significant at 0.01 level
*** Correlation significant at 0.001 level

3.4.3 Differences in subjectively-measured outcome variables by gender and living environment.

Table 3.4 represents the results of the two-way ANOVA, comparing the effect and interaction of gender and living environment on subjectively-measured physical activity, psychological measures of anxiety, depression and general well-being.

3.4.3.1 The effect of gender and living environment on anxiety

A two-way ANOVA indicated that, for the HADS anxiety score, there was a significant small interaction effect (d = 0.2) between gender and living environment (F (1, 31) = 5.48, p < .05) (Figure 3.1). Female students who lived on-campus (HADS anxiety score = 3.2) were more likely to experience heightened anxiety levels than males who lived on-campus (HADS anxiety score = 1.8). However male students who lived off-campus (HADS anxiety score = 2.4) were more likely to experience anxiety in comparison to female students who lived off-campus (HADS anxiety score = 2.0). There was no significant main effect for gender or living environment.

Figure 3.1: Interaction effect of HADS Anxiety Score on living environment and gender

Table 3.4: Two-way ANOVA for differences in subjectively-measured outcome variables across gender and living environment.

	On-Campus University Accommodation				Off-Campus Accommodation				All			
	Male (n= 11)		Female (n= 9)		Male (n= 8)		Female (n= 4)		Male (n= 19)		Female (n=13)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
HADS Depression	5.2	1.8	7.3	2.0	4.9	3.2	6.0	4.5	5.1	2.4	6.9	2.9
HADS Anxiety	1.8	1.9	3.2	1.7	2.3	1.7	2.0	1.8	2.0	1.8	2.9	1.8*
SF-12 Physical Component Score %	92.2	5.3	84.1	19.8	89.7	12.1	94.6	2.1	91.2	8.6	87.4	17.0
SF-12 Mental Component Score %	81.8	8.6	74.5	12.7	85.4	8.0	84.4	9.2	83.3	8.3	77.6	12.3**
SF-12 Total % Score Average	86.4	6.6	78.9	12.2	87.8	7.1	89.1	5.5	87.0	6.7	82.1	11.4**
IPAQ Weekly Physical Activity (METS-hours/week)	47.7	29.3	48.1	30.6	72.8	39.3	45.5	15.3	58.3	35.2	47.4	27.0

* $p < .05$ significant interaction effect of gender and living environment
** $p < .05$ significant main effect of living environment

3.4.3.2 The effect of gender and living environment on quality of life

There was no significant interaction between gender and living environment on the SF-12 Mental Component Score and no main effect of gender but a significant small main effect (d = 0.2) of living environment (F (1, 32) = 5.12, $p < .05$). It was evident that living on-campus had a negative effect on mental health (SF-12 MCS, M = 78.5%) in comparison to those who live off-campus (SF-12 MCS, M = 85.1%).

There was no significant interaction between gender and living environment on the SF-12 Total Average Score (%) and no main effect of gender but a small (d = 0.2) significant main effect of living environment (F (1, 32) = 5.56, $p < .05$). Results illustrated that those students who lived off-campus had significantly better mental health (SF-12 = 88.2%) than those who lived in on-campus accommodation (SF-12 = 83.0%).

There was no significant interaction or main effects for gender and living environment for the remaining outcome variables.

3.4.4 Physical activity differences across gender and living environment

For subjectively-measured levels of weekly physical activity, there was no significant interaction effect between gender and living environment or main effect of gender. There was a significant small main effect (d = 0.3) for living environment (F (1, 32) = 9.09, $p < .05$) with students living in off-campus accommodation (M = 65.3, SD = 35.9 hours/week) demonstrating higher levels of weekly physical activity than those living in on-campus accommodation (M = 47.9, SD = 29.1 hours/ week).

For subjectively-measured levels of work related walking, there was no significant interaction effect between gender and living environment or main effect of gender. There was a significant small main effect (d = 0.3) for living environment (F (1, 31) = 9.82, $p < .001$) with students living in off-campus accommodation (M = 27.5, SD = 33.1 hours/ week) reporting

higher levels of work related walking than those living in on-campus University accommodation (*M* = 1.2, *SD* = 3.3 hours/ week).

For subjectively-measured levels of work related moderate physical activity, there was a significant small interaction effect (d = 0.2) between gender and living environment (F (1, 31) = 7.57, p < .01). Female students living off-campus (M = 36.7, SD = 39.7 MET-hours/week) reported higher levels of work-related moderate physical activity than male students living off-campus (M = 7.5, SD = 80.9 MET-hours/week). However males who lived in on-campus accommodation (M = 0.7, SD = 2.4 MET-hours/week) reported higher levels of moderate physical activity than female students who lived on-campus (M = 0.1, SD = 0.3 MET-hours/week). There was a significant small main effect (d = 0.2) for gender (F (1, 31) = 7.12, *p* < .05) with females (*M* = 9.3, *SD* = 23.7 MET-hours/week) reporting higher levels of work related moderate physical activity than males (*M* = 3.6, *SD* = 19.4 MET-hours/ week). There was a significant small main effect (d = 0.4) for living environment (F (1, 32) = 14.71, p < .001) with students living off-campus (*M* = 15.5, *SD* = 25.4 MET-hours/ week) having higher levels of work related moderate physical activity than those living on-campus in University accommodation (*M* = 0.5, *SD* = 17.9 MET-hours/ week).

For subjectively-measured levels of work-related vigorous physical activity, there was no significant interaction effect between gender and living environment and no main effect found for gender. There was a significant small main effect (d = 0.2) for living environment (F (1, 31) = 5.81, p < .05) with students living on-campus in University accommodation (*M* = 0.4, *SD* = 1.2 hours/ week) having lower levels of work-related vigorous physical activity than those living off-campus (*M* = 4.2, *SD* = 8.2 hours/ week respectively).

For subjectively-measured levels of work-related total activity, there was a significant small interaction effect (d = 0.1) between gender and living environment (F (1, 31) = 5.02, p < .05). Female students who lived off-campus (*M* = 90.9, SD = 97.3 hours/week) reported higher

levels of total work-related physical activity than male students who lived in off-campus accommodation (M = 30.7, SD = 39.9 hours/ week. It was also evident that male students who lived on-campus (M = 2.5, SD = 5.6 hours/ week) reported higher levels of total work-related physical activity than female students living on-campus (M = 1.6, SD = 3.1 hours/ week). There was a significant small main effect (d = 0.1) found for gender (F (1, 31) = 4.71, p < .05) with females (*M* = 23.9, *SD* = 58.0 hours/ week) having higher levels of work-related total activity than males (*M* = 14.4, *SD* = 29.0 hours/week). There was a significant small main effect (d = 0.3) for living environment (F (1, 32) = 18.52, p < .001) with students living on-campus (*M* = 47.9, *SD* = 29.1 hours/ week) having lower levels of work-related total activity than those living off-campus (*M* = 65.3, *SD* = 35.9 hours/ week). There was no significant interaction or main effects between gender and living environment on the remaining subscales on the IPAQ (p > .05).

3.4.4.1 Differences in objectively-measured outcome variables by gender and living environment.

Table 3.5 represents the results of the two-way ANOVA, which indicated, for objectively-measured percentage (%) of time spent in very vigorous physical activity, there was no significant interaction effect between gender and living environment. There was a significant small main effect (d = 0.1) for gender (F (1, 32) = 4.22, p < .05) with males (*M* = 0.3, *SD* = 0.3 %/daily, *M* = 2.3, *SD* = 2.1 minutes/daily) illustrating higher levels of daily very vigorous physical activity than females (*M* = 0.1, *SD* = 0.1 %/daily; *M* = 0.8, *SD* = 0.9 minutes/daily). No main effect was found for living environment.

A two-way ANOVA indicated there was no significant interaction or main effect evident between gender and living environment for the remaining intensities of objectively-measured physical activity.

Table 3.5: Two-way ANOVA for differences in objectively-measured outcome variables across gender and University

| | On-Campus | | | | Off-Campus | | | | All | | | |
| | Male (n=11) | | Female (n= 9) | | Male (n= 8) | | Female (n= 4) | | Male (n= 19) | | Female (n=13) | |
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Step Count	8072	2350	8907	3980	10809	4275	9064	2019	9224	3479	8955	3404
Total time in Activity (daily mins)	739.7	77.4	707.6	97.0	788.6	104.0	718.8	101.7	760.3	90.3	711.0	94.3
Light PA (daily mins)	664.9	67.0	630.6	96.9	688.7	86.5	645.7	73.3	694.9	74.5	635.2	87.5
Light PA (%)	89.9	3.2	88.8	4.7	86.9	4.2	90.1	2.6	88.6	3.8	89.2	4.1
Moderate PA (daily mins)	61.8	20.8	67.3	30.4	81.1	30.6	58.8	18.6	69.9	26.5	64.7	26.8
Moderate PA (%)	8.3	2.5	9.7	4.0	10.5	2.9	8.0	1.5	9.2	2.8	9.1	3.4
Vigorous PA (daily mins)	11.4	6.5	9.3	9.1	15.6	14.3	12.4	10.0	13.2	10.4	10.3	9.1
Vigorous PA (%)	1.6	1.0	1.5	1.5	2.2	2.0	1.6	1.1	1.8	1.5	1.5	1.4
Very Vigorous PA (daily mins)	1.6	1.7	0.4	0.2	3.2	2.3	1.8	0.9	2.3	2.1	0.8	0.9
Very Vigorous PA (%)	0.2	0.2	0.1	0.0	0.4	0.3	0.3	0.1	0.3	0.3*	0.1	0.1*

* $p < .05$ significant main effect of gender

n = numbers

3.4.5 Summary of findings

To summarise there was a relationship between increased engagement in very vigorous physical activity and lower levels of depression. It was also apparent that even light intensity physical activity had a positive relationship with student's mental health. Light and moderate intensity physical activity had a positive effect on student's quality of life. This study also identified that anxiety was more prevalent among female students who lived in on-campus accommodation compared to males who lived in on-campus accommodation, whereas off-campus accommodation recognised males to have elevated anxiety levels in comparison to females who lived off-campus.

Interaction effects indicated female students who lived in off-campus University accommodation to report higher levels of self-report moderate and total work-related physical activity than male students who lived in on-campus University accommodation. This study also identified that living in on-campus accommodation had a negative impact on the mental health being and total quality of life scores. As well as reduced levels of self-reported weekly physical activity and aspects of work-related physical activity to include work-related walking, moderate, vigorous and total physical activity. Finally the study identified apparent gender differences where females reported higher levels of self-reported work-related moderate and total physical activity than males, whereas accelerometer data illustrated male students to engage in higher levels of very vigorous physical activity than their female counterparts.

3.4.6 Analysis of qualitative data

Analysis of health behaviours in first year students at both universities was conducted using an inductive approach (Thomas, 2003). Interviews were conducted on a sub-sample of the study participants, which were transcribed and thoroughly read through at least three times. Within the transcripts 'meaning units' were identified as either positive or negative behaviours, retrospectively throughout school and currently at University. The meaning units were then categorised as first or second order themes with an overall theme identified for all participants. A final table of overall themes was created to summarise the second order themes and identify either common positive or negative overall themes across the dimensions of health, physical activity and dietary behaviours at school and at present in University.

3.4.6.1 Key themes related to student health behaviours

The overall themes and dimensions relating to student's perceptions of the effect of University on health behaviours are highlighted in Table 3.6. These included; perceptions of health, school health behaviours and University health behaviours. The findings suggest that students have a vague perception about the components that make up a healthy lifestyle, with no students identifying the mental health aspect of health without further questioning; however most students identified diet and physical activity to be aspects of health. This is highlighted in the second-order themes that emerged; health includes diet and exercise, vague knowledge of mental health aspect of health and emphasised by the following quotation:

'Just eating healthily, exercising every now and again but yea that's about it' (male student living on-campus).

A majority of students recalled positive health behaviours at school where, regular activities with family dietary support allowed a healthy lifestyle at school and good diet and active at school emerged as second-order themes, further emphasised by the following quotation:

'I was much healthier back then there was activities everyday 2 or 3 activities every

day and my food was really good because my mum would prepare fresh food everyday it was never from the freezer always freshly made' (female student living on-campus).

When asked to compare their health behaviours from school to University a majority of students reported their health behaviours to be better at school (n= 4), where University was portrayed to have a negative effect on their health behaviours. Some of the second-order themes were identified as; healthier during school, health, physical activity and diet declined since coming to University, which is highlighted by the following quotation:

'Probably a bit worse not eating as healthily and probably not doing as much exercise as I did at school, not being on the go as much' (male student living on-campus).

However it must also be highlighted that the remaining students (n = 2) found coming to University to have a positive effect on their health behaviours where second-order themes were identified as; University encouraged increased physical activity through joining the gym and healthier at University, which is emphasised by the following quotation:

'I'd like to say now, yea I would say now I'm more involved in sport here than I was at school although I did PE that was only ever once a week for 2 hours or something where as Frisbee now is 2 or 3 times a week for 2 hours or something and I'm always walking about the campus and I'm eating healthily and not getting too stressed' (male student living on-campus)

These qualitative results highlight the negative impact University can have on health behaviours in some first year students further indicating the need for implementing interventions that encourage positive health behaviours among first year students.

3.4.6.2 Key themes related to student physical activity levels

Table 3.7 summarises the overall themes related to students' knowledge of current physical

activity guidelines as well as past and present physical activity levels. These included; knowledge of physical activity guidelines, school physical activity levels and University physical activity levels. A number of students confidently knew the current UK physical activity guidelines of 30 minutes of moderate intensity physical activity on five or more days a week as recommended by the 2011 UK Chief Medical Officers (Department of Health, 2011). Some of the second-order themes that developed from the data collected include, good knowledge of current physical activity guidelines with quotations emphasising this:

'Oh I can't remember is it something like 150 minutes of moderate intensity activity and 75 minutes of vigorous' (female student living off-campus).

Although it was evident that some students were unfamiliar with the current physical activity guidelines for health benefits as identified in the following second-order theme; vague knowledge of current physical activity recommendations, highlighted by the following quotation:

'A couple of hours a week or a day just to make sure your as healthy as possible' (male student, living on-campus).

A majority of students positively described school physical activity levels where second-order themes emerged as; high level of physical activity participation inside and outside school and daily high intensity physical activity inside and outside, family support and regular school PE lessons. This is highlighted in the following quotations:

'high, every day I was doing something, every day was a different sport and I was in the National Squad for Karate' (male student living on-campus),

'As I was saying that (school) was when I was at my most active just because of the teams I was involved with and the time I had as well, I remember at school I didn't have a lot of commitments other than playing

football or playing sports I was always doing something that involved being

active' (male student living off-campus)

This highlights the increased intensity of physical activities experienced at school, along with regular involvement in outside school physical activities. However one student portrayed negative physical activity levels at school as identified in the following second-order theme; no interest in school sports due to intimidation, lack of confidence with lack of opportunity in out of school clubs and a lack of enjoyment, which is emphasised in the following quotations from the same student:

'there was never really the opportunity from where I'm from anyway or any sport I'm

interested in there was never the opportunity I never really bothered or had the chance

to' (male student living on-campus)

'Yea and I would never do it (physical activity), I felt quite intimidated I

suppose I never really had the confidence to do it because there were always

people better at it than you so I never used to enjoy it or I never did it' (male

student living on-campus)

Students were asked about their current physical activity levels now at University where a majority reported University to have a negative effect with second-order themes emerging such as; University work load and structure change negatively affect physical activity participation and University encourages less structure and reduced physical activity motivation. The reasons behind these physical activity reductions are also identified in the following quotations:

'I think because schoolwork was less intense and having so many clubs around

me I had more motivation back home because the different groups I went to I

had more structure I think. I think living here (on-campus) it can be hard to motivate myself to get out whereas it was easier at home' (female student living on-campus)

'I think growing up plays a big part in it I think you get to a point where going out, social factors play a big part in it and then commitments like work and assignments for University. I think you get so used to going through school and you do your homework for an hour a night and then the rest of the night is yours, you end up playing football or doing whatever you want to do and then you come to University and there's a lot of work that needs to be done as well as employment work, so I think during school definitely' (male student living off-campus)

These insights into student physical activity levels highlight the need for concern among this first year student population. It was also identified through second-order themes that physical activity intensity reduces due to the effect of University; regular physical activity but reduced intensity compared to school and physical activity decline from Semester 1 to Semester 2. This is highlighted by the following quotations:

'a decrease since school but I'm still playing hockey but just not as intense' (female student living on-campus)

'I don't know if I am slightly fitter but in total it is probably the same but it was more high intensity when I was at karate so probably in total the same amount of time but just not the same intensity' (male student living on-campus)

It is important to highlight that the same student who recalled negative school physical

activity levels reported University to have a positive effect on their physical activity levels highlighted by second-order theme; University sport more appealing than school activities and in the following quotation:

> 'A lot more I would say it's increased mainly due to the Frisbee side of it but also with the walking about everywhere and back and forward on the campus. Especially with me living in halls its easier for me to go back and forth to my lectures and my flat rather than just staying around in the Union for an hour or so just sitting doing nothing, it makes it a lot better that way' (male student living on-campus)

This suggests that University has the potential to have a positive influence on students' physical activity levels through increased opportunities available at University along with campus-based living allowing an independent lifestyle.

3.4.6.3 Key themes related to student dietary behaviours

Table 3.8 highlights the overall themes related to students' perceptions of diet as well as dietary behaviours at school and University. These included; knowledge of recommended dietary behaviours, school dietary behaviours, and University dietary behaviours. Student's knowledge of recommended dietary behaviours for health benefits were varied where some of the second-order themes identify; good knowledge of recommended dietary behaviours and identifies difference between good and bad diets. A majority of students positively reflected on school dietary behaviours with second-order themes categorised as; healthy eating behaviours in school, meals are planned and eaten in routine and school encouraged good dietary behaviours with family support. This is emphasised in the following quotations:

> 'I think it was really good back then because I also had the structure of mum or dad making tea at home and then obviously school canteen food it was easier to regulate what you ate' (female student living on-campus)

'Not too bad, because you were in school at a set time every day you had your set routines of your breakfast and lunch so you got into a routine of eating similar things so yea healthy enough' (male student living off-campus).

However there were some students who portrayed negative school dietary behaviours where second-order themes emerged as, negative impact of social support encouraged negative eating habits, identified in the following quotation:

'I didn't really have breakfast because I like sleeping more than having food so I would have like crisps at 11am and then we (friendship group) would go down town for lunch so we would go to the noodle bar or subway or McDonalds and then I would have my dinner and then I would have crisps or something at night' (female student living off-campus)

It is important to note that this particular student who portrayed negative dietary behaviours at school reported similar dietary behaviours when at University which could be related to the unchanging living environments where they remained living at home in the progression to University.

Dietary behaviours now at University were negatively described by a majority of the students interviewed where second-order themes emerged as; irregular routine at University encourages negative dietary behaviours such as snacking and irregular eating patterns and lack of routine, irregular meal times, not used to cooking for self, as highlighted in the following quotations:

'Probably not as good as home but still not bad probably eating at weirder times but still having 3 meals a day' (male students living on-campus).

Negative dietary behaviours at the weekends were also identified through second-order themes; University weekends encourage negative dietary behaviours, as confirmed in the following quotations:

'Maybe sometimes if you're in town you grab something to eat in town like Nandos or something, Sunday seems to be an unhealthy day not all the time but if you're out on the Saturday so maybe get a take-away now and again' (female student living on-campus)

'I think my diet is poor at the weekends definitely I just end up eating what you can eat when you can eat it, like chips or whatever, I think drink (alcohol) is a big part of your diet at the weekend to be honest' (male student living off-campus)

However it is important to note that not all students found University to have a negative effect on their dietary behaviours where students who moved from living at home at school to living in halls of residence at University, second-order themes were described as, better dietary behaviours due to the independent nature of University and more control over what is eaten, identified through the following quotation:

'Now they are a lot better except for when I go home I sort of pig out because its free but when I'm at University it's a lot healthier because I am the one buying it and I take note of what I am buying and whether it is healthy or not and you think "should I eat this" but yea they are a lot better now than they were' (male student living on-campus)

This finding highlights the potential for University campus settings to be utilised for positive dietary behaviours.

3.4.6.4 Summary of findings

The key findings that emerged from the qualitative aspect of the study identified the dimension of health to be predominantly made up of diet and exercise whereas there was a substantial lack of knowledge with regards to the mental health aspect among the student

population. A majority of the students recalled positive health behaviours at school and described current health behaviours at University to have had a negative impact on their health. University was generally identified to have had a negative impact on health behaviours.

The interviews explored students' knowledge of physical activity where a proportion of students knew the recommended physical activity guidelines for health benefits. A majority of students recalled positive school physical activity levels both inside and outside school. Current behaviours were revealed to have had a negative influence through the progression to University where some students reported remaining involved in physical activity but intensity had reduced since school and outside University physical activities were minimal. However one student identified University to have had a positive impact on physical activity levels since school due to increased sporting opportunities now available to students at University. Where living in on-campus accommodation also encouraged increased physical activity participation due to regular campus-based walking.

The final focus of the interviews was to identify student dietary behaviours where a majority of students were able to successfully identify what incorporates a healthy and unhealthy diet. Previous dietary behaviours at school were positively reflected due to family support and regular meal times whereas University was identified by a majority of students to have had a negative influence on dietary behaviours due to lack of routine through varying daily lecture times and weekends were identified to have negatively affected dietary behaviours at University. However it must be noted that although in general University was portrayed to have a negative influence on dietary behaviours, one student did identify University to have had a positive effect on dietary behaviours due to the independent nature of living away of home and therefore having more control over what is eaten.

In general the qualitative interviews identified students to reveal University to have had a negative impact on health, physical activity and dietary behaviours however it was also acknowledged that some aspects of University life encouraged a change in behaviour or allowed students to have more independence and control over their health behaviours.

Table 3.6: Overall themes relating to student's perceptions of the effect of University on health behaviours.

Second Order Theme	Overall Theme	Dimensions
• Good knowledge of mental health, diet and PA benefits for health benefits • Health includes diet and exercise, vague knowledge of mental health aspect • Understands diet and exercise are aspects of health • Positive attitude, Active & Absence of illness • Absence of illness and not being overweight • Identifies being physically active as a key aspect of good overall health	Knowledge of what health incorporates	Perception of Health
• Good diet and active • Health benefits through daily physical activity • Very active at school • Regular activities with family dietary support allowed healthy lifestyle at school • Very physically active school life	Health behaviours were better at school	School Health Behaviours
• Similar to at school • Enjoy University sports • Healthier at University • University encouraged increased physical activity through joining gym • Healthier now	University has a positive effect on health	University Health Behaviours
• Not as good as school • Healthier during school Health physical activity and diet declined since coming to University • Exercise less and its more individual at University • Reduced physical activity levels and negative diet behaviours	University has a negative effect on health	

Table 3.7: Overall themes relating to student's perceptions of the effect of University on physical activity levels.

Second Order Theme	Overall Theme	Dimensions
• Correct knowledge of current physical activity guidelines • Good knowledge of current physical activity guidelines • Good idea of physical activity guidelines and behaviours • Good knowledge of current physical activity guidelines	Good knowledge of current physical activity guidelines	Knowledge of physical activity guidelines
• Unsure of physical activity guidelines • Vague knowledge of current physical activity recommendations	Vague knowledge of current physical activity guidelines	
• Job encouraged school physical activity • Physically active inside and outside school with social support • Very active at through outside school football involvement • High level of physical activity participation inside and outside school • Daily high intensity physical activity inside and outside school, family support and regular school PE lessons • Regularly physically active inside and outside school regardless of PE not being compulsory	School had a positive effect on physical activity levels	School Physical Activity Levels
• No interest in school sports due to intimidation and lack of confidence with lack of opportunity in out of school clubs • Lack of enjoyment • University encourages a reduction in physical activity intensity • Lack of time and routine at University compared to school that contributes to reduced physical activity levels	School had a negative effect on physical activity levels	

• University sport more appealing than school activities • University provides a wide range of physical activity choices for students • More physical activity at University	University has a positive effect on physical activity levels	University Physical Activity Levels
• Physical activity intensity & frequency decreased • University work load and structure change negatively affect physical activity participation • Physical activity decline from Semester 1 to Semester 2 • University encourages less structure and reduced physical activity motivation • Regular physical activity but reduced intensity compared to school	University has a negative effect on physical activity levels	

Table 3.8: Overall themes relating to student's perceptions of the effect of University on dietary behaviours.

Second Order Theme	Overall Theme	Dimensions
• Identifies difference between good and bad diets • Differences between good and bad food groups • Perceptions of healthy food groups • Good knowledge of recommended dietary behaviours • Knowledge of food groups • Perception of a balanced diet	Knowledge of recommended dietary behaviours	Knowledge of recommended dietary behaviours
• Vague knowledge of current dietary guidelines • Vague knowledge of current guidelines for age group	Lack of knowledge of recommended dietary behaviours	
• Good diet at school eating had a routine • Healthy eating behaviours in school, meals are planned and eaten in routine • School encouraged good dietary behaviours with family support • School dietary behaviours were in a set routine with regular family support at meal times	School has a positive effect on dietary behaviours	School Dietary Behaviours
• Negetive impact of social support encouraged negative eating habits • School encouraged unhealthy snacking	School has a negative effect on dietary behaviours	
• Better dietary behaviours due to independent nature of University and more control over what is eaten	University has a positive effect on dietary behaviours	

	University has a negative effect on dietary behaviours	University Dietary Behaviours
- Lack of routine, irregular meal times, not used to cooking for self - Similar poor dietary behaviours to school at University - meal times depends on lectures - University encourages less structured and strict diet - Irregular routine at University encourages negative dietary behaviours such as snacking and irregular eating patterns - University weekends encourage negative dietary behaviours - Irregular meal times negatively impact diet - Social network can have a positive or negative affect on dietary behaviours		

3.5 Discussion

This study examined students in their second Semester of first year at University, focusing on the association between depression, anxiety, quality of life and physical activity. The study also looked at whether there were significant differences between each of these variables in relation to gender and living environment. In addition, the study looked at whether there was a significant interaction between gender and living environment on depression, anxiety, quality of life and objectively and subjectively-measured physical activity.

3.5.1 The relationship between depression and physical activity levels

It was identified that objectively-measured, very vigorous physical activity was associated with lower levels of depression ($p < 0.05$) (Table 3.3). These findings share similarities with results taken from the 2005 – 2006 US National Health and Nutrition Examination Survey (NHANES), which also measured physical activity levels objectively using Actigraph accelerometers (Vallance, Winkler, Gardiner, Healy, Lynch & Owen, 2011). Results identified significantly lower levels of depression among US adults who participated in more than 36 minutes of moderate-vigorous physical activity a day, compared to those who took part in less than 8.52 minutes of daily moderate-vigorous physical activity. However the measure used to assess depression was the Patient Health Questionnaire-9 (PHQ-9) (Kroenke, Spitzer & Williams, 2001) as opposed to the HADS questionnaire (Zigmund & Snaith, 1983) used in the current study suggesting that differences in depression levels could be evident. It is important to note that the results from the 2011 study did not specifically look at the student population but represent the US adult population, however results still support the finding from the current study highlighting the importance of encouraging more vigorous intensity physical activity as an approach to reduce symptoms of depression.

In 2008 Teychenne, Ball and Salmon conducted a review of the literature surrounding physical activity intensity and the likelihood of developing depression, where conclusions

identified four observational studies to illustrate a stronger association between vigorous intensity physical activity and the likelihood of reduced depression when compared to other lower intensity physical activities (Ruuskanen and Ruoppila, 1995; Lampinen et al. 2000; Lee and Russel, 2003; Wise et al. 2006). These findings share important similarities to the current study where it was evident that higher intensity physical activities (very vigorous) elicited lower, more favourable levels of depression, however it is important to note that the previously mentioned study populations were looking at adults and not specifically the student population. It is also important to acknowledge that findings from the current study identified a higher, less favourable mean depression score ($M = 5.8$) to the UK norms for HADS depression ($M = 3.7$; Crawford et al*.,* 2001) further highlighting the prevalence of depression among this current first year student sample.

Similar findings were evident in a 2005 study looking at the effect of different total energy expenditures on depression (Dunn, Madhukar, Kampert, Clark & Chambliss, 2005). Results identified the higher energy expenditure of 17.5kcal/kg/week encouraged a significant reduction of 47% in mean depression scores compared to the lower energy expenditure of 7.0 kcal/kg/week recorded 12 weeks after baseline. These findings suggest energy expenditure is an influential factor in the reduction of depression. However it must be emphasised that the study sample was not an accurate representation of the student population as participants varied in age from 20 to 45 years old. In addition, it should be noted that the measure of depression was the Hamilton Rating Scale for Depression (Hamilton, 1968) instead of the HADS questionnaire that was used in the current study, which should be taken into consideration when comparing the results with the current study.

A UK study by Andrews and Wilding (2004) similarly assessed depression among the student population using the HADS questionnaire (Zigmond & Snaith, 1983). The current study reported a higher, less favourable mean HADS depression score among students in

their second Semester of first year ($M = 5.8$) than the values reported by Andrews and Wilding ($M = 4.3$; Andrews & Wilding, 2004) reporting HADS depression score in the middle of the second academic year of University. This suggests that first year at University to be a more depression-eliciting year than the later years in a degree course.

Earlier evidence by Steptoe and Butler (1996) found lower levels of emotional distress among a large study sample (n = 5,061) of adolescents who participated in vigorous intensity physical activity. Research suggests that many mental health issues are apparent by early adulthood (Kessier, Berglund, Demier, Jin, Merikangas & Walters, 2005) highlighting the importance of examining this specific population. Through National surveys of college counseling directors in the US, Gallagher (2007) identified ever-increasing occurrences of mental health issues among University students. However encouraging more vigorous forms of physical activity among this specific population could help reduce symptoms of depression and lead to lower levels of depression in adulthood as highlighted in the findings in this study.

3.5.2 The relationship between physical activity and anxiety

Findings from this study indicate that anxiety does not appear to be related to physical activity engagement, as there were no significant relationships between anxiety and objectively-measured physical activity of any intensity ($P>0.05$) (Table 3.3). Contrary to these current findings, a UK study described 20% of University students who reported no symptoms of anxiety one month prior to University entry (2000) to report a significant increase in levels of anxiety by mid-course (2002) (Andrews & Wilding, 2004) suggesting University does appear to be an anxiety provoking time. The same HADS questionnaire (Zigmond and Snaith, 1983) was used to measure anxiety as the current study, where findings from the current study reported anxiety levels to be considerably lower ($M = 2.3$) than those reported by Andrews and Wilding (2004) ($M = 9.4$) and lower than the UK norms for the

anxiety aspect of the HADS questionnaire (M = 6.1; Crawford et al. 2001). Such differences in anxiety could be attributed to the different time points these anxiety levels were measured, where the current study looked at first year anxiety levels and Andrews and Wilding (2004) measured levels mid-course (middle of the second academic year). This suggests that symptoms of anxiety are not unique to first year students but it is in this initial year that causes these levels to be heightened, where results from the Andrews and Wilding study indicate 36% of students who were previously anxious one month prior to entering first year at University (2000) were found to have recovered by mid-course (2002) further emphasising the potential negative effect entering first year has on student well-being in comparison to later years in the degree course.

Recent research by Cooke and colleagues (2006) identified University students to predominantly experience increased levels of anxiety as opposed to signs of depression in their first year of study, whereas the current study did not find anxiety to be more predominant than depression among this sample of first year University students. The GP-CORE questionnaire was used in this study by Cooke and colleagues (2006), which is the recommended version of the CORE-OM questionnaire for use among the general or student population. This incorporates aspects of subjectively-measured well-being, anxiety, depression and physical issues (Sinclair, Barkham, Evans, Connell & Audin, 2005) in contrast to the HADS questionnaire (Zigmond and Snaith, 1983) used in the current study, emphasising the current difficulty in measuring and validating psychological factors with previous research. It should be noted that the findings by Cooke and colleagues (2006) were evident at the start of University entry whereas findings from this current study measured anxiety levels in the second Semester of first year. Nonetheless current and previous research underline the importance of this initial entry stage in first year at University, where further

research of student well-being is required at this crucial stage of potentially heightened anxiety levels when compared to the later stages of their degree courses.

Earlier evidence exists supporting the current findings where Morris, Steinberg, Sykes and Salmon (1990) found no association between high levels of physical activity and a reduction in anxiety, but found it had a positive effect on depression levels. Supporting the findings from the current study where physical activity had a significant effect on reduced depression levels and no relationship was found for reduced levels of anxiety. However this study measured self-report physical activity in adolescents in comparison to the objectively-measured physical activity levels in University students through accelerometer data used in the current study.

Regardless of the current finding of no relationship between anxiety and physical activity, other previous research suggests anxiety to be a prevalent issue in many students' experiences. Heightened anxiety levels in first year could be the foundation for further developing other elements of mental health such as depression in more vulnerable students, highlighting the need for attention and further research among the student population.

3.5.3 The relationship between quality of life and physical activity levels

This study found a significant positive correlation between the SF-12 Physical Component Score, Mental Component Score and Total Average Score with objectively-measured light physical activity ($P<0.05$), illustrating that even low levels of physical activity correspond to enhanced psychological well-being. A positive correlation (Table 3.3) was also evident between objectively-measured moderate physical activity and the SF-12 Physical Component Score, further accentuating the recommended physical activity guidelines of at least 30 minutes of moderate intensity physical activity on at least five days a week (Townsend et al., 2012) can have a positive effect on physical functioning. These findings relate to previous literature by Hassmen, Koivula and Uutela (2000) where they found a positive relationship

between improved quality of life and regular physical activity. Similar to the current study, questionnaires (Beck Depression Inventory, the State-Trait Anger Scale, Cynical Distrust Scale and the Sense of Coherence inventory) were administered to assess quality of life among a student population where conclusions illustrated reduced levels of depression, anger and stress levels in those individuals who were physically active in comparison to those who were not as physically active. This research study along with the results from the current study illustrate the positive effect physical activity of even light intensity has on psychological well-being, highlighting the importance of encouraging increased physical activity participation among the student population as a way to enhance student quality of life throughout the University experience.

Bray and Born (2004) found lower levels of stress and tension among a student population sample that were physically active compared to those students who were not physically active. This further illustrates the importance of encouraging the student population to engage in physical activity due to the acknowledged links with enhanced quality of life. In addition this 2004 study assessed quality of life similarly through questionnaires, the Profile of Mood States- Adolescent (Terry, Lane, Lane & Keohane, 1999) and General Health Questionnaire-28 (Goldberg & Hillier, 1979) were used as opposed to the SF- 12 (Ware, Kosinki and Keller, 1996) questionnaire used in the current study. In order to gain a further insight into the intensity of student physical activity the current study used accelerometer data compared to the self-report physical activity questionnaire data used by Bray and Born (2004), this could lead to an inaccurate interpretation and comparison of the physical activity undertaken.

Stallman (2010) investigated the psychological well-being of the student population in comparison to the non-student population and found 83.9% of students to have significantly increased distress levels when compared to the general population (29%), illustrating University students to be an at risk population for developing negative mental health

behaviours. These findings share similarities to the current study, which found students who lived on-campus to have significantly less favourable quality of life when compared to off-campus students.

A recent population based study looked at physical activity levels and health related quality of life using the SF-36, the long version of the SF-12 (Jurakic, Pedisic & Greblo, 2010). The study found a positive association between subjectively-measured leisure-time physical activity and health-related quality of life. Although the 2010 study did not specifically look at the student population the findings still demonstrate even low levels of physical activity participation can have a positive effect on a person's quality of life as reinforced by the findings from the current study.

3.5.4 The difference between subjectively and objectively-measured physical activity levels and outcome variables across gender

The first aspect of the final quantitative research aim was to explore the difference between subjectively and objectively-measured physical activity levels and outcome variables across gender. This study found male students to have a significantly higher percentage of objectively-measured very vigorous physical activity levels than their female counterparts (Table 3.5). This finding shares similarities with previous objectively-measured accelerometer research where males were found to participate in 45% more vigorous intensity physical activity than females (Trost et al., 2002), however it must be stressed that this was a pre-University aged study sample and therefore younger than the current sample.

Casperson, Pereira and Curran (2000) found a smaller reduction in regular vigorous intensity physical activity in males (-28.6%) compared to females (-36.0%) from the ages of 12 – 21 years old. These findings provide support for the current study where males were found to participate in significantly higher amounts of vigorous intensity physical activity than their female counterparts. Casperson and colleagues study (Casperson et al., 2000) looked at

longitudinal changes in activity levels compared to the cross-sectional nature of the current study, which could be an interesting aspect to look at for future research into changes in student physical activity levels across first year at University. Caspersen, Pereira and Curran also use subjectively-measured physical activity through the National Health Survey data as opposed to the objective accelerometer data used in the current study.

However in contrast to current findings, Dinger and Behrens (2006) found small differences in objectively-measured moderate and vigorous intensity physical activity (MVPA), where female students recorded slightly higher levels of MVPA ($M = 13.8$ minutes/day) than male students ($M = 13.2$ minutes/day). Whereas findings from the current study recorded higher levels of very vigorous intensity physical activity in males than females. Dinger and Behrens similarly measured physical activity intensity through accelerometer data and results also identified college students in the US not to be meeting the current recommended physical activity guidelines for health benefits.

The current study findings contrast previous longitudinal research by Van Mechelen, Twisk, Post, Snel and Kemper (2000) examining gender differences in physical activity intensities from adolescence (13years old) to adulthood (27 years old) and demonstrated that after the age of 16 years old there was no difference between males and females and time spent in very vigorous physical activity. It should be noted that this study assessed physical activity intensity through structured interviews incorporating all activity above 4 METs of intensity compared to the objective accelerometer data collected in this current study, which could contribute to the differences in the findings.

The current study found female students to report significantly higher levels of subjectively-measured work-related total and moderate physical activity levels compared to their male counterparts. In contrast to these findings, a recent 2012 study similarly assessed self-report

physical activity levels using the IPAQ and identified male students to report higher levels of walking and total physical activity than female students (Ozdol, Ozer, Pinar, & Cetin, 2012). Rouse and Biddle (2010) examined University students' subjectively-measured physical activity levels and also found self-report levels of physical activity to be higher in male students (M = 39.8 minutes/ week) compared to female students (M = 21.7 minutes/ week) which contrasts what was found in the current study where females reported higher levels self-report physical activity than males. It must be highlighted that different measures were however used to assess subjectively-measured physical activity levels. Rouse and Biddle (2010) used ecological momentary assessment diaries which required participants to write down every 15 minutes the main behaviour they were currently undertaking over a 2 day period in contrast to the IPAQ used in the current study which required participants to recall physical activity levels over the previous 7 days. The study sample is another limitation that should be considered when comparing the current study with this recent UK based study, which had a total of 84 students (46 male and 38 female), 66% of them being first year undergraduate students in comparison to the current study which had a total of 32 first year students (19 male and 13 female) highlighting some of the differences in the participants recruited and a potential reason as to why differences in the results were evident.

The current study identified living environment and gender to have a significant impact on anxiety levels among the student study sample (Table 3.4). Findings identified female students who live in on-campus accommodation to experience heightened anxiety levels when compared to their male counterparts who lived in similar on-campus accommodation. It was also evident that male students who lived in off-campus accommodation experienced higher anxiety levels than female students who lived in off-campus accommodation. This evident change in students' anxiety levels could be characterised as state anxiety (Spielberger

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& Sydeman, 1994), which is also known as transitory and identified as temporary feelings of fear or nervousness due to this change in environment from school or home to University and halls of residence. This finding is supported by previous research that identifies University students predominantly experience increased levels of anxiety in their first year of study (Cooke et al., 2006). It should be noted that these anxiety levels were measured at the start of University entry and did not differentiate between on- and off-campus living environment whereas findings from this current study measured anxiety levels in the second Semester of first year.

Findings from the current study indicate that engagement in higher physical activity intensities correspond with reduced levels of depression. This finding suggests Universities need to further encourage female students to engage in more moderate to vigorous intensity physical activity.

3.5.5 The difference between subjectively and objectively-measured physical activity levels and outcome variables across living environment

The final aspect of the quantitative research aim of the study was to explore the difference between subjectively and objectively-measured physical activity levels and outcome variables across living environment. The study found students living in off-campus accommodation to have more favorable mental health and quality of life than those who lived in on-campus accommodation (Table 3.4). This suggests that students living off-campus or at home have a significantly enhanced quality of life compared to those who live in on-campus accommodation.

Contrary to these current findings recent research in 2009 (Kins, Beyers, Soenens, & Vansteenkiste, 2009) assessed subjectively-measured well-being to include aspects of life satisfaction, subjective vitality and depressive symptoms in young adults. Findings identified participants who still resided with their parents or those who lived in a student apartment on the weekdays and regularly returned home at weekends had a poorer quality of life compared

to those participants who lived independently. Previous research suggests living with parents can restrict young adults from gaining independence and therefore inhibiting adulthood (Elm & Schwartz, 2006; Flanagan, Schulenberg & Fulingini, 1993; White, 2002). The independent living environment evident in the Kins and colleagues' (2009) study was similar to the on-campus living environment evident in the current study, however Kins and colleagues looked at young adults and did not specifically investigate the subjective well-being of the student population.

However similar to the current study which identified independent living environments on-campus to have a negative impact on students, a recent study looked at the impact of living environment on first year University students and found students who lived in the parental home expressed healthier habits with regards to food choices with increased fruit and vegetable consumption compared to those students who lived outside the family home (Ansari, Stock, & Mikolajczyk, 2012).

There is a lack of recent research identifying the effect of the University living environment on student well-being, however earlier evidence exists which shares similar findings to the current study indicating heightened stress levels through increased independent living evident at University (Mudore, 1999). The importance of encouraging positive health behaviours and well-being among this specific population is demonstrated in research indicating increased anxiety levels due to students finding the process of progressing to University overwhelming. Which may in time lead to the development of depression and negatively impact on the University experience and academic performance (Wintre & Yaffe, 2000).

Previous research indicates students who decide to live on-campus in halls of residence in their first year at University can experience high levels of support from their fellow peers associated with significantly higher levels of adjustment (Barthelemy & Fine, 1995), however findings from the current study suggest differently, where on-campus living environment was

found to have a negative impact on student well-being. This research however dates back to almost 20 years ago which would suggest the findings from the present study could be a better representation of the current student population.

This study found on-campus accommodation to have a negative effect on students' subjectively-measured work-related; walking, moderate, vigorous and weekly physical activity levels as well as total physical activity levels compared to those who lived in off-campus accommodation. These findings are consistent with previous subjectively-measured physical activity research undertaken in a Turkish University, which discovered students who lived in on-campus halls of residence reported lower levels of both total physical activity and moderate physical activity than those students who lived at home or off-campus (Ozdol, Ozer, Pinar, & Cetin, 2012). These findings are similar to the current study, which also found lower physical activity levels among students who lived on-campus in University accommodation. It is important to note that the long version of IPAQ was used in the Turkish study as opposed to the short version of the IPAQ used in the current study.

In contrast to the study findings, previous research by Brevard and Ricketts (1996) found no significant differences between subjectively-measured weekly energy expenditure, type of exercise, activity-level patterns in students, or whether they lived on-campus or off-campus. Findings reported 29% of those who lived on-campus and 28% of those who lived off-campus exhibited either inactivity or light physical activity, highlighting little difference between these two living conditions. Although this study similarly assessed subjective physical activity levels through questionnaire data the study is dated and the sample size was a lot larger with a total of 114 students in comparison to the 32 student participants in this current study which should be considered when comparing these samples.

The work-related physical activity findings from this current study indicated that those students who lived in off-campus accommodation whose living environment may not have

changed from school to University reported higher levels of work related walking than those students whose living environment changed in the progression to University. This could suggest that students whose living situation did not change also retained a job from school, whereas those students who moved away from home and currently lived in on-campus accommodation did not have a job. This evidence further highlights that living in on-campus accommodation could have a negative impact on student physical activity levels.

3.5.6 Qualitative discussion

The purpose of the fifth and final research aim of the study was to explore a sample of first year University students' perceptions of their health behaviours, physical activity levels and dietary behaviours from school to University. The influence of University study on the physical activity levels and dietary behaviours was examined using an inductive approach through interviews with first year students at both universities. From the interviews, a number of positive and negative aspects of the students' past school behaviours and present University behaviours were identified. These positive and negative past and present experiences shared common themes among the students interviewed; the following sections will discuss the overall themes identified in relation to existing literature. The findings will be discussed in relation to the three dimensions of: Health, Physical Activity and Dietary Behaviours at school and University.

3.5.6.1 Health Behaviours

The interviews initially identified student's current perception and knowledge of health, which acknowledged most students to be aware of the physical activity and diet aspects of health, however there was an evident lack of knowledge with regards to the mental health aspect (Table 3.6). However previous research indicates that the awareness of mental health has vastly increased in recent years due to the increasing prevalence of student referrals to

University Health Services (Andrews & Wilding, 2004). This indicates that mental health awareness is increasing but there is still a large percentage of the student population that require more information to increase their knowledge in order to reduce the prevalence of mental health cases among the student population and encourage students to get help and support sooner rather than later.

Previous qualitative research examined mental health changes in the second Semester of first year at University and categorised a sample of first year students as either 'thriving' or 'just surviving' (Richardson, King, Garrett & Wrench, 2012). The students were asked to rate changes in their mental health during their first year, no students identified as 'thriving' reported negative mental health changes due to the first year University experience whereas 63% of those students identified as 'just surviving' reported their mental health to have changed for the worse. Feelings of stress, anxiety and being overwhelmed by the University process were commonly associated with negative changes in mental health (Richardson, King, Garrett, & Wrench, 2012). Richardson and colleagues (2012) also explored how these different groups coped with stress in their first year, the 'thriving' students described the use of pro-active strategies when a stressful situation was encountered through seeking help from lecturers or fellow students. Whereas the 'just surviving' students reported avoiding these stressful situations which tended to make the situation worse. This highlights the need for universities to implement intervention strategies to make this first year experience at University a less stressful time and provide all first year students with ways in which to cope with stressful situations.

University is a time of great change where the importance of developing not only academic skills but also interpersonal and stress-management skills should be encouraged among the student population as a way to encourage positive health behaviours (Nicpon, Huser, Blanks, Sollenberger, Befort, & Robinson, 2007; Shim & Ryan, 2012). These interviews highlight the

need for interventions to be put in place in order to educate first year University students more on mental health and how to encourage positive health behaviours.

3.5.6.2 Physical Activity Levels

Findings from the interviews identified that the majority of students reported a reduction in their physical activity levels since school, where school was seen to have a positive effect on physical activity levels in comparison to their current physical activity levels at University (Table 3.7). These results could be attributed to the physical activity undertaken in school time due to the compulsory Physical Education (PE) classes evident on school curriculums not apparent at University, where physical activity engagement becomes an option to students. These results share similarities with previous qualitative research by Kimball, Jenkins and Wallhead (2009) investigating the influence of high school PE on University students' physical activity levels, where evident reductions in physical activity levels from school to University were found. Kimball and colleagues (2009) attribute these reductions toward school PE curriculums not better preparing students for the physical activity barriers they are set to encounter during the transition to early adulthood, suggesting that high school does not encourage life-long physical activity levels among high school leavers. For many students, University is traditionally seen as the next stage after high school stressing the importance of promoting positive life-long physical activity levels whilst at school.

The majority of students in the current study reported reduced physical activity levels since progressing to University from school where previous research suggests that negative experiences at school PE classes were the key barriers to physical activity participation in later years (Coakley & White, 1992). This could be a key-contributing factor into the reasons why students' physical activity levels decrease when progressing onto University from school as highlighted in the findings of the current study where a majority of students reported a reduction in physical activity participation since school.

Allender, Cowburn and Foster (2006) reviewed previous qualitative research regarding participation in sport and physical activity among teenagers and young adults, which identified significant transitions in life to be a key barrier to physical activity participation. Transitions included changing schools where family support was identified as having a positive influence in continuing physical activity participation; these findings could share similarities to the findings from the current study, which specifically looked at the progression from school to University.

Another important finding from the current study identified students physical activity levels at University to report a noticeable reduction in their physical activity intensity and frequency, which is a key finding also evident in previous research by Bray and Born (2004) identifying decreases in physical activity frequency and intensity recorded in the last two months of school and the first two months of University. This implies that it may not necessarily be that physical activity ceases when progressing to University but it may be the intensity of the activity that reduces. The quantitative findings from the current study also highlight the importance of higher intensity physical activities to reduce depression among the student population suggesting universities need to implement interventions that incorporate enjoyable high intensity physical activities among the student population.

The current study also identified negative physical activity levels at University due to lack of physical activity enjoyment at school leading to negative physical activity levels at University. Mulvihill, Rivers and Aggleton (2000) identified enjoyment to be a fundamental aspect of physical activity participation and adherence. Fairclough, Stratton and Baldwin (2002) identify UK school PE curriculums to be predominantly performance-based, focused around team sports such as football, rugby and hockey where feelings of discomfort were apparent when demonstrating skills surrounded by school peers. This finding shares similarities to the findings in the current study where one student reported feeling intimated

which contributed to reduced physical activity levels at school, indicating a lack of choice and variety in school PE classes. This suggests that schools predominantly promoting team sports may encourage lifelong physical activity for some and may have a detrimental effect on the physical activity levels of many others. However universities are seen to offer an ever-increasing range of sports and physical activity opportunities to students as a way of encouraging positive physical activity levels contributing to enhanced overall health. These findings emphasise the importance of encouraging positive physical activity levels at a young age as it could influence the physical activity levels later in life.

Flintoff and Scraton (2001) found non-traditional activities such as dance to be more popular among girls at school, which are activities commonly offered at University as either an exercise class (Zumba) or a sports club (cheerleading), illustrating the increased provision and opportunities available at University. This aspect of increased opportunity evident at University is highlighted in findings from the current study where enrolling at University encouraged increased physical activity levels for some students due to the range of sports available in comparison to the limited sports available at school.

3.5.6.3 Dietary Behaviours

It was evident through the qualitative interviews that students generally reported University to have a negative effect on their dietary behaviours when compared to their school dietary behaviours (Table 3.8). This is a relatively common finding in University students where previous research by Racette, Deusinger, Strube, Highstein and Deusinger (2008) investigated the changes in dietary behaviours from first year through to final year in US undergraduate students. Interestingly the findings suggested that the evident increases in weight gain that was experienced in first year did not continue through to final year, another noteworthy finding in this study was that 85% of students had moved from University halls

of residence into off-campus accommodation by final year. These results highlight that on-campus living environment in first year at University could be a fundamental year that promotes unhealthy dietary behaviours through weight gain, which is evidently reduced in later years of study, highlighting the need for interventions to try and reduce this prevalence among on-campus students.

Previous qualitative research identified various barriers and enablers for healthy weight management among a sample of University students (Greaney et al., 2009). It was evident more barriers were identified by students than enablers, those students who identified more barriers tended to be less physically active. Barriers included stress and time constraints associated with being a student, which led to unhealthy eating behaviours at University. These findings are similar to the current study which identified meal times to be lecture and schedule dependent leading to irregular meal times and a less structured diet. Aspects identified as enablers were social support and physical activity. An important finding in this study by Greaney and colleagues (2009) found female students identified social support as both an enabler and a barrier to eating healthily. This finding was also reported in the current study, which identified dietary behaviours to be positively or negatively impacted depending on who you were with. The environmental factor of living situation was evident as both a barrier and an enabler where students reported time constraints made it difficult to prepare healthy meals for themselves combined with the unhealthy food choices available at the University canteen. However enablers were also identified for on-campus living where some students reported the University canteen facilities to support healthy dietary behaviours and the layout of their campus encouraged positive walking behaviours therefore enhancing positive physical activity levels. This highlights similarities with the current study where on-campus living encouraged regular walking yet it is important to acknowledge that what may be identified as an enabler to one student could be seen as a barrier to another. It is important

to note that this study used on-line focus groups as a way to gain a qualitative understanding of student dietary behaviours, which could lead to condensed responses from students, limiting the discussion that might occur during one-on-one interviews used in the current study.

American research by Wengreen (2009) identified 23% of first year students to have gained more than 5% of body weight during a 16-week period initially assessed before University entry (August) and at the end of the first Semester (December). Another key finding in this study was that 65% of those first year students who were identified to have gained more than 5% of body weight lived in on-campus accommodation and ate more than 2 extra meals a week than those students who lived in off-campus accommodation and did not gain more than 5% body weight. Further suggesting that living on-campus has a negative impact on diet and overall health behaviours.

Previous research suggests the change in living environment evident at University may encourage weight gain, where Levitsky (2004) suggested that it could be due to the increased amount and greater choice available at University dining halls promoting increased energy intake. As identified in the current study, dietary behaviours were understood to have been negatively affected by University, which could be due to the unsupervised nature of meal times and portion sizes evident at University. These findings highlight the need to target on-campus dining halls to provide and encourage healthier dietary behaviours among first year students.

3.5.7 Limitations of the study

The current research study does have limitations, which should be noted. Primarily the study was limited by its small sample size of first year students. A larger sample size would increase the validity of the findings and potentially lead to larger effect sizes in the results where only small effect sizes were evident ($d >= 0.2$). Secondly, ideally the number of

participants would have been more evenly distributed across gender and living environment. Thirdly the IPAQ 7-day self-report questionnaire used in this study to assess subjective physical activity levels of first year students would have benefited from being researcher led to further clarify each question and gain the most reliable indication of physical activity behaviours. The researcher goes through the questionnaire with the participant further explaining parts when necessary, for a more reliable indication of physical activity levels. Finally the study did not collect postcode data identifying students' hometown or school location, which would distinguish student's socioeconomic background prior to University entry. This data could therefore identify the physical activity provisions and opportunities available to those students' during childhood and at school and whether this had an impact on their University physical activity levels.

3.5.8 Conclusions

This study was designed to explore first year at University in relation to student mental health and physical activity levels using both quantitative and qualitative research methods. The findings from this study demonstrate that for many students, the University experience can have a negative impact on mental health and physical activity levels. The quantitative findings from this study confirm the widely acknowledged mental health benefits of even light intensity physical activity, and suppressed feelings of depression evident through higher intensities. The study also identified living environment to have a significant impact on student mental health and quality of life. Students who lived in on-campus University accommodation were identified to have less favorable quality of life scores and lower levels of self-report physical activity than those students who lived in off-campus accommodation. The qualitative aspect of the study further strengthens this quantitative finding, where a majority of students who moved into halls of residence portrayed University to have had a negative impact on their previous school physical activity levels and dietary behaviours.

Findings from this study highlight the need for interventions to be implemented within University campuses in order to reduce these ever increasing negative health behaviours among the first year student population.

3.5.9 Future recommendations

Recommendations for future research in this area would be to collect data as early in the Semester as possible where work pressures and deadlines are at their minimum and student enthusiasm for additional endeavors are at their peak might encourage increased student participation. Previous research has also investigated first year University students at various time points in their University experience. Therefore in order to accurately identify changes in student health behaviours and physical activity levels throughout the University journey it would be interesting to examine this aspect and build upon the evidence in Scottish Universities.

Chapter 4: Study Two – A longitudinal examination of student health behaviours during first year at University

4.1 Aims

The aim of study two is to:

1) Identify the changes in physical activity levels of students from Semester one to Semester two of first year at University.

2) Identify the mental health changes in students from Semester one to Semester two of first year at University.

3) Identify the changes in students' physical activity levels and mental health across gender and living environment.

4.2 Methods

This longitudinal study used a quantitative approach to gather data on physical activity, psychological well-being and health behaviours among a student population at two time points in their first year at University.

4.2.1 Participants

Participants (n = 52) were students in their first year of undergraduate degree programmes at either the University of Strathclyde or Heriot Watt University, recruited through poster advertisement at both University sites (Appendix L), email distribution lists and through word of mouth. It must be noted that participants used in Study two were a different cohort of first year University students. The key inclusion criteria for participants were that they were in full-time first year study at either Higher Education Institutions and that they fully understood the requirements of the study.Written informed consent (Appendix M) was provided before data collection began with additional verbal information given to participants on the first visit to the laboratory. The Participant Information Sheet (Appendix N) was to remind participants of their right to withdraw from the study at any point with no reason

necessary and to remind them of the confidentiality and anonymity that would be maintained throughout the study. The first phase of data collection took place during the first academic Semester of student's first year (September 2013), referred to as 'Semester 1', carried out over a period of 8 weeks at both Universities. The second phase of data collection incorporated identical study procedures to phase 1 on the same sample of first year students, and took place at the beginning of the second academic Semester of first year (January 2014), referred to as 'Semester 2'.

4.2.2 Measures

The study involved two visits to the laboratory where collection of quantitative data took place on both visits. The same researcher conducted all the data collection in order to maintain consistency throughout and develop a thorough understanding of each participant's health behaviours.

4.2.2.1 Demographic Variables

After written informed consent was given, participants were asked to complete a demographic questionnaire (Appendix O) to assess gender, age, ethnicity, undergraduate degree course and current living environment. Students who lived in University halls of residence were categorised as 'living on-campus' and those who remained living at home or lived in alternative accommodation were categorised as 'living off-campus'.

4.2.2.2 SF-12

The first of the psychological well-being questionnaires completed was the Short Form-12 (Appendix E). The Short-Form-12 (SF-12) is a four-week recall 12-item self-report questionnaire developed by Ware, Kosinki and Keller (1996) and is used to assess aspects of overall health-related quality of life, including an individual's physical and mental health. The SF-12 is a shorter version of the SF-36, and for the purpose of this study, the shorter version was used where previous research confirms the SF-12 as an appropriate method for

assessing health-related quality of life (Ware, Kosinki, & Keller, 1996; Gandek et al.*,* 1998). The SF-12 is a 12-item scale with six questions relating to the Physical Component Score of well-being (PCS), with a Likert scale that varies for each question. Six questions are related to the Mental Component Score (MCS). The scoring of the twelve questions related to Physical and Mental Health are calculated and range from 0% to 100% where a Total Average Score (%) is calculated, a higher % score on the SF-12 represents a higher level of physical and psychological health. Previous research by Adler, Raju, Beveridge, Wang, Zhu and Zimmermann (2008) identified the SF-12 to have good reliability and validity for assessing health related quality of life among the student population.

4.2.2.3 Hospitality Anxiety and Depression Scale

The Hospital Anxiety and Depression Scale (HADS) (Appendix F) was a questionnaire developed by Zigmond and Snaith in 1983. It is a self-report questionnaire used frequently to assess anxiety and depression, which requires the participants to recall how they have felt in the previous week. The HADS comprises a 14-item scale with seven questions relating to anxiety and seven questions relating to depression. Answers consist on a four point Likert scale; 0= not at all, 1= not often, 2= quite a lot, 3= definitely. Scores are calculated where a score of 0-7 signifies no presence of clinical symptoms, 8-10 indicates mild symptoms, 11-14 demonstrates moderate symptoms of depression and anxiety and a score of 15-21 indicates severe symptoms. Crawford, Henry, Crombie and Taylor (2001) published UK norm data for HADS depression as 3.68 and HADS anxiety as 6.14 out of a maximum score of 21. Previous research suggests that the HADS is a widely used and valid measure of depression and/or anxiety within a population. In 2002, results from a review of 747 papers that utilised the HADS demonstrated its validity and reliability for use within the general population, in general practice and with psychiatric patients (Bjelland, Dahl, Haug, & Neckelmann, 2002).

4.2.2.4 Physical Assessments

Physical assessments included recording of participant's height, weight, blood pressure, hip and waist circumference. Height was recorded using a Stadiometer (Model 225, Seca Ltd) and weight was assessed using precision scales (Model 770, Seca Ltd). Participants' systolic and diastolic blood pressures were recorded using an Omron 2 automatic blood pressure monitor, which was placed on the participant's relaxed left upper arm. Waist and hip circumferences were measured using a tape measure and participants were asked to position their feet together to ensure consistency in measurements. Waist circumference was measured around the participants' narrowest point from the mid-point between the inferior margin of the lowest rib and the iliac crest, and hip circumference was measured around the widest point of the participants' hips.

4.2.2.5 International Physical Activity Questionnaire

Participants were asked to complete the International Physical Activity Questionnaire (IPAQ) (Appendix G) on their second visit to the laboratory scheduled 7 days after the initial visit, which is used to assess the physical activity levels of participants over the previous 7-days through a self-report questionnaire. The intensity of physical activity incorporated on the IPAQ include Walking, Moderate and Vigorous intensity physical activity, which is accumulated to distinguish participants Total Physical Activity levels. The IPAQ also includes domains of Work-, Transport-, Domestic- and Leisure-related physical activity. The IPAQ was chosen for this study due to its high validity and reliability in assessing an individual's frequency, intensity and duration of self-reported physical activity throughout the previous 7-day week. Previous research confirms the IPAQ to have good construct and validity when used alongside objective physical activity monitors and self-report diaries (Hagstromer, Oja, & Sjostrom, 2006).

4.2.2.6 ActiGraph Accelerometer

A 19g tri-axial accelerometer GT3X+ (ActiGraph, LLC, Pensacola, FL, USA) was used to assess the participants' objective physical activity levels through measuring frequency, intensity and duration of activity. The accelerometer was attached to an adjustable elastic belt and worn on the participant's right hip for 7 consecutive days. Each participant was provided with thorough instruction on how to wear the ActiGraph and asked to fill in an activity log (Appendix H) to provide detail on when the device was removed (non-wear time) on each of the 7 days.

4.2.2.7 Accelerometer cut point & non-wear time analysis

The tri-axial accelerometer was recently developed by Sasaki, John and Freedson in 2011 to assess physical activity levels. The Freedson Adult VM3 (2011) cut points were used in this study to determine the intensity of the activity being undertaken, measured as counts per minute (CPM). Recent research by Sasaki, John and Freedson (2011) confirms the validity of the cut points of the Freedson Adult VM3 (2011) where the same Actigraph monitor was used. Light exercise was considered between 0 to 2690 CPM, moderate exercise from 2691 to 6166 CPM, vigorous 6167 to 9642 CPM and very vigorous exercise was considered as 9643 CPM and above. Activity monitors were set to a sample rate of 10-second time intervals, also known as 'epoch' length. Research has identified the shorter epochs to more accurately record irregular, short bursts of physical activity common in young people (Trost, McIver, & Pate, 2005; Reilly, Penpraze, Hislop, Davies, Grant, & Paton, 2008). Previous research suggested a minimum of 8 hours monitoring per day over a period of 4 days was sufficient to evaluate habitual physical activity levels (Trost, Pate, Freedson, Sallis, & Taylor, 2000) however for the purposes of this study we requested participants to wear the device for 7 consecutive days in order to fully identify a first year student's physical activity habits and to allow for non-wear time and measurement errors. In order for an accurate measurement of

student daily activity levels, inclusion criteria for the study included daily accelerometer recording of a minimum of 10 hours (600 minutes) set by the global reliability and validity study of the IPAQ (Craig et al., 2003). In accordance with previous research the first day of the measurement period was included if participants accumulated a minimum of 383 minutes (Troped et al., 2007). Research by Cain and Geremia in 2011 considered at least 8 hours on weekends as a valid wear time day which was also included in the inclusion criteria of the current study. Although participants were required to wear the accelerometer all day for 7-days, accelerometers are not water proof and therefore had to be removed for water based activities and bathing which were instructed to be included in the accelerometer non-wear time log. The recorded accelerometer data was analysed through the corresponding ActiLife software (ActiGraph, LLC, Pensacola, FL, USA).

4.2.3 Procedures

The study procedures involved two visits to the University laboratory, on the initial visit the participants were asked to confirm whether they understood the requirements of the study by reading through the information sheet provided and were given the opportunity to ask any questions prior to seeking informed consent. Participants were then asked to complete a demographic questionnaire and a series of psychological well-being questionnaires (SF-12 and HADS). Participants' height, weight, blood pressure, waist and hip circumference were then assessed. Once participants completed all questionnaires and physical assessments, they were then fitted with a tri-axial accelerometer (GT3x Actigraph) and provided with instruction on how to wear it. Participants were asked to wear the accelerometer for 7 full days to assess the frequency, duration and intensity of their daily activity. Participants were told to contact the researcher if they have any issues during the 7-day measurement period. After the 7-day measurement period, the participants were asked to return to the laboratory to return their accelerometer and non-wear time log diary. Self-report physical activity levels

were also measured during this visit using the International Physical Activity Questionnaire (IPAQ).

4.2.4 Data Analysis

SPSS software was used to descriptively analyse and report on quantitative data (SPSS; PASW Statistics 17.0 for Windows, SPSS Inc., Surrey, UK). Significance was accepted at $p < 0.05$. The study had full retention of participants at Semester 2 with a total of 52 participants at both time points. Participants' objective accelerometer data were screened for any outliers to exclude any days that did not meet the inclusion criteria or any circumstances that would affect their habitual physical activity levels in Semester 2, leading to the exclusion of four participants from the data analysis. Therefore comparisons between Semester 1 and Semester 2 were made on 48 male and female first year students.

All data were also screened for normal distribution using the Kolmogorov-Smirnov test (Field, 2009) and homogeneity of variance using Levene's test (Field, 2009) to determine the appropriateness of parametric analysis. If any of the variables did not meet these assumptions at either Semester 1 or Semester 2, a subsequent square root log transformation of the data (Tabachnick & Fidell, 2001) was conducted. This indicated no significant difference in the log- transformed data or the original data. Therefore, to ease interpretation, parametric tests were used for subsequent data analysis on the original data (Tabachnick & Fidell, 2001).

4.2.4.1 Changes in physical activity, depression, anxiety and psychological well-being from Semester 1 to Semester 2

Paired sample T-tests were used to examine the changes in subjectively- and objectively-measured physical activity, physical characteristics and psychological measures of anxiety, depression and psychological well-being between Semester 1 and Semester 2. Effect sizes

were estimated using Cohen's d interpretation guidelines of d >= 0.2 (small effect size), d >= 0.5 (medium effect size) and d >= 0.8 (large effect size) (Cohen, 1988).

4.2.4.2 Differences between gender and living environment and outcome variables

In order to determine whether gender and living environment had an impact on the changes in subjectively- and objectively- measured physical activity, physical characteristics and psychological measures of anxiety, depression and psychological well-being, change scores were calculated from Semester 1 to Semester 2 in these outcome variables. Subsequently a repeated-measures ANOVA was conducted to examine the influence of gender and living environment on changes in physical activity, physical characteristics and psychological well-being, anxiety and depression. Cohen's d Effect sizes (Cohen, 1969) were calculated to measure the magnitude of the differences between gender and living environment from Semester 1 to Semester 2.

4.3 Results

4.3.1 Descriptive statistics

This longitudinal study had full retention at both time points with a total of 52 first year University students from two Scottish Universities. However due to incomplete data sets and participant exclusions in Semester 2, the total number of participants included in the study was reduced to 48 participants, with an even distribution of twenty-four male and female student participants. The physical assessment data collected in Semester 1 (September 2013) and Semester 2 (January 2014) for all students is presented in Table 4.1. The living environment of students is described as either living 'on-campus' in University accommodation or living 'off-campus' in accommodation away from University including remaining living at home. A majority of the student sample lived in on-campus

accommodation (n= 35: 72.9%) compared to the amount that lived in off-campus accommodation (n= 13: 27.1%). A total of fourteen students (7 male) participated in this longitudinal study from the University of Strathclyde where a majority of students studied Sport and Physical Activity (n= 13) with one student who studied Maths, Statistics and Accounting. A total of thirty-four (17 male) students from Heriot Watt University took part in this longitudinal study with a majority of students (n= 14) belonging to the Engineering department (Chemical, Electrical, Mechanical, Architectural & Civil). A total of 10 students were from The School of Management and Languages, whilst the remainder of the Heriot Watt University students academic studies included the departments of Life Sciences, Psychology, Actuarial Sciences and Physics (n= 10). For all the students included in the study neither the living environment nor the academic course being studied changed from Semester 1 to Semester 2.

4.3.2 Changes between outcome variables

The following section highlights the significant changes between physical assessment measurements as well as changes in depression, anxiety, psychological well-being and subjectively and objectively-measured physical activity from Semester 1 to Semester 2. This is followed by a section reporting analyses that investigated whether gender and living environment, and the interaction between these, had a significant effect on changes in depression, anxiety, psychological well-being and subjectively and objectively-measured physical activity.

4.3.2.1 Changes in physical characteristics

Table 4.1 illustrates the means and standard deviations of the participants' descriptive statistics for Semester 1 and Semester 2 data. There was an overall significant increase in waist circumference from Semester 1 to Semester 2, the mean difference between Semester 1 and Semester 2 was 1.90cm and the 95% confidence interval for the estimated population

mean difference is between .87cm and 2.93cm. The effect size was small ($d = 0.3$). A paired sample t-test showed that the difference between Semesters was significant ($t = 3.719$, df = 47, $p = .001$). There was also an overall significant increase in hip circumference, the mean difference between Semester 1 and Semester 2 was 1.65cm and the 95% confidence interval for the estimated population mean difference is between .63cm and .2.67cm. The effect size was small ($d = 0.2$). A paired sample t-test showed that the difference between Semesters was significant ($t = 3.263$, df = 47, $p < .01$). These results highlight changes in student's body composition in first year at University with increased hip and waist circumference measurements from Semester 1 to Semester 2.

Table 4.1: Summary of descriptive statistics and physical data

	Semester 1												Semester 2											
	On-Campus (n= 35)				Off-Campus (n= 13)				All (n= 48)				On-Campus (n= 35)				Off-Campus (n= 13)				All (n= 48)			
	Male (n= 16)		Female (n= 19)		Male (n= 8)		Female (n= 5)		Male (n= 24)		Female (n= 24)		Male (n= 16)		Female (n= 19)		Male (n= 8)		Female (n= 5)		Male (n= 24)		Female (n= 24)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Age (years)	18.4	0.7	18.1	0.6	18.0	0.9	19.0	1.4	18.3	0.8	18.3	0.9	18.5	0.6	18.4	0.7	18.3	0.7	19.2	1.3	18.4	0.7	18.6	0.9
Height (cm)	181.5	8.7	166.9	6.5	175.0	5.1	163.5	7.4	179.3	8.2	166.2	6.7	181.5	8.8	166.8	6.7	174.7	5.9	63.9	7.2	179.2	8.5	166.2	6.8
Weight (kg)	74.6	14.8	62.0	11.0	68.0	7.4	65.0	5.7	72.4	13.0	62.6	10.1	75.9	13.5	62.8	9.8	69.3	9.9	62.8	5.8	73.7	12.6	62.8	9.0
Systolic Blood Pressure (mmHg)	142.9	13.8	131.8	12.5	140.8	16.6	138.6	16.3	142.2	14.5	133.2	13.3	134.6	5.6	130.8	11.1	135.9	7.2	137.2	11.5	135.0	6.1	132.1	11.2
Diastolic Blood Pressure (mmHg)	86.8	8.2	82.2	8.9	83.5	8.3	86.2	9.8	85.7	8.2	83.0	9.0	75.6	7.8	80.2	10.7	79.0	7.6	74.8	9.7	76.7	7.7	79.1	10.5
Waist Circumference (cm)	77.1	8.0	71.5	6.2	74.8	5.2	74.6	4.4	76.4	7.2	72.1	5.9	79.2	8.4	73.6	5.3	77.7	7.0	73.5	2.9	78.7	7.9**	73.6	4.8**
Hip Circumference (cm)	94.8	7.7	96.2	7.4	92.6	6.5	97.6	3.4	94.1	7.3	96.5	6.8	96.3	8.4	97.7	6.5	96.0	8.1	97.6	3.4	96.2	8.1*	97.7	5.9*

* Change significant at .01 level
** Change significant at .001 level

4.3.2.2 Changes in anxiety levels

Table 4.2 illustrates the means and standard deviations for participants' subjectively-measured anxiety. There was an overall significant decrease in HADS anxiety score from Semester 1 to Semester 2. The mean difference between Semester 1 and Semester 2 was -2.44 and the 95% confidence interval for the estimated population mean difference is between -3.34 and -1.53. The effect size was large ($d = 0.8$). A paired sample t-test showed that the difference between Semesters was significant ($t = 5.387$, df = 47, p < .001). These results highlight that student anxiety levels decreased from Semester 1 to Semester 2.

4.3.2.3 Changes in objectively-measured physical activity

Table 4.3 illustrates the means and standard deviations for participants' objectively measured physical activity. There was an overall increase in light intensity physical activity (percentage of daily physical activity) from Semester 1 to Semester 2. The mean difference between Semester 1 and Semester 2 was .94% and the 95% confidence interval for estimated population mean difference is between .35% and 1.53%. The effect size was small ($d = 0.3$). A paired sample t-test showed that the difference between Semesters was significant ($t = 3.195$, df = 47, $p < .05$).

There was an overall decrease in time spent in moderate intensity physical activity (average daily minutes) from Semester 1 to Semester 2. The mean difference between Semester 1 and Semester 2 was -10.81 minutes and the 95% confidence interval for the estimated population mean was between -15.43 minutes and 6.18 minutes. The effect size was small ($d = 0.1$). A paired sample t-test showed that the difference between conditions was significant ($t = 4.701$, df = 47, $p < .001$).

There was an overall decrease in the percentage of time spent in moderate intensity physical activity from Semester 1 to Semester 2. The mean difference between Semester 1 and Semester 2 was -1.0% and the 95% confidence interval for the estimated population mean is

between -1.51% and -0.49%. The effect size was medium ($d = 0.5$). A paired sample t-test showed that the difference between Semesters was significant ($t = 3.949$, df $= 47$, $p < .001$). These objectively-measured physical activity findings illustrate this sample of students to be spending more time in light intensity physical activity and less time in moderate intensity physical activity from Semester 1 to Semester 2.

There were no significant changes from Semester 1 to Semester 2 for the remaining outcome variables ($p > .05$).

Table 4.2: Subjectively-measured outcome variables

	Semester 1												Semester 2											
	On-campus (n= 35)				Off-campus (n= 13)				All (n= 48)				On-campus (n= 35)				Off-campus (n= 13)				All (n=)			
	Male (n= 16)		Female (n= 19)		Male (n= 8)		Female (n= 5)		Male (n= 24)		Female (n= 24)		Male (n= 16)		Female (n= 19)		Male (n= 8)		Female (n= 5)		Male (n= 24)		Female (n= 24)	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
HADS Depression	3.3	2.2	1.1	1.4	1.3	1.2	2.6	3.2	2.6	2.1	1.4	1.9	2.8	1.8	1.0	1.1	2.0	3.0	2.8	2.3	2.5	2.2	1.4	1.6
HADS Anxiety	8.3	4.0	5.6	3.5	6.0	3.3	8.2	4.8	7.5	3.9	6.1	3.9	5.1	2.3	3.2	2.0	5.3	3.6	5.4	1.5	5.2	2.7*	3.6	2.1*
SF-12 Total Average Score (%)	83.7	9.6	85.6	11.5	84.7	8.0	82.3	11.3	84.1	8.9	84.9	11.3	80.9	12.7	88.0	7.8	82.6	16.4	85.8	16.4	81.4	13.7	87.6	7.2
SF-12 Physical Component Score (%)	90.6	5.6	88.2	12.4	86.5	10.9	92.5	3.5	89.2	7.8	89.1	11.2	85.4	13.7	89.9	11.1	84.4	15.2	93.3	8.6	85.1	13.9	90.6	10.6
SF-12 Mental Component Score (%)	76.8	17.4	83.1	13.2	83.0	13.4	72.0	22.0	78.9	16.2	80.2	15.6	76.3	18.8	86.2	9.1	80.7	19.7	78.3	3.5	77.8	18.8	84.5	8.8

* Change significant at .001 level

Table 4.3: Objectively- measured outcome variables

	Semester 1												Semester 2											
	On-campus (n= 35)				Off-campus (n= 13)				All (n= 48)				On-campus (n= 35)				Off-campus (n= 13)				All (n= 48)			
	Male (n= 16)		Female (n= 19)		Male (n= 8)		Female (n= 5)		Male (n= 24)		Female (n= 24)		Male (n= 16)		Female (n= 19)		Male (n= 8)		Female (n= 5)		Male (n= 24)		Female (n= 24)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Total time in Activity (daily minutes)	870.8	52.7	847.7	62.8	901.8	55.8	881.0	65.1	881.2	54.6	854.6	63.4	855.4	62.1	837.5	81.1	840.6	45.8	851.3	29.8	850.5	56.6	840.3	73.0
Light PA (daily minutes)	793.8	42.4	779.5	52.3	822.3	53.7	805.8	76.9	803.3	47.3	785.0	57.3	792.1	68.7	775.2	76.0	779.9	53.5	781.2	44.1	788.1	63.1	776.4	69.8
Light PA (%)	91.3	3.8	92.0	2.7	91.2	1.9	91.3	2.2	91.2	3.2	91.9	2.6	92.5	2.8	92.6	2.4	92.7	2.2	91.7	3.0	92.6	2.6*	92.4	2.5*
Moderate PA (daily minutes)	63.6	25.4	62.9	22.5	69.4	18.9	68.5	11.2	65.5	23.1	64.0	20.6	51.6	18.3	55.6	17.6	50.5	13.4	61.0	24.2	51.2	16.5**	56.7	18.7**
Moderate PA (%)	7.2	2.7	7.3	2.4	7.7	1.9	7.9	1.8	7.4	2.4	7.4	2.2	6.1	2.3	6.6	2.0	6.0	1.7	7.2	2.9	6.1	2.1**	6.8	2.2**
Vigorous PA (daily minutes)	12.0	15.6	4.9	4.2	9.0	9.3	5.0	3.2	11.0	13.6	4.9	4.0	10.9	11.8	5.8	4.8	8.7	7.4	7.4	5.4	10.2	10.4	6.1	4.8
Vigorous PA (%)	1.3	1.7	0.6	0.5	1.0	1.1	0.6	0.4	1.2	1.5	0.6	0.5	1.3	1.4	0.7	0.5	1.1	0.9	0.9	0.6	1.2	1.2	0.7	0.5
Very Vigorous PA (daily minutes)	1.5	1.8	0.4	0.6	1.3	1.8	1.8	1.6	1.4	1.7	0.7	1.0	0.9	1.2	0.9	1.2	1.4	2.0	1.7	1.9	1.0	1.5	1.0	1.4
Very Vigorous (%)	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.2

* Change significant at .05 level
** Change significant at .001 level

4.3.2.4 Differences in subjectively and objectively-measured outcome variables by gender and living environment

Table 4.4 illustrates the means and standard deviations for participants' subjectively-measured physical activity. A between-groups ANOVA was conducted to compare the main effect and interaction of gender and living environment on changes in subjectively-measured and objectively-measured physical activity, psychological measures of anxiety, depression and general well-being. There were no significant interaction or main effects between gender and living environment for any of the subjectively- or objectively-measured outcome variables ($p > .05$).

4.3.3 Summary of key findings

To summarise the key findings the study identified significant changes from Semester 1 to Semester 2 in increased waist and hip circumference, highlighting first year at University to be a time where changes in body composition are evident. It was also apparent that anxiety levels decreased from Semester 1 to Semester 2, highlighting entry to University in semester 1 to be a time of heightened anxiety, which was significantly reduced in Semester 2. It was identified that significant changes in objectively-measured physical activity, where the percentage of time spent in light intensity physical activity increased from Semester 1 to Semester 2, however both minutes and percentage of time spent in moderate intensity physical activity were found to decrease from Semester 1 to Semester 2. This study investigated whether gender or living environment influenced changes in physical activity and psychological well-being. Although no significant findings were evident in this study, small reductions are apparent in a majority of the outcome variables from Semester 1 to Semester 2.

Table 4.4: Subjective self-report physical activity levels

	Semester 1												Semester 2											
	On-campus (n= 35)				Off-campus (n= 13)				All (n= 48)				On-campus (n= 35)				Off-campus (n= 13)				All (n= 48)			
	Male (n= 16)		Female (n= 19)		Male (n= 8)		Female (n= 5)		Male (n= 24)		Female (n= 24)		Male (n= 16)		Female (n= 19)		Male (n= 8)		Female (n= 5)		Male (n= 24)		Female (n= 24)	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
IPAQ Walking PA (min/day)	56.3	37.9	71.4	43.4	95.8	56.6	70.9	38.6	69.5	47.6	71.3	41.6	54.6	32.1	66.2	40.3	97.9	60.2	109.7	36.4	69.1	47.0	75.3	42.7
IPAQ Moderate PA (min/day)	30.0	50.1	30.6	41.8	65.7	61.7	68.8	81.4	41.9	55.6	38.6	52.6	14.1	12.7	25.0	25.3	88.7	53.6	46.3	38.5	38.9	47.6	29.5	28.9
IPAQ Vigorous PA (mind/day)	38.0	28.3	48.4	42.0	53.0	52.2	48.0	40.8	43.0	37.5	48.3	40.9	37.5	24.9	37.6	26.5	43.1	41.2	37.4	31.6	39.3	30.5	37.6	26.9
IPAQ Total PA (min/day)	124.3	91.2	150.4	99.6	214.6	141.6	187.7	61.0	154.4	115.8	158.1	93.0	106.2	36.2	128.8	77.3	229.7	138.2	193.4	8.2	147.4	101.0	142.3	80.9
IPAQ Work Related PA (min/day)	12.3	49.3	15.5	42.3	31.4	88.9	64.3	43.7	18.7	63.8	25.7	46.3	2.1	8.6	10.5	32.8	52.0	69.7	55.7	54.4	18.8	45.9	19.9	41.3
IPAQ Transport Related PA (min/day)	49.6	35.4	42.3	24.9	69.5	41.4	60.0	19.9	56.2	37.8	46.0	24.6	45.7	31.5	49.7	36.2	49.7	42.8	60.6	25.4	47.0	34.8	52.0	34.1
IPAQ Domestic Related PA (min/day)	9.8	12.2	13.1	17.3	35.4	28.8	7.1	10.7	18.3	22.4	11.8	16.2	7.9	8.4	13.0	14.5	42.4	45.8	6.9	6.6	19.4	31.0	11.8	13.3
IPAQ Leisure Related PA (min/day)	52.6	34.9	79.5	51.9	78.3	62.2	56.3	21.9	61.2	46.1	74.7	47.8	50.5	26.2	55.6	33.7	85.6	45.6	70.3	48.3	62.2	37.0	58.6	36.5

4.4   Discussion

This study examined changes in student's levels of depression, anxiety, quality of life and physical activity levels over two time points in first year at University. These were initially measured upon arrival at the beginning of Semester 1 with follow-up conducted 5 months later at the beginning of Semester 2. The study also looked at the differences between gender and living environment, and whether the interaction between these had a significant effect on changes in depression, anxiety, psychological well-being and subjectively and objectively-measured physical activity levels in first year University students.

4.4.1   Changes in physical characteristics

The first key aspect of the study was to examine changes in student's physical characteristics over two time points in first year at University. It was identified that hip and waist circumference significantly increased from Semester 1 to Semester 2 in this sample of first year students (Table 4.1). These findings share similarities with recent longitudinal research looking at the changes in male students' anthropometric measures in the transition from high school to University (Pullman et al., 2009). The results from this study identified increases in waist circumference from Phase 1 (M = 82.1cm, SD = 0.7cm) to Phase 2 (M = 83.1cm, SD = 0.8cm), as well as increases in hip circumference from Phase 1 (M = 98.1cm, SD = 0.6cm) to Phase 2 (M = 99.4cm, SD = 0.7cm). These results share similarities with the results recorded in the male students of the current study where increases in waist circumference were evident from Semester 1 (M = 76.4cm, SD = 7.2cm) to Semester 2 (M = 78.7cm, SD = 7.9cm), as well as apparent increases in hip circumferences from Semester 1 (M = 94.1cm, SD = 7.3cm) to Semester 2 (M = 96.2cm, SD = 8.1cm). However it is interesting to note that although the mean circumference for both phases was lower in the current study compared to the study by Pullman and colleagues (2009), the increases in waist circumference over the two time points was greater in the current study (M = +2.3, SD = 0.7) which is an increase of more than

double that of the Pullman study (M = +1.0, SD = 0.1). The current study also reported greater gains in hip circumference from Semester 1 to Semester 2 (M = +2.1, SD = 0.8) when compared to the smaller gains reported in the Pullman study (2009) (M = +1.3, SD = 0.1), highlighting the significant increases in hip and waist circumference evident in this current study sample of first year male University students. However it must be noted that seasonal limitations exist when comparing these data sets, as data were collected at the end of the academic Semesters (November 2006 and March 2007) as opposed to data collection procedures at the beginning of the academic Semesters evident in the current study (September 2013 and January 2014), which could contribute to the reasons why these differences were evident. Regardless of this, these results highlight the need for interventions to be implemented to reduce these unhealthy increases in hip and waist circumference from further increasing throughout their time at University.

These findings also share similarities with previous literature looking at changes in body composition during the initial stages of University entry (Gropper et al., 2011), where results illustrated significantly greater gains in the waist circumference of the total sample (M = +8.8, SD = 4.0 cm) from phase 1 to phase 2 sharing similarities with the waist gains evident in the current study sample (M = +1.9, SD = 0.1 cm). It was also evident in this study by Gropper and colleagues (2011) that males had higher gains in waist circumference (M = +2.4, SD = 2.8) when compared to their female counterparts (M = +0.2, SD = 4.3), a finding that was also evident in the current study where changes in males waist circumference was greater (M = +2.3, SD = 0.7) than the change recorded in female students (M = +1.5, SD = -1.1) from Semester 1 to Semester 2. This suggests that the male student population should be further targeted for their participation and compliance in future interventions.

Racette and colleagues (2005) looked at the longitudinal changes in students' weight during first year at an American University, which identified significant increases in both weight (M

= +2.5kg, SD = 5.0kg) and a 0.9kg/m^2 increase in BMI. Although the current study only found hip and waist circumference to significantly change it is important to highlight that increases were also evident in student's weight (M = +0.8kg, SD = -0.4kg) and BMI (M = +0.3kg/m^2, SD = -0.3kg/m^2) in the current sample which is also a common finding in first year University students from Semester 1 to Semester 2. However it is important to note that when comparing these two study samples that limitations could exist in the sample size, where the current study had a total of 48 students (24 male) whereas the Racette study (2005) had a total of 118 first year students (52 male) suggesting that a greater study sample may generate a greater degree of change in a sample of student participants as highlighted in the results of these two studies.

The aspect of weight gain during first year at University is not a new concept amongst the research in America which documents the gain of weight in first year as the "Freshman 15", implying that first year (freshmen) students experience 15 pounds of weight gain during this initial year, which is related to changes in behaviour to include increased food intake and decreased physical activity levels (Hoffman, Policastro, Quick, & Soo-Kyung, 2006). Therefore, along with the findings from the current study which highlighted a significant increase in waist and hip circumference from Semester 1 to Semester 2, this reinforces the need for further research into the aspect of the factors associated with changing body composition and the implementation of interventions to try and reduce these unfavorable changes in students during first year at University.

4.4.2 Changes in anxiety levels

The study also identified a significant decrease in anxiety levels from Semester 1 to Semester 2 in this sample of first year University students as measured by the anxiety subscale on the HADS questionnaire, suggesting initial entry to the University environment to be an anxiety provoking time that alleviates thereafter (Table 4.2). This change in students' anxiety levels

decreasing from Semester 1 to Semester 2 could be considered state anxiety (Spielberger & Sydeman, 1994), which is typically identified as temporary feelings of fear or nervousness due to this change in environment, in this case the change from school to University.

Previous research by the American College Health Association (2011) confirms anxiety to be to one of the top three mental health conditions experienced by University students. These findings share similarities with recent longitudinal research by Mailey and colleagues (2012) investigating anxiety levels in female first year University students, which also used the anxiety subscale on the HADS questionnaire, further highlighting its reliability for use among the student population. This study examined the effectiveness of a peer-delivered behavioural intervention implemented after phase 1 of data collection. Although results found no significant reductions in anxiety levels between the intervention group and the control group from phase 1 in the first week of Semester 1 to phase 2 measured in the final week of Semester 2. It was still evident small reductions in anxiety levels occurred, the anxiety levels in the intervention group illustrated slight reductions from phase 1 (HADS anxiety score $M = 7.7$, $SD = 3.1$) to phase 2 (HADS anxiety score $M = 7.6$, $SD = 3.6$) as measured by the HADS questionnaire, which was also evident in the control group from phase 1 (HADS anxiety score $M = 7.4$, $SD = 3.3$) to phase 2 (HADS anxiety score $M = 7.1$, $SD = 3.8$). These findings share similarities with the sample of female students in the current study, which saw a reduction in HADS anxiety score from Semester 1 (HADS anxiety score $M = 6.1$, $SD = 3.9$) to Semester 2 (HADS anxiety score $M = 3.6$, $SD = 2.1$). However it is important to note that the current study did not implement an intervention unlike the study by Mailey and colleagues (2012), regardless of this, the findings from both studies indicate entry to the University environment in first year to be a time of heightened unfavorable anxiety levels. However the implementation of appropriate anxiety reducing interventions could significantly reduce these heightened levels.

The findings from the current study also share similarities with previous UK longitudinal research by Cooke and colleagues (2006), which identified first year at University to predominantly be a time of heightened anxiety as opposed to a time of depression. This study collected data over four time-points in first year to include one month prior to University entry, one month after University entry, end of Semester 1 and end of Semester 2. It must be highlighted that the subjective questionnaire used to assess anxiety levels was different to the HADS questionnaire used in the current study. The GP-CORE questionnaire consists of 14-items, identified as a suitable measure among the student population, taken from the 34-item CORE-OM questionnaire. The GP-CORE measures aspects of subjective well-being to include symptoms of anxiety and depression, scores range from 0-40 where a lower score signifies better mental health (Sinclair et al., 2005). Findings from the data collected at these time points identified a rise and fall in anxiety levels across first year with a significant reduction in GP-CORE score at the end of Semester 2 ($M = 12.4$, $SD = 5.9$) when compared to scores reported at the end of Semester 2 ($M = 13.1$, $SD = 5.8$), which shares similarities to the data collection points and findings of the current study. It must be noted that although in these instances anxiety levels reduce throughout the course of first year they did not return to those levels measured prior to entry to the University environment ($M = 10.8$, $SD = 5.2$). These research findings by Cooke and colleagues (2006) along with the findings from the current study highlight the importance of identifying and reducing these elevated levels of anxiety, where previous research identifies anxiety to be a buffer toward further mental health issues which could subsequently lead to elevated levels of depression. This highlights the importance of identifying and employing appropriate interventions to alleviate these symptoms of anxiety in first year University students upon entry in Semester 1.

Anxiety can exist as either state or trait. State anxiety is recognised as the temporary feelings of fear or nervousness due to an upcoming event or situation whereas trait anxiety refers to

the constant level of stress that is characteristic of that individual related to their personality (Tilton, 2008). Therefore these reductions in anxiety levels in these study samples over the course of first year could be attributed to increased levels of state anxiety due to the elevated levels of stress and anxiety placed on students at the beginning of University entry.

However contrary to this finding previous UK longitudinal research by Andrews and Wilding (2004) looked at the relationship between depression and anxiety to life-stress and achievement in students at two time points also using the HADS questionnaire to assess anxiety levels in University students. Results from this study found anxiety to increase over these two time-points where phase 1 ($M = 8.8$, $SD = 3.9$) illustrated lower anxiety levels compared to phase 2 ($M = 9.4$, $SD = 4.1$) where mean scores of 8-10 on the HADS anxiety scale indicate the presence of mild anxiety symptoms. In contrast to the current study which identified reduced anxiety levels from Semester 1 ($M = 6.8$, $SD = 3.9$) to Semester 2 ($M = 4.4$, $SD = 2.5$) corresponding no presence of clinical symptoms among this study sample. However these differences could be attributed to the difference in sample size which saw a total of 351 students respond at both time points compared to the significantly smaller study sample of 48 in the current study. Further limitations are evident when comparing the findings of the current study to the findings by Andrews and Wilding (2004), where the second phase of data collection in the current study was at the mid-point of first year at the beginning of Semester 2 whereas Andrews and Wilding (2004) looked at anxiety levels mid-course, which was two years after initial data collection (2002). This highlights the limitations that exist in comparing the results from these two studies looking at anxiety levels in first year University students, however it is still evident that high levels of anxiety are evident among the student population suggesting more support is required among this population to reduce these unfavorable anxiety levels.

A recent longitudinal research study investigated the effect of a relaxation intervention on anxiety levels in female University students living in on-campus accommodation (Dehghan-Nayeri & Adib-Hajbaghery, 2011). Anxiety was assessed at two time points, initially in the first Semester of living in halls of residence with follow-up conducted immediately after the intervention group had completed a two-month period of relaxation techniques. The intervention group received educational sessions delivered by a specialist to include information and demonstrations on how to relax oneself using progressive muscular relaxation techniques to be performed on a daily basis by the student participants, along with fortnightly telephone calls from the researcher to monitor compliance. Findings from this study identified a positive effect of reduced anxiety levels in female students who were part of the intervention relaxation group. This highlights that relaxation techniques can successfully reduce feelings of anxiety among females who reside in on-campus accommodation which could prove to be particularly beneficial at times of heightened anxiety such as during examination periods and entry to the University environment. This type of intervention should be considered by researchers when developing future interventions in an attempt to reduce levels of anxiety in students.

4.4.3   Changes in subjectively-measured physical activity levels

This study also looked at the change in subjectively-measured levels of physical activity, although results did not identify a significant change from Semester 1 to Semester 2 it is still important to highlight the reductions in students' perceived levels of self-reported physical activity (Table 4.4). The current study sample reported high levels of self-report physical activity across all domains at both time points on the IPAQ, which would suggest this study sample are more than meeting the current recommended physical activity guidelines for their age group. However it is interesting to note that when this subjective data is compared with the objective accelerometer data recorded these levels are drastically lower, which would

suggest that this study sample were over-reporting their subjective vigorous physical activity levels. This is a common finding when using self-report physical activity measures, where previous research has specifically identified a notable overestimation of duration and intensity of physical activity (Montoye, Kemper, Saris, & Washburn, 1996). Regardless of this issue it is still important to incorporate these subjective physical activity assessment measures into research studies to allow researchers to gain a greater understanding of how physically active individuals perceive themselves to be. Alongside objective physical activity assessment measures will allow researchers to wholly understand the physical activity levels of a target population and allow the implementation of appropriate physical activity promotion interventions.

Therefore it is important to look at the possible reasons as to why individuals over report their physical activity levels, research suggests individuals want to present themselves in a more positive way and therefore report higher and more socially acceptable responses (Edwards, 1957). It is important to note that research identifies those in higher education to include the University population will tend to over report physical activity levels due to the increased importance and knowledge they possess related to the contributing factors associated with a healthy lifestyle (Droomers, Schrijvers, van de Mheem, & Mackenbach, 1998). This could be a key contributing to factor to the over reported physical activity levels identified in this current sample of students.

Similar to the current study, previous research by Dinger and Behrens (2006) compared subjectively-measured IPAQ data with objectively-measured accelerometer physical activity assessment data in a sample of University students. Findings from this study identified students to recall higher levels of subjectively-measured moderate-vigorous intensity physical activity (Male, M = 82.6, SD = 63.8 minutes/day; Female, M = 53.1, SD = 48.9 minutes/day)

when compared to the corresponding moderate-vigorous intensity accelerometer data (Male, M = 24.2, SD = 20.7; Female, M = 15.8, SD = 14.4 minutes/day).

This finding is similar to the current study, which illustrates over reporting of vigorous intensity physical activity at both time points. In Semester 1 subjectively-measured vigorous intensity physical activity levels were reported to be considerably higher (Males, M = 43.0, SD = 37.5; Females, M = 48.3, SD = 40.9 minutes/day) than those objectively-measured vigorous intensity physical activity levels (Males, M = 11.0, SD = 13.6 minutes/ day; Females, M = 4.9, SD = 4.0 minutes/ day) average daily vigorous intensity minutes. These levels were also similarly identified in Semester 2 of data collection where IPAQ data illustrated higher levels of self-report vigorous intensity physical activity (Males, M = 39.3, SD = 30.5; Females, M = 37.6, SD = 26.9 minutes/ day) when compared to the objectively-measured accelerometer data for vigorous intensity physical activity in Semester 2 (Males, M = 10.2, SD = 10.4; Females, M = 6.1, SD = 4.8 minutes/day). Although it is important to note that the study by Dinger and Behrens (2013) did not look at physical activity levels at two time points unlike the current study which also suggests lower physical activity levels from Semester 1 to Semester 2 as identified by reduced self-report physical activity levels over the two time points. However in contrast to these findings by Dinger and Brehrens (2006), more recent research by Gregory, Weinstock, Ash and Pescatello (2012) similarly investigated University students' physical activity levels. Gregory and colleagues (2012) identified a significant under reporting of self-report frequency and intensity ($M = 50.2$, $SD = 68.0$ Total Time minutes) when compared to objective accelerometer physical activity assessment ($M = 57.5$, $SD = 56.1$ Total Time minutes).

Previous research looking at the changes in female physical activity levels during the transition to college (Han, Dinger, Hull, Randall, Heesch & Fields, 2008), identified significant weekly decreases in time spent in moderate intensity physical activity from first

year to second year at University ($M = -21.6$, $SD = -24.1$ daily moderate minutes). These findings share similarities with the current study which identified female students to have reduced levels of moderate intensity physical activity levels from Semester 1 to Semester 2 ($M = -9.1$, $SD = 39.4$ daily moderate minutes). These findings highlight the reductions evident in female University students' moderate intensity physical activity in their first year at University, however it must be acknowledged that the measure used to assess subjective physical activity levels was the Modifiable Activity Questionnaire for Adolescents (MAQA; Aaron, Kriska, Dearwater, Cauley, Metz & LaPorte, 1995) in comparison to the IPAQ used in the current study which could attribute to the large difference in average daily minutes. Although the average age of student samples were similar (Hans *et al.* $M = 18.2$, $SD = 0.4$ years; Current study, $M = 18.3$, $SD = 0.9$ years) the length between data collection points was different where the current study had a gap of five months between Semester 1 and Semester 2 in comparison to the longer 12 month gap evident in the study by Hans and colleagues (2008).

4.4.4   Changes in objectively-measured physical activity levels

This study also looked at the changes in objectively-measured physical activity levels across two time points of first year at University and found the percentage of time spent in light intensity physical activity increased from Semester 1 to Semester 2 whereas the time and percentage of time spent in moderate intensity physical activity reduced (Table 4.3). These findings suggest that students are spending more time in light intensity physical activity to the detriment of spending less time in moderate intensity physical activity and therefore reducing the potential for the associated health benefits gained through moderate intensity activity over the course of first year at University. Although there is a current lack of longitudinal evidence that exists specifically looking at the objective accelerometer physical activity levels of the University student population, findings exist in a study investigating the

longitudinal change in moderate-vigorous intensity physical activity among a sample of 759 urban adolescent students over a 5-year period from 2004 to 2009 using accelerometry (Trang, Hong, van der Ploeg, Hardy, Kelly, & Dibley, 2012). Findings identified moderate-vigorous intensity physical activity significantly reduced by 38% per year, with findings also identifying males to be spending almost 3 times more time in MVPA than their female counterparts. These findings share similarities with the current study, which identified a reduction in male moderate intensity physical activity from Semester 1 ($M = 65.5$, $SD = 23.1$ minutes/day) to Semester 2 ($M = 51.2$, $SD = 16.5$ minutes/day) as well as a reduction in females moderate intensity physical activity from Semester 1 ($M = 64.0$, $SD = 20.6$ minutes/day) to Semester 2 ($M = 56.7$, $SD = 18.7$ minutes/day). These findings also highlight the average time spent in moderate intensity physical activity by females was lower than males in Semester 1, however this changed at Semester 2 where females were identified to take part in increased levels of moderate intensity physical activity than males. Similar findings as well as possible explanations as to why these changes occur are evident in student physical activity research by Pinto (1995) which also identified females to take part in higher levels of moderate intensity physical activities such as aerobics and walking, compared to males who tend to participate in less aerobic forms of exercise such as weightlifting upon entry to the University environment. This suggests a possible reason behind the shift in physical activity levels in male and female students from Semester 1 to Semester 2 in this current sample and highlights the need for increased intensity interventions to be targeted at not only the female student population but also males in order for these levels to avoid decreasing any further throughout University study.

A recent research review by Ferrara (2009) supports the current findings, where University students increased their participation in lower intensity physical activity and exercised at lower intensities and durations than those currently recommended for health benefits. This

finding is also supported by that of Racette and colleagues (2005) which examined students over their first two years at University and identified a reduction in participation of aerobic exercise but an increase in stretching exercises in both male and female students. These significant findings within research highlight the importance of increasing the intensity of student's physical activity levels in order to gain the desired associated health benefits.

However in contrast to the current findings which identified a reduction in objectively-measured physical activity levels, Pinto and colleagues (2005) looked at the exercise participation of University students and found no significant change in exercise behaviours from first year to second year. Although no changes in behaviours were evident, researchers identified 42% of their student sample to be inactive or not meeting the recommended guidelines of 30 minutes of moderate intensity physical activity on most days of the week, highlighting the importance of targeting this specific population who are acknowledged to participate in reduced levels and intensities of physical activity. Although the current study sample demonstrate they are meeting the current recommendation at both time points of 30 minutes of moderate intensity most days of the week. However it is important to highlight that significant reductions in physical activity intensity are evident from Semester 1 ($M = $ 64.8, $SD = 21.7$ Moderate intensity minutes/daily) to Semester 2 ($M = 54.0$, $SD = 17.7$ Moderate intensity minutes/daily). It is therefore crucial that these moderate intensity physical activity levels do not further reduce, highlighting the essential need for this specific population to be encouraged to take part in higher physical activity intensities throughout first year.

In order for researchers to implement appropriate physical activity interventions it is crucial that we identify the key reasons associated with why first year University students tend to take part in reduced intensities of physical activity upon entry to the University environment. Previous research investigated the perceived barriers towards physical activity looking at

students of school age (grade 7 – 12) and first year University students (Gyurcsik, Spink, Bray, Chad, & Kwan, 2006). Data were collected through the use of semi-structured open-ended surveys, where students were asked, "Were there any physical activities that you would like to do but didn't in the last six months?". Barriers were generically defined as 'anything that may stop you from doing physical activity'. Students were asked to list up to five barriers that prevented them from taking part in physical activity during the past 6 months using an open-ended approach. Results from this study highlighted significant differences in the perceived barriers between these two different age groups, where University students reported social invitations (e.g. "I was invited to go out partying"), lack of training partners and travelling home to see friends and family as the key interpersonal barriers towards not taking part in physical activity. Whereas the younger age groups reported the fact that their friends were not physically active, restrictions from parents on physical activity and lack of family support to be the key interpersonal determinants of not taking part in physical activity. Workload and cold dark weather was also quoted as a key barrier of University students, which was not a barrier evident among the younger age groups. Instead other competing interests such as "bible study" took priority over physical activity participation, however both groups identified lack of transportation to facilities as a key barrier. It is interesting to note that the average number of barriers described by participants significantly increased as school grade increased where findings identified first year University students to report the most barriers towards physical activity participation. This could be attributed to the increased levels of stress, reduced social support and an increase in risky health behaviours evident during this major life change from school to University, further highlighting the need for physical activity promotion interventions within this specific population. Behrens and Dingers (2003) identified that the physical activity levels of students is lower at weekends compared to weekday physical activity levels, this

could be attributed to the absence of lectures or less structured days on weekends with less activities scheduled or available for students to take part in. This research identifying these barriers associated with University students will help structure future interventions in the attempt to eliminate these perceived barriers among this population of first year University students.

4.4.5 The effect of gender and living environment on subjectively-measured physical activity levels

The final aspect of the study was to explore the differences between subjectively- measured physical activity levels across gender and living environment. Although the current study did not find living environment or gender to significantly influence changes in self-reported physical activity levels from Semester 1 to Semester 2, data did highlight lower levels of physical activity in students living in on-campus accommodation compared to the students who lived in off-campus accommodation (Table 4.4). Findings from the current study highlighted students who lived in on-campus accommodation had reductions in self-report total physical activity to include average daily walking, moderate and vigorous intensity physical activity from Semester 1 to Semester 2 in both male (M = -18.1, SD = 90.1 minutes/day) and female students (M = -21.5, SD = 75.3 minutes/day). Whereas it is interesting to note that those students who lived in off-campus accommodation reported increases in their total physical activity levels from Semester 1 to Semester 2 in both male (M= +15.2, SD = 136.5 minutes/day) and female students (M = +5.7, SD = 93.2 minutes/daily). These findings share similarities with findings by Bray and colleagues (2010) who compared the physical activity levels of Semester 1 at University with the physical activity levels measured eight months previous, identifying a significant decrease in vigorous intensity physical activity. Findings also identified those students who remained living with their parents in the transition from school to University and therefore in off-campus

accommodation were significantly less likely to have insufficient activity levels than those who lived in on-campus accommodation. Further highlighting the significant impact University living environment can have on student's physical activity levels, which is very often accompanied with a high proportion of students living in on-campus residences in first year.

Similar to these findings by Bray and Born (2010), Butler and colleagues (2004) investigated the longitudinal changes in female first year University students who resided in halls of residence upon entry to University. Similar to the current study data collection took place at the beginning of first year with follow-up five months later. Findings suggested that body weight increases were associated with a reduction in physical activity due to a significant reduction in subjective total physical activity. The study identified no significant increase in dietary energy intake over the two time points which further highlights the association between reduced physical activity levels being the key determinant of weight gain. However this study specifically looked at female first year University students whereas the current study looked at both male and female first year students. The self-report physical activity questionnaire used in this study was the Baecke Questionnaire of Habitual Physical Activity (BQHPA) (Baecke, Burema, & Frijters, 1982) in comparison to the IPAQ used in the current study. It must also be noted that limitations exist when using self-report measures to assess physical activity, research highlights occurrences of over reporting the time spent in activity and overestimating the intensity of the activity being undertaken (Montoye et al., 1996).

Longitudinal research by Racette and colleagues (2008) looked at the association between living environment and changes in weight gain, physical exercise levels and diet from first year to final year at University. Findings identified a modest increase in body weight and BMI from first year to senior year, suggesting the frequency of harmful weight gain experienced during first year does not continue throughout the University experience

(Levitsky, Halbmaier, & Mrdjenovic, 2004; Racette, Deusinger, Strube, Highstein, & Deusinger, 2005). The initial findings from this study identified increases of body weight could be attributable to the adverse health behaviours experienced through living in the halls of residence environment in first year. This finding shares similarities with the current study where significant changes in body composition (hip and waist circumference) were identified from Semester 1 to Semester 2 of first year at University yet findings did not identify an effect of living environment on increased waist and hip circumference. It was evident that 100% of the Racette and colleagues (2008) study sample lived in on-campus halls of residence in their first year at University, which drastically reduced to only 15% in student's final year, whereas 72.9% of the current study sample lived in on-campus accommodation at both time points. This highlights the high number of students residing in on-campus halls of residence in their first year of University and stresses the importance of implementing appropriate positive health behaviour interventions to those students living in on-campus accommodation.

Although not specifically related to the physical activity levels of students it is important to look at the research by Turley and Wodtke (2010), which investigated the effect of living on campus and academic performance in first year University students. Results were taken from the National Postsecondary Student Aid Survey (NPSAS), which revealed that living in on-campus accommodation did not have a significant effect on a majority of student's first year academic performance from a range of institutions. This finding suggests that living on-campus elicits a positive effect on students' academic behaviours, which could be associated with their increased involvement and engagement in University activities through living on-campus compared to those who live off-campus (Astin, 1984). Students living on-campus have been shown to interact more with staff members and mentors as well as having endless access to academic resources, a luxury those living off-campus do not have. This highlights

the importance of on-campus living environment for the increased academic achievement potential yet could relate to a negative impact on physical activity levels among the student population.

4.4.6 Limitations of the study

The current longitudinal study has its limitations. Firstly it is important to critique the study participants, as many students were studying Sport and Physical Activity (n = 13) who may have more knowledge regarding physical activity guidelines and may be generally more active than those not studying Sport. It is also important to note the social desirability associated with subjective self-report measures where it was evident most of the student sample reported higher levels of vigorous intensity physical activity when compared to the corresponding objective accelerometer data recorded. Secondly the IPAQ 7-day self-report questionnaire used in this study to assess subjective physical activity levels of physical levels of first year students would have benefitted from being researcher-led, where the researcher goes through the questionnaire with the participant further explaining parts or questions when necessary. Finally in order to accurately measure the impact of first year entry to University on students, it would be beneficial to measure levels of physical activity, psychological well-being and health behaviours prior to entry to the University environment. Therefore identifying the impact of entry to first year University on previous behaviours and how they change throughout a University undergraduate degree.

4.4.7 Conclusions and Future Recommendations

This longitudinal study was designed to investigate the changes in student's physical activity and mental health throughout first year at University, using subjective and objective quantitative research methods. The findings from this study identified entry to the University environment to initially have a negative impact on anxiety levels, which are then reduced later in the year highlighting initial entry to be a time of heightened anxiety levels. This

important finding can help practitioners in the future implement interventions to reduce these anxious feelings at the beginning of University and signpost the student support services available in this new environment. It was also evident that negative changes in body composition were evident from Semester 1 to Semester 2 which could be attributable to the changing dietary behaviours as well as the reduced physical activity levels, which were also apparent in the reduced objectively-measured moderate intensity physical activity levels in this study sample. The amount of time spent in light intensity physical activity increased from Semester 1 to Semester 2 and moderate intensity physical activity decreased. However participation in regular moderate intensity physical activity has been widely accepted to be associated with health benefits from exercise highlighting the importance of increasing students light intensity physical activity to a higher intensity for health benefits. Findings from this longitudinal study highlight the need for the early implementation of interventions at entry to University in an attempt to reduce the negative health behaviours and reduced physical activity levels adopted after entry to the University environment.

Chapter 5: Conclusions

University students are a key population to study due to their future influential roles in society after graduation and becoming part of our future adult generation. Therefore it is extremely important to encourage positive health behaviours among this particular population in order to further encourage positive health behaviours into adulthood. Thus tackling some of the key physical inactivity related diseases such as obesity and depression through increased physical activity promotion and overall healthy living is of considerable importance. The evidence endorsing the vast benefits of physical activity participation for health is ever-increasing. Therefore the aim of this thesis was to provide Universities with accurate up-to-date knowledge and understanding of student physical activity levels as well as their mental health and well-being upon entry to the University environment. These studies specifically provide current information regarding first year Scottish University students, a population previously under researched. The findings from both studies contribute towards the growing body of evidence surrounding physical activity levels and the mental health of the University student population.

Study one aimed to examine the current physical activity levels and prevalence of symptoms associated with mental health to include depression, anxiety and quality of life, as well as the relationship between these outcome variables in Semester 2 of first year at University. The findings from study one identified a significant relationship between those students who engaged in very vigorous intensity physical activity and lower more favorable levels of depression. Findings also identified male first year students to be participating in higher levels of physical activity compared to their female counterparts. This suggests that Universities need to implement interventions to encourage higher intensities of physical activity among the student population in order to reduce these levels of heightened depression, specifically evident among female students. Also incorporated in study one were

semi-structured interviews, this allowed the researcher to gain a more thorough understanding of individual's previous school experiences and current University health behaviours. This added a greater insight into the motivations and barriers in regards to physical activity participation and intensity level. The interviews looked into students' perspectives on their school and University health behaviours, physical activity levels and dietary behaviours. Only one student acknowledged their physical activity levels to have improved since University entry. This was due to the increased opportunity and access to a wider variety of sports and physical activities, highlighting the potential of University campuses to be in the promotion of positive physical activity levels. However a majority of the interviews identified students to report University entry to have a negative impact on their health, physical activity levels and dietary behaviours. The key reasons were due to the change in daily routines due to the University academic timetable structure and the elimination of compulsory PE sessions previously incorporated into school timetables. This finding highlights the crucial reduction in physical activity levels from school to University, and suggests the need for further efforts from Universities to tackle this physical activity issue.

The findings from study one identified student health behaviours at one time point in first year, however research suggests student health behaviours change over time at University. Study two was designed to identify the changes in these behaviours over the course of first year at University. Students' waist and hip circumference increased from Semester 1 to Semester 2. In addition to this finding, study two also identified students' physical activity levels to have reduced over the course of first year. Students were found to be spending more time in light intensity physical activity to the detriment of spending less time in moderate intensity physical activity. This could suggest that changes in body composition in first year at University correspond with the reduced physical activity intensity levels, which is highly

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endorsed by previous physical inactivity related research. It is therefore essential to encourage increased physical activity intensities among this specific population, particularly among those who live in on-campus accommodation.

Study two also identified Semester 1 to be a time of heightened anxiety among students, where anxiety levels were higher when compared to levels recorded in Semester 2. This suggests that intital entry and the transition to the University environment to be an anxiety provoking period yet this reduced over time. This could be due to a range of life-changes occurring in this initial transition which often include moving away from home and family, meeting new people and adapting to the change in academic routine and lifestyle at University. This is a key finding that should be acknowledged by University health services in order to implement anxiety reducing interventions and coping techniques for students when they initially enter first year.

The findings from study two provide researchers and health professionals with detailed information on the specific time points that encourage unhealthy behaviours in first year students. This will allow relevant interventions to be implemented at the appropriate stages in order to promote healthy lifestyles. For example, students could receive welcome information prior to University entry on what is to be expected in the first Semester allowing students to prepare in the environment they are already comfortable and confident in. Thereafter upon entry to the University environment, students should be given free opportunities to meet new people in environments that encourage positive health behaviours such as free yoga and pilates exercise sessions or free entry to the gym.

The findings from both studies provide researchers and University health care professionals with a deeper understanding of how University life can impact entry level students' physical activity levels and mental health. The current prevalence of University physical activity promotion is wide and varying where a majority of Universities in the UK have fully

equipped gyms and sports halls designed specifically for physical activity and sports sessions. Many of the University gyms will have a wide and varying Exercise timetable for staff and students to be active at University through exercise classes from Zumba to Spin as well as well-established sports clubs sessions from Rowing to Hockey. These sessions are commonly advertised through a Fresher's Sports Fair in September and re-Fresher's Sports Fair in January. Student Enrichment teams also host a variety of Health and Well Being events throughout the year to highlight various health days such as World Mental Health Day to get more students talking about mental health and seek advice and help. However it is known that not all students take advantage of the current promotional attempts to get students more active and it tends to be students who are already active that take advantage of these interventions.

The findings from both studies identified a significant reduction in the intensity of the physical activity being undertaken during first year at University. This was evident in the participants' self-report recall questionnaire data, accelerometer data and qualitative interviews. This is a key finding suggesting that physical activity levels at University may not cease altogether but instead reduce in intensity. Study two identified students to be sacrificing time in both moderate and vigorous intensity physical activity for increased time spent in light intensity physical activity.

5.1 Applied Implications of the Research Findings

The findings from study one and two contribute towards the growing evidence surrounding the physical activity levels and mental health behaviours, specifically regarding the Scottish University student population. The findings provide Universities with the appropriate knowledge and understanding of student physical activity and mental health behaviours. The overall findings suggest physical activity levels were low in first year students and anxiety levels elevated, therefore implementing an intervention to reduce these occurances might

reduce these anxiety levels. Using the popular spaces available on University campuses could provide students with various options to be physically active. This will also provide students with the information required to lead a healthy and active lifestyle whilst at University. University libraries are ideal locations to target a wide range of physically inactive students through the use of the large spaces available. Libraries could promote physical activity in study breaks, providing free short sessions to students that incorporate time away from studying to reduce the long periods of sitting. Relaxation exercises will not only provide students with a productive break from their studies but could benefit their academic work and efficiency (Dehghan-Nayeri & Adib-Hajbaghery, 2011). In order to specifically target and reduce these evidently increasing physical inactivity levels among students residing in on-campus accomodation, exercise professionals should also target halls of residence from the beginning of term and promote physical and sporting activities. It is important for Universities to use the information gained from both these studies in order to change these unhealthy student behaviours upon entry to the first year University environment.

5.2 Recommendations for Future Research

In order to further identify the impact of entry to first year, future research should measure health behaviours prior to entry to the University environment and identify physical activity levels and mental health in students. These behaviours should be compared with those measured upon University entry, which will further identify the impact of the transition from school to University. Monitoring student behaviours throughout the duration of their undergraduate degree in order to assess the magnitude of the behaviour change would also be suggested. It would also be useful to look at whether specific degree courses have an impact on students' physical activity levels and mental health as a way to identify whether additonal support and physical activity interventions should be incorporated into certain academic syllabuses.

Through the qualitative aspect of study one a deeper understanding of students' change in routine in comparison to school was gained. A theme that emerged was the change in sleeping patterns evident at University, where it was seen as more irregular with increased unsociable sleeping hours. The aspect of sleeping behaviours could be crucial to overall health, physical activity levels and mental health and it is recommended that there is future research into the sleeping patterns and behaviours of first year University students.

The qualitative interviews incorporated into study one was to uncover the dietary behaviours of first year University students and further identify the health behaviours of the student population. This can commonly be assessed by the use of food diaries that can identifiy the times of daily food consumption as well as the nutritional value of the foods being consumed. This would also further support changes in body composition data that were included in the current research studies.

In order to fully understand health behaviours specific to the student population, it would be useful for future research to consider a control comparison of a non-University age cohort. This will help identify the impact University has on various health behaviours compared to the general population. The location of the University would also be a useful aspect to investigate further.The current study included one University that was city-centre based and the other University is a rural University on the outskirts of the city, and it which could be argued that the location may play a crucial part in influencing students' health behaviours. It would also be useful to take into consideration the type of University as to whether it was Russel group or post-1992. The current study compared data depending on living environment such as on-campus or off-campus, a future recommendation would be to also compare the data depending on University as this will help identify whether the University type has an impact on student health behavours.

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Appendix A:
Study 1 Recruitment Posters

Would you like to find out how physically active you are?

University of Strathclyde Glasgow

Why not find out by taking part in this study?

We are currently recruiting <u>first year undergraduate</u> students to assess physical activity levels over a seven-day period using Actigraph accelerometers.

For the study, we would like you to wear an Actigraph for seven days, in addition to completing a few questionnaires regarding your physical activity and health.

For more information please contact:
johanna.shaw@strath.ac.uk

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For more information please contact:
j.shaw@hw.ac.uk

j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk

Appendix B:
Study 1 Written Informed Consent

Consent Form

Name of department: School of Psychological Sciences and Health, Physical Activity for Health group

Title of the study: An examination of student health behaviours during first year at University

- I confirm that I have read and understood the information sheet for the above project and the researcher has answered any queries to my satisfaction.
- I understand that my participation is voluntary and that I am free to withdraw from the project at any time, without having to give a reason and without any consequences.
- I understand that I can withdraw my data from the study at any time.
- I understand that any information recorded in the investigation will remain confidential and no information that identifies me will be made publicly available.
- I consent to being a participant in the project
- I consent to being audio recorded as part of the project at visit three Yes/ No

(PRINT NAME)	Hereby agree to take part in the above project
Signature of Participant:	Date:

Appendix C:

Study 1 Participant Information Sheet

Participant Information Sheet

Name of department: School of Psychological Sciences and Health, Physical Activity for Health group
Title of the study: An examination of student health behaviours during first year at University

Introduction
This research study is being conducted at the University of Strathclyde by a post-graduate student, Johanna Shaw, as part of her research project. Her contact details are: johanna.shaw@strath.ac.uk. The study is supervised by Dr Ann-Marie Knowles (annmarie.knowles@strath.ac.uk) and Dr Allan Hewitt (allan.hewitt@strath.ac.uk).

What is the purpose of this investigation?
The purpose of the study is to observe health behaviours, specifically psychological, dietary and physical activity levels, of young adults during their first year at two Scottish Universities. This is to identity the relationship between various health behaviours in first year University students, to identify any differences in health behaviours between the two universities and to gain an in-depth understanding of how these behaviours influence one another.

Do you have to take part?
Your involvement in this research is completely voluntary and no financial compensation will be available. As a volunteer you have no obligation to participate or continue with the study if you do not want to. Furthermore, if you withdraw during the course of the study you do not need to provide a reason for your decision and this will not affect your relationship with the University of Strathclyde and/or Heriot-watt University.

What will you do in the project?
You will be asked to make a maximum of three visits for all study procedures. These may be conducted in one of the physical activity for health research facilities at the University of Strathclyde or Heriot Watt University or at a more convenient location on campus.

Visit one: The first visit will last around 45 minutes. During this visit the researcher will make sure that you understand what will be done during the study and answer any questions that you may have prior to any data collection. You will be fitted with a heart rate monitor and your resting heart rate will be recorded. During this time, you will be asked to complete a short demographic questionnaire detailing your age, gender and contact details and a series of psychological well-being questionnaires. Your blood pressure, height, weight, waist and hip circumference will also be assessed. The researcher will then fit you with an activity monitor (ActiGraph). If it is more convenient we can supply the monitors and you can fit them in your own time. The researcher will also give you an instruction sheet about the ActiGraph monitor and how to fit it (in case you need to remove it). You are asked to wear the monitor for 7 days. If this is not possible then a further option is available for you to wear the monitor for 3 consecutive days over the course of a week (ideally with one of those days being a weekend day). The researcher will then provide you with a 7 day food diary for to complete.

Please note:

- If an activity monitor fails, which sometimes occurs in this type of research then you may be asked if you wish to wear the device for an additional week. However you are reminded that this is completely voluntary your participation in the rest of the study will not be affected if you decline additional measurement periods.

Visit two: Visit two will last approximately 20 minutes. You will be asked to return for study visit two approximately one week after study visit one. At this point the researcher will collect the ActiGraph monitor and food diary from you. The researcher will discuss the food diary with you to clarify unclear entries or missing items. You will also be asked to complete a self-report physical activity behaviour questionnaire and invited to participate in an interview at a subsequent visit.

Visit three: Visit three will last approximately 30-45 minutes and is an individual recorded interview with the MPhil researcher at a location convenient for you. The aim of the interview is to discuss your health behaviours during your first year at University. Visit three will only be required for a random sample of the participants and you would only be invited for interview if you indicated approval on your second visit and in the consent form below. You may also withdraw from being invited for interview at this point, even if you had initially indicated approval in your consent form.

Why have you been invited to take part?
We are looking to recruit first year University students (aged between 17 and 24 years, undergraduate students in full time education, either living at home or away from home). Unfortunately we are not able to include people with conditions which affect normal physical activity. We have invited you as you are a first year student at University. Once you have read the full study information below we are asking you to provide consent for your participation.

What are the potential risks to you in taking part?
There is only very minimal risk involved in participating in this study. The activity monitor (ActiGraph) which you will be asked to wear is attached using a medical adhesive. As with all adhesives there is a small risk of the skin being sensitive to this adhesive. We can provide a low allergy dressing if preferred or the activity monitor can be removed.

What happens to the information in the project?
All information associated with the respondents who are participating in the study will be pseudo-anonymous. Once the study has been completed all records will be stored in the School of Psychological Sciences and Health departments achieves at the University of Strathclyde for the duration of five years: after which, all records will be destroyed.

The University of Strathclyde is registered with the Information Commissioner's Office who implements the Data Protection Act 1998. All personal data on participants will be processed in accordance with the provisions of the Data Protection Act 1998.

Thank you for reading this information – please ask any questions if you are unsure about what is written here.

What happens next?
If after reading this information form you are confident with the process involved and would like to participate, please complete the consent form and hand it to either the researcher or supervisor.

If, after reading this information form you would not like to participate you do not need to do anything else and we thank you for your time.

If you participate in the study you will be offered the opportunity to receive individual feedback and a report of the overall findings once the study is completed. We may aim to publish the overall study findings in a relevant journal and if this is the case all data will be anonymous.

Researcher Contact Details:
Johanna Shaw, post-graduate student, School of Psychological Sciences and Health, Level 5 Graham Hills Building, University of Strathclyde, Glasgow. Email: johanna.shaw@strath.ac.uk

Chief Investigator Details:
The main supervisor contact for this project is Dr Ann-Marie Knowles, Address: Physical activity for Health group, School of Psychological Sciences and Health, Room GH538, Level 5 Graham Hills Building, University of Strathclyde, 40 George Street, Glasgow, G1 1QE. Tel: 0141 548 3412. E-mail: annmarie.knowles@strath.ac.uk

This investigation was granted ethical approval by the School of Psychological Sciences and Health ethics committee.

If you have any questions/concerns, during or after the investigation, or wish to contact an independent person to whom any questions may be directed or further information may be sought from, please contact:

Chair of the School of Psychological Sciences and Health Ethics Committee
Dr Susan Rasmussen

School of Psychological Sciences and Health
University of Strathclyde
Graham Hills Building
40 George Street
Glasgow
G1 1QE

Telephone: 0141 548 2575
Email: s.a.rasmussen@strath.ac.uk

Appendix D:
Study 1 Demographic Questionnaire

Information & Contact Details

Name:

Male/Female:

Date of Birth:

Age:

Contact Details

Address:

Postcode

Phone Number:

Email:

Undergraduate degree course:

Appendix E:
Short Form-12

SF-12 Questionnaire

In general, would you say your health is:
___ Excellent (1)
___ Very Good (2)
___ Good (3)
___ Fair (4)
___ Poor (5)

Does your health limit you in these activities? If so, how much?
Moderate activities, such as: moving a table, pushing a vacuum cleaner, bowling, or playing golf:
___ Yes, limited a lot (3)
___ Yes, limited a little (2)
___ No, not limited at all (1)

Climbing several flights of stairs:
___ Yes, limited a lot (3)
___ Yes, limited a little (2)
___ No, not limited at all (1)

During the past 4 weeks, have you had any of the following problems with your work or other regular activities as a result of your physical health?
Accomplished less than you would like:
___ Yes (2)
___ No (1)

Were limited in the kind of work or other activities:
___ Yes (2)
___ No (1)

During the past 4 weeks, were you limited in the kind of work you do or other regular activities as a result of any emotional problems? (such as feeling depressed or anxious)
Accomplished less than you would like:
___ Yes (2)
___ No (1)

Didn't do work or other activities as carefully as usual:
___ Yes (2)
___ No (1)

During the past 4 weeks, how much did pain interfere with your normal work? (including both work outside the home and housework)
___ Not at all (1)
___ A little bit (2)
___ Moderately (3)
___ Quite a bit (4)
___ Extremely (5)

How much of the time during the past 4 weeks…
Have you felt calm and peaceful?
___ All of the time (1)
___ Most of the time (2)
___ Some of the time (3)
___ A little of the time (4)
___ None of the time (5)

Did you have a lot of energy?
___ All of the time (1)
___ Most of the time (2)
___ Some of the time (3)
___ A little of the time (4)
___ None of the time (5)

Have you felt downhearted and blue?
___ All of the time (1)
___ Most of the time (2)
___ Some of the time (3)
___ A little of the time (4)
___ None of the time (5)

During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities? (like visiting with friends, relatives, etc)
___ All of the time (1)
___ Most of the time (2)
___ Some of the time (3)
___ A little of the time (4)
___ None of the time (5)

Appendix F:
Hospitality Anxiety and Depression Scale

Hospitality Anxiety and Depression Scale (HADS)

Tick the box beside the reply that is closest to how you have been feeling in the past week.
Don't take too long over you replies: your immediate is best.

D	A		D	A	
		I feel tense or 'wound up':			**I feel as if I am slowed down:**
	3	Most of the time	3		Nearly all the time
	2	A lot of the time	2		Very often
	1	From time to time, occasionally	1		Sometimes
	0	Not at all	0		Not at all
		I still enjoy the things I used to enjoy:			**I get a sort of frightened feeling like 'butterflies' in the stomach:**
0		Definitely as much		0	Not at all
1		Not quite so much		1	Occasionally
2		Only a little		2	Quite Often
3		Hardly at all		3	Very Often
		I get a sort of frightened feeling as if something awful is about to happen:			**I have lost interest in my appearance:**
	3	Very definitely and quite badly	3		Definitely
	2	Yes, but not too badly	2		I don't take as much care as I should
	1	A little, but it doesn't worry me	1		I may not take quite as much care
	0	Not at all	0		I take just as much care as ever
		I can laugh and see the funny side of things:			**I feel restless as I have to be on the move:**
0		As much as I always could		3	Very much indeed
1		Not quite so much now		2	Quite a lot
2		Definitely not so much now		1	Not very much
3		Not at all		0	Not at all
		Worrying thoughts go through my mind:			**I look forward with enjoyment to things:**
	3	A great deal of the time	0		As much as I ever did
	2	A lot of the time	1		Rather less than I used to
	1	From time to time, but not too often	2		Definitely less than I used to
	0	Only occasionally	3		Hardly at all
		I feel cheerful:			**I get sudden feelings of panic:**
3		Not at all		3	Very often indeed
2		Not often		2	Quite often
1		Sometimes		1	Not very often
0		Most of the time		0	Not at all
		I can sit at ease and feel relaxed:			**I can enjoy a good book or radio or TV program:**
	0	Definitely	0		Often
	1	Usually	1		Sometimes
	2	Not Often	2		Not often
	3	Not at all	3		Very seldom

Please check you have answered all of the questions

Appendix G:
International Physical Activity Questionnaire

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE
(October 2002)

LONG LAST 7 DAYS SELF-ADMINISTERED FORMAT

FOR USE WITH YOUNG AND MIDDLE-AGED ADULTS (15-69 years)

The International Physical Activity Questionnaires (IPAQ) comprises a set of 4 questionnaires. Long (5 activity domains asked independently) and short (4 generic items) versions for use by either telephone or self-administered methods are available. The purpose of the questionnaires is to provide common instruments that can be used to obtain internationally comparable data on health–related physical activity.

Background on IPAQ
The development of an international measure for physical activity commenced in Geneva in 1998 and was followed by extensive reliability and validity testing undertaken across 12 countries (14 sites) during 2000. The final results suggest that these measures have acceptable measurement properties for use in many settings and in different languages, and are suitable for national population-based prevalence studies of participation in physical activity.

Using IPAQ
Use of the IPAQ instruments for monitoring and research purposes is encouraged. It is recommended that no changes be made to the order or wording of the questions as this will affect the psychometric properties of the instruments.

Translation from English and Cultural Adaptation
Translation from English is encouraged to facilitate worldwide use of IPAQ. Information on the availability of IPAQ in different languages can be obtained at www.ipaq.ki.se. If a new translation is undertaken we highly recommend using the prescribed back translation methods available on the IPAQ website. If possible please consider making your translated version of IPAQ available to others by contributing it to the IPAQ website. Further details on translation and cultural adaptation can be downloaded from the website.

Further Developments of IPAQ
International collaboration on IPAQ is on-going and an *International Physical Activity Prevalence Study* is in progress. For further information see the IPAQ website.

More Information
More detailed information on the IPAQ process and the research methods used in the development of IPAQ instruments is available at www.ipaq.ki.se and Booth, M.L. (2000). *Assessment of Physical Activity: An International Perspective.* Research Quarterly for Exercise and Sport, 71 (2): s114-20. Other scientific publications and presentations on the use of IPAQ are summarized on the website.

LONG LAST 7 DAYS SELF-ADMINISTERED version of the IPAQ. Revised October 2002.
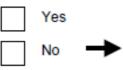
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INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** and **moderate** activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal.

PART 1: JOB-RELATED PHYSICAL ACTIVITY

The first section is about your work. This includes paid jobs, farming, volunteer work, course work, and any other unpaid work that you did outside your home. Do not include unpaid work you might do around your home, like housework, yard work, general maintenance, and caring for your family. These are asked in Part 3.

1.   Do you currently have a job or do any unpaid work outside your home?

☐ Yes

☐ No ➡   **Skip to PART 2: TRANSPORTATION**

The next questions are about all the physical activity you did in the last 7 days as part of your paid or unpaid work. This does not include traveling to and from work.

2.   During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, heavy construction, or climbing up stairs **as part of your work**? Think about only those physical activities that you did for at least 10 minutes at a time.

_____ **days per week**

☐ No vigorous job-related physical activity ➡   **Skip to question 4**

3.   How much time did you usually spend on one of those days doing **vigorous** physical activities as part of your work?

_____ **hours per day**
_____ **minutes per day**

4.   Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads **as part of your work**? Please do not include walking.

_____ **days per week**

☐ No moderate job-related physical activity ➡   **Skip to question 6**

LONG LAST 7 DAYS SELF-ADMINISTERED version of the IPAQ. Revised October 2002.

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5. How much time did you usually spend on one of those days doing **moderate physical activities** as part of your work?

_____ hours per day
_____ minutes per day

6. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **as part of your work**? Please do not count any walking you did to travel to or from work.

_____ days per week

☐ No job-related walking   ➡   *Skip to PART 2: TRANSPORTATION*

7. How much time did you usually spend on one of those days **walking** as part of your work?

_____ hours per day
_____ minutes per day

PART 2: TRANSPORTATION PHYSICAL ACTIVITY

These questions are about how you traveled from place to place, including to places like work, stores, movies, and so on.

8. During the **last 7 days**, on how many days did you **travel in a motor vehicle** like a train, bus, car, or tram?

_____ days per week

☐ No traveling in a motor vehicle   ➡   *Skip to question 10*

9. How much time did you usually spend on one of those days **traveling** in a train, bus, car, tram, or other kind of motor vehicle?

_____ hours per day
_____ minutes per day

Now think only about the **bicycling** and **walking** you might have done to travel to and from work, to do errands, or to go from place to place.

10. During the **last 7 days**, on how many days did you **bicycle** for at least 10 minutes at a time to go **from place to place**?

_____ days per week

☐ No bicycling from place to place   ➡   *Skip to question 12*

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11. How much time did you usually spend on one of those days to **bicycle** from place to place?

     _____ hours per day
     _____ minutes per day

12. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time to go from place to place?

     _____ days per week

     ☐ No walking from place to place ➡ *Skip to PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY*

13. How much time did you usually spend on one of those days **walking** from place to place?

     _____ hours per day
     _____ minutes per day

PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY

This section is about some of the physical activities you might have done in the **last 7 days** in and around your home, like housework, gardening, yard work, general maintenance work, and caring for your family.

14. Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, chopping wood, shoveling snow, or digging **in the garden or yard**?

     _____ days per week

     ☐ No vigorous activity in garden or yard ➡ *Skip to question 16*

15. How much time did you usually spend on one of those days doing **vigorous** physical activities in the garden or yard?

     _____ hours per day
     _____ minutes per day

16. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** activities like carrying light loads, sweeping, washing windows, and raking **in the garden or yard**?

     _____ days per week

     ☐ No moderate activity in garden or yard ➡ *Skip to question 18*

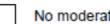LONG LAST 7 DAYS SELF-ADMINISTERED version of the IPAQ. Revised October 2002.

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17. How much time did you usually spend on one of those days doing **moderate** physical activities in the garden or yard?

     _____ **hours per day**
     _____ **minutes per day**

18. Once again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** activities like carrying light loads, washing windows, scrubbing floors and sweeping **inside your home?**

     _____ **days per week**

     [ ]   No moderate activity inside home   ➡   *Skip to PART 4: RECREATION,*
                                                  SPORT AND LEISURE-TIME
                                                  PHYSICAL ACTIVITY

19. How much time did you usually spend on one of those days doing **moderate** physical activities inside your home?

     _____ **hours per day**
     _____ **minutes per day**

PART 4: RECREATION, SPORT, AND LEISURE-TIME PHYSICAL ACTIVITY

This section is about all the physical activities that you did in the **last 7 days** solely for recreation, sport, exercise or leisure. Please do not include any activities you have already mentioned.

20. Not counting any walking you have already mentioned, during the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **in your leisure time?**

     _____ **days per week**

     [ ]   No walking in leisure time   ➡   *Skip to question 22*

21. How much time did you usually spend on one of those days **walking** in your leisure time?

     _____ **hours per day**
     _____ **minutes per day**

22. Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **vigorous** physical activities like aerobics, running, fast bicycling, or fast swimming **in your leisure time?**

     _____ **days per week**

     [ ]   No vigorous activity in leisure time   ➡   *Skip to question 24*

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23.	How much time did you usually spend on one of those days doing **vigorous** physical activities in your leisure time?

    _____ **hours per day**
    _____ **minutes per day**

24.	Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like bicycling at a regular pace, swimming at a regular pace, and doubles tennis **in your leisure time?**
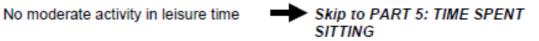
    _____ **days per week**

    ☐ No moderate activity in leisure time ➡ *Skip to PART 5: TIME SPENT SITTING*

25.	How much time did you usually spend on one of those days doing **moderate** physical activities in your leisure time?
    _____ **hours per day**
    _____ **minutes per day**

PART 5: TIME SPENT SITTING

The last questions are about the time you spend sitting while at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television. Do not include any time spent sitting in a motor vehicle that you have already told me about.

26.	During the **last 7 days**, how much time did you usually spend **sitting on a weekday?**

    _____ **hours per day**
    _____ **minutes per day**

27.	During the **last 7 days**, how much time did you usually spend **sitting on a weekend day?**

    _____ **hours per day**
    _____ **minutes per day**

This is the end of the questionnaire, thank you for participating.

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Appendix H:
Accelerometer Non-Wear Time Log

Accelerometer Non-Wear Time Log

To include times when accelerometer was taken off for bathing/ sleeping and activities such as swimming and cycling

Monday (e.g. 10pm-9am sleeping)	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

Appendix I:
Study 1 Recorded Interview Written Informed Consent

Consent Form: Recorded Interview

Name of department: School of Psychological Sciences and Health, Physical Activity for Health group
Title of the study: An examination of student health behaviours during first year at University

Check Boxes

☐ I confirm that I have read and understood the information sheet for the above project and the researcher has answered any queries to my satisfaction.

☐ I understand that my participation is voluntary and that I am free to withdraw from the project at any time, without having to give a reason and without any consequences.

☐ I understand that I can withdraw my data from the study at any time.

☐ I understand that any information recorded in the investigation will remain confidential and no information that identifies me will be made publicly available.

☐ I consent to being audio recorded as part of the project at visit five.

(PRINT NAME)	Hereby agree to take part in the above project
Signature of Participant:	Date:

Appendix J:
Study 1 Recorded Interview Participant Information
Sheet

Participant Information Sheet: Recorded Interview

Name of department: School of Psychological Sciences and Health, Physical Activity for Health group
Title of the study: An examination of student health behaviours during first year at University

What is the purpose of this investigation?
The aim of the interview is to discuss your health behaviours during your first year at University.

Do you have to take part?
No you do not have to take part, your involvement in this aspect of the study is completely voluntary and no financial compensation will be available. As a volunteer you have no obligation to participate or continue with the study if you do not want to. Furthermore, if you withdraw during the course of the study you do not need to provide a reason for your decision and this will not affect your relationship with the University of Strathclyde and/or Heriot-watt University.

What will you do in the project?
The recorded interview will take place in a quiet location at either the physical activity for health research facilities at the University of Strathclyde or Heriot Watt University.

Visit three: Visit five will last approximately 30 minutes and is an individual recorded interview with the MPhil researcher. Visit five is completely voluntary and you will only be invited for interview if you indicated approval in the consent form below. You may also withdraw from being invited for interview at any point, even if you had initially indicated approval in your consent form.

Why have you been invited to take part?
We are looking to recruit first year University students (aged between 17 and 24 years, undergraduate students in full time education, either living at home or away from home). We have invited you as you are a first year student at University. Once you have read the full study information below we are asking you to provide consent for your participation.

What happens to the information in the project?
All information associated with the respondents who are participating in the study will be pseudo-anonymous, which means that all of the data collected will not have a name associated with it throughout. Once the study has been completed all records will be stored in the School of Psychological Sciences and Health departments achieves at the University of Strathclyde for the duration of five years: after which, all records will be destroyed.

The University of Strathclyde is registered with the Information Commissioner's Office who implements the Data Protection Act 1998. All personal data on participants will be processed in accordance with the provisions of the Data Protection Act 1998.

Thank you for reading this information – please ask any questions if you are unsure about what is written here.

What happens next?
If after reading this information form you are confident with the process involved and would like to participate, please complete the consent form and hand it to either the researcher or supervisor.

If, after reading this information form you would not like to participate you do not need to do anything else and we thank you for your time.

If you participate in the study you will be offered the opportunity to receive individual feedback and a report of the overall findings once the study is completed. We may aim to publish the overall study findings in a relevant journal and if this is the case all data will be anonymous.

Researcher Contact Details:
Johanna Shaw, post-graduate student, School of Psychological Sciences and Health, Level 5 Graham Hills Building, University of Strathclyde, Glasgow. Email: johanna.shaw@strath.ac.uk

Chief Investigator Details:
The main supervisor contact for this project is Dr Ann-Marie Knowles, Address: Physical activity for Health group, School of Psychological Sciences and Health, Room GH538, Level 5 Graham Hills Building, University of Strathclyde, 40 George Street, Glasgow, G1 1QE. Tel: 0141 548 3412. E-mail: annmarie.knowles@strath.ac.uk

This investigation was granted ethical approval by the School of Psychological Sciences and Health ethics committee.

If you have any questions/concerns, during or after the investigation, or wish to contact an independent person to whom any questions may be directed or further information may be sought from, please contact:

Chair of the School of Psychological Sciences and Health Ethics Committee
Dr Susan Rasmussen

School of Psychological Sciences and Health
University of Strathclyde
Graham Hills Building
40 George Street
Glasgow
G1 1QE

Telephone: 0141 548 2575
Email: s.a.rasmussen@strath.ac.uk

Appendix K:
Study 1 Semi-Structured Interview Guide

Tick	**Semi-structured Interview Guide**
	Start recording **Participant ID number:** **Date & time of interview:** ***(With your permission)*** **This interview will be recorded; all the information will be kept completely confidential and anonymous. The aim of this interview is to discuss your health behaviours during your first year at University.**

1. Students' <u>perceptions</u> of <u>health</u>	
	So firstly tell me what you understand by the term 'health'?
	(WHO definition: Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.)
	Tell me what do you understand about the **mental health** aspect of health?
	What do you understand about the **physical health** aspect of health?
• Students' <u>health behaviour</u> at <u>School</u>	
	Taking a look back to when you were at school how would you say your overall health was like then?
• Students' <u>health behaviour</u> at <u>University</u>	
	What would you say your health has been like since coming to University?
• Comparing students' health from School to University	
	After reflecting on both your health at school and University when would you say you were at your healthiest?
2. Students' <u>perceptions</u> of <u>Physical Activity</u>	
	So moving onto the physical aspect of health, do you know what the current recommended physical activity guidelines for a healthy lifestyle are for your age group?
	If not… How physically active do you think your age group should be for health benefits in a typical week?
	How often?
	How long?
	What intensity? *Light, Moderate, Vigorous or Very Vigorous*
• Students' <u>Physical Activity behaviour</u> at <u>School</u>	
	Looking back again to when you were at school how would you say your physical activity levels were like then?

	How often?
	How long?
	Who with?
	During school? *PE lessons*
	After school? *Clubs*
	Out of school sports clubs?
	Weekday Physical Activity?
	Weekend Physical Activity?
• **Students' <u>Physical Activity behaviour</u> at <u>University</u>**	
	What would you say your physical activity levels were like now at University?
	How often?
	How much?
	Who with?
	Fresher events?
	Sports Clubs?
	Weekday Physical Activity?
	Weekend Physical Activity?
• **Comparing students' Physical Activity levels from School to University**	
	After reflecting on both your physical activity levels at both school and University when would you say you felt more physically active?
3. **Students' <u>perceptions</u> of <u>dietary behaviours</u>**	
	So moving onto your perceptions of dietary behaviours, what do you think your age group should be eating for health benefits?
	Do you know what the current recommendations for a healthy diet are?
	Food groups?
	How often?
	How much
	What would you say a <u>good diet/ meal</u> would consist of?

	Examples and food groups
	What would you say a <u>bad diet/ meal</u> would consist of?
	Examples and food groups
• **Students' <u>dietary</u> behaviour at <u>School</u>**	
	Looking back to school what would you say your dietary behaviours were like?
	When did you eat (times)?
	How much?
	Who with?
	Weekday behaviour?
	Weekend behaviour?
• **Students' <u>dietary</u> behaviour at <u>University</u>**	
	What would you say your dietary behaviours are like now at University?
	When do you eat (times)?
	How much?
	Who with?
	Weekday behaviour?
	Weekend behaviour?
End of interview	

End of interview

Ok that's great the interview is now over, thank you again for taking part in the study just to remind that all the information recorded will be kept confidential and anonymous.

Appendix L:
Study 2 Recruitment Posters

Would you like to find out how physically active you are?

University of **Strathclyde** Glasgow

Why not find out by taking part in this study?

We are currently recruiting <u>first year undergraduate</u> students to assess any changes in physical activity levels and sleeping behaviours over a seven-day period using Actigraph accelerometers.
For the study, we would like you to wear an Actigraph for seven days in September and again in January, in addition to completing a few questionnaires regarding your physical activity and health.

For more information please contact:
johanna.shaw@strath.ac.uk

johanna.shaw@strath.ac.uk
johanna.shaw@strath.ac.uk
johanna.shaw@strath.ac.uk
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johanna.shaw@strath.ac.uk
johanna.shaw@strath.ac.uk
johanna.shaw@strath.ac.uk

Would you like to find out how physically active you are?

HERIOT WATT UNIVERSITY

Why not find out by taking part in this study?

We are currently recruiting <u>first year undergraduate</u> students to assess any changes in physical activity levels and sleeping behaviours over a seven-day period using Actigraph accelerometers.
For the study, we would like you to wear an Actigraph for seven days in September and again in January, in addition to completing a few questionnaires regarding your physical activity and health.

For more information please contact:
j.shaw@hw.ac.uk

j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk j.shaw@hw.ac.uk

Appendix M:
Study 2 Written Informed Consent

Consent Form

Name of department: School of Psychological Sciences and Health, Physical Activity for Health group
Title of the study: A longitudinal investigation into the changes in student health behaviours throughout the time spent in first year University.

Check Boxes

☐ I confirm that I have read and understood the information sheet for the above project and the researcher has answered any queries to my satisfaction.

☐ I understand that my participation is voluntary and that I am free to withdraw from the project at any time, without having to give a reason and without any consequences.

☐ I understand that I can withdraw my data from the study at any time.

☐ I understand that any information recorded in the investigation will remain confidential and no information that identifies me will be made publicly available.

☐ I consent to being a participant in the project

(PRINT NAME)	Hereby agree to take part in the above project
Signature of Participant:	Date:

Appendix N:

Study 2 Participant Information Sheet

Participant Information Sheet

Name of department: School of Psychological Sciences and Health, Physical Activity for Health group
Title of the study: A longitudinal investigation into the changes in student health behaviours throughout the time spent in first year University.

Introduction

This research study is being conducted at the University of Strathclyde by a post-graduate student, Johanna Shaw, as part of her research project. Her contact details are: johanna.shaw@strath.ac.uk. The study is supervised by Dr Ann-Marie Knowles (annmarie.knowles@strath.ac.uk) and Dr Allan Hewitt (allan.hewitt@strath.ac.uk).

What is the purpose of this investigation?

The purpose of the study is to observe health behaviours, specifically psychological, sleeping patterns and physical activity levels, of young adults during their first year at two Scottish Universities. This is to identity the relationship between various health behaviours in first year University students, to identify any differences and changes in health behaviours from the beginning of Semester 1 (September) to the beginning of Semester 2 (January) between the two universities and to gain an in-depth understanding of how these behaviours influence one another and to monitor whether a change is evident in health behaviours.

Do you have to take part?

No you do not have to take part, your involvement in this research is completely voluntary and no financial compensation will be available. As a volunteer you have no obligation to participate or continue with the study if you do not want to. Furthermore, if you withdraw during the course of the study you do not need to provide a reason for your decision and this will not affect your relationship with the University of Strathclyde and/or Heriot-watt University.

What will you do in the project?

You will be asked to make a maximum of five visits for all study procedures. These may be conducted in one of the physical activity for health research facilities at the University of Strathclyde or Heriot Watt University or at a more convenient location on campus.

Visit one: The first visit will last around 30 minutes. During this visit the researcher will make sure that you understand what will be done during the study and answer any questions that you may have prior to any data collection. You will be fitted with a heart rate monitor and your resting heart rate will be recorded. During this time, you will be asked to complete a short demographic questionnaire detailing your age, gender and contact details and a series of psychological well-being questionnaires. Your blood pressure, height, weight, waist and hip circumference will also be assessed. The researcher will then fit you with an activity monitor (ActiGraph). If it is more convenient we can supply the monitors and you can fit them in your own time. The researcher will also give you an instruction sheet about the ActiGraph monitor and how to fit it (in case you need to remove it). You are asked to wear the monitor for 7 days. If this is not possible then a further option is available for you to wear the monitor for 3 consecutive days over the course of a week (ideally with one of those days being a weekend day).

Please note:

- If an activity monitor fails, which sometimes occurs in this type of research then you may be asked if you wish to wear the device for an additional week. However you are reminded that this is completely voluntary your participation in the rest of the study will not be affected if you decline additional measurement periods.

Visit two: Visit two will last approximately 20 minutes. You will be asked to return for study visit two approximately one week after study visit one. At this point the researcher will collect the ActiGraph monitor from you. You will also be asked to complete a self-report physical activity behaviour questionnaire and invited to participate in visits three and four in January 2014.

Visit three: The third visit will last around 30 minutes using the same procedure undertaken in visit one but it will take place in January 2014. You will be fitted with a heart rate monitor and your resting heart rate will be recorded. During this time, you will be asked to complete the same series of psychological well-being questionnaires. Your blood pressure, height, weight, waist and hip circumference will also be assessed. The researcher will then fit you with the same activity monitor (ActiGraph). You are asked to wear the monitor for another 7 days. If this is not possible then a further option is available for you to wear the monitor for 3 consecutive days over the course of a week (ideally with one of those days being a weekend day).

Visit four: Visit four will last approximately 20 minutes using the same procedure as visit two. You will be asked to return for study visit four approximately one week after visit three. At this point the researcher will collect the ActiGraph monitor from you. You will also be asked to complete a self-report physical activity behaviour questionnaire and invited to participate in an interview at a subsequent visit.

Why have you been invited to take part?
We are looking to recruit first year University students (aged between 17 and 24 years, undergraduate students in full time education, either living at home or away from home). We have invited you as you are a first year student at University. Once you have read the full study information below we are asking you to provide consent for your participation.

What happens to the information in the project?
All information associated with the respondents who are participating in the study will be pseudo-anonymous, which means that all of the data collected will not have a name associated with it throughout. Once the study has been completed all records will be stored in the School of Psychological Sciences and Health departments achieves at the University of Strathclyde for the duration of five years: after which, all records will be destroyed.

The University of Strathclyde is registered with the Information Commissioner's Office who implements the Data Protection Act 1998. All personal data on participants will be processed in accordance with the provisions of the Data Protection Act 1998.

Thank you for reading this information – please ask any questions if you are unsure about what is written here.

What happens next?
If after reading this information form you are confident with the process involved and would like to participate, please complete the consent form and hand it to either the researcher or supervisor.

If, after reading this information form you would not like to participate you do not need to do anything else and we thank you for your time.

If you participate in the study you will be offered the opportunity to receive individual feedback and a report of the overall findings once the study is completed. We may aim to publish the overall study findings in a relevant journal and if this is the case all data will be anonymous.

Researcher Contact Details:
Johanna Shaw, post-graduate student, School of Psychological Sciences and Health, Level 5 Graham Hills Building, University of Strathclyde, Glasgow. Email: johanna.shaw@strath.ac.uk

Chief Investigator Details:
The main supervisor contact for this project is Dr Ann-Marie Knowles, Address: Physical activity for Health group, School of Psychological Sciences and Health, Room GH538, Level 5 Graham Hills Building, University of Strathclyde, 40 George Street, Glasgow, G1 1QE. Tel: 0141 548 3412. E-mail: annmarie.knowles@strath.ac.uk

This investigation was granted ethical approval by the School of Psychological Sciences and Health ethics committee.

If you have any questions/concerns, during or after the investigation, or wish to contact an independent person to whom any questions may be directed or further information may be sought from, please contact:

Chair of the School of Psychological Sciences and Health Ethics Committee
Dr Susan Rasmussen

School of Psychological Sciences and Health
University of Strathclyde
Graham Hills Building
40 George Street
Glasgow
G1 1QE

Telephone: 0141 548 2575
Email: s.a.rasmussen@strath.ac.uk

Appendix O:
Study 2 Demographic Questionnaire

Information & Contact Details

Name:

Male/Female:

Date of Birth:

Age:

Contact Details

University living environment (i.e halls/ home):

Address of University living environment:

Postcode:

Phone Number:

University Email Address:

Personal Email Address:

Undergraduate degree course: