A Person-centred Analysis of the Time Use, Daily Activities and Health-related Quality of Life of Irish School-going Late Adolescents

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Abstract

Purpose: The health, well-being and quality of life of the world's 1.2 billion adolescents are global priorities. A focus on their patterns or profiles of time-use and how these relate to health-related quality of life (HRQoL) may help to enhance their well-being and address the increasing burden of non-communicable diseases in adulthood. This study sought to establish whether distinct profiles of adolescent 24-hour time-use exist and to examine the relationship of any identified profiles to self-reported HRQoL. *Method:* This cross-sectional study gathered data from a random sample of 731 adolescents (response rate 52%) from 28 schools (response rate 76%) across Cork city and county. A person-centred approach, latent profile analysis (LPA), was used to examine adolescent 24-hour time-use and relate the identified profiles to HRQoL. *Results:* Three male profiles emerged, namely *productive*, *high leisure* and *all-rounder*. Two female profiles, *higher study/lower leisure* and *moderate study/higher leisure*, were identified. The quantitative and qualitative differences in male and female profiles support the gendered nature of adolescent time-use. No unifying trends emerged in the analysis of probable responses in the HRQoL domains across profiles. Females in the *moderate study/higher leisure* group were twice as likely to have above average global HRQoL. *Conclusion:* Distinct time-use profiles can be identified among adolescents but their relationship with HRQoL is complex. Rich mixed-method research is required to illuminate our understanding of how quantities and qualities of time-use shape lifestyle patterns and how these can enhance the HRQoL of adolescents in the 21st century.

Key words: *time diary, finite mixture models, young people, well-being, health*

Background

There are now 1.2 billion adolescents (aged 10 - 19 years) in the world [1]. While the last 50 years has seen significant improvements in child health, the same gains have not been recorded for adolescents [2]. Consequently, their health and well-being is now a global priority [1, 3]. Recent policies call for increased attention to non-communicable causes of disease burden and lifestyle risk factors in adolescence [4], not least because important determinants of health and well-being are imbedded in young people's daily behavior, as reflected in their time-use [5, 6]. Indeed, how one lives out one's daily life is closely connected with health and quality of life [7-9]. Given that, time-use studies make an ideal contribution to the evaluation of well-being and quality of life [10-13].

To date, most studies of young people's lifestyles and time-use have tended to focus on a small number of discrete activities in isolation [14, 15]. However, it cannot be assumed that healthy levels of one activity are indicative of an overall healthy lifestyle [16]. Indeed, the finite nature of time requires trade-offs or substitutions among necessary and desired activities [17-19]. For example, although it is hypothesised that screen time displaces physical activity [20, 21], high levels of physical activity and sedentary behaviour can coexist [16, 22]. Therefore, macroscopic views are increasingly favoured in research on lifestyles and health with social scientists focusing more on overall patterns of daily activities [23, 24]. Such *person-centred* views are growing in popularity in research on adolescent lifestyles too [16, 25-33]. The person-centred approach seeks to understand the person as a functioning or organised whole rather than a summation of variables [34]. In fact, with this approach, the variable values are of no importance in themselves. Rather, they are meaningful only as parts of a configuration [34]. Importantly, person-centred analyses of adolescent time-use can more effectively capture the interconnectedness of activity choices and portray the complexity of activity participation typical of many young people's lives [35], and the impact on their health, well-being and quality of life [36].

Capturing the complexity of adolescent activity requires not just person-centred analytical methods but also the collection of data on all the activities performed by an individual in a 24-hour cycle, as these are the building blocks that create an overall lifestyle or pattern of time-use [37]. As a result, those concerned with adolescents' health have been urged to pay attention to these "...overall patterns of daily life, including sleep, eating habits, mass media consumption, extra-curricular activities, and relationships with parents and

peers". [5, p. 413]. However, there is a lack of such person-centred studies of adolescent 24-hour time-use [22], with a few exceptions [38-40].

The inclusion of positive outcome variables has recently been identified as one of the important requirements of quantitative developmental research [41]. One such variable is health-related quality of life (HRQoL). Indeed, there is growing consensus that the creation of a complete picture of young people's health and well-being requires an assessment of HRQoL outcomes [42]. No doubt reflecting this and contemporary perspectives that endorse an ecological view of the determinants of adolescent health and well-being [1, 43], and that honour young people's subjective perspectives of their own well-being and quality of life [44, 45], studies examining the relationship between HRQoL and discrete time-use behaviours in adolescents are increasing. More time in physical activity and longer sleeping hours have been found to be associated with better HRQoL, while high levels of recreational screen time are associated with poorer HRQoL [46-52]. However, these variable-centred studies do not take the previously described time-use trade-offs or displacements into account. In fact, the relationship between adolescent overall time-use patterns and HRQoL has not been examined to date (Hunt & McKay, 2014, under review).

With that in mind, we aimed to establish whether distinct patterns, or profiles, of adolescent 24-hour time-use exist in a cross-sectional sample of Irish late adolescents and to examine the relationship of any identified profiles to self-reported HRQoL.

Methods

Sample and Participant Selection

In 2007, we recruited a cross-sectional, random sample of adolescents aged 15 - 19 years in full-time education who were living at home (consistent with previous international studies [53]) in County Cork, Ireland. Second-level schools were randomly selected, from the governmental schools' register, with probability of selection proportionate to enrolment. School principals were asked to provide consent and 28 of 37 selected schools (76%) agreed to participate. Each school then identified one class group from the two

designated years[1] resulting in 1413 students being invited to participate. The first author provided written and verbal information for students and written information for parents. Students and parents were required to complete the consent/assent form. Consent/assent was obtained for 731 students (52%) who were subsequently enrolled in the study.

Measures

Time-use

Time-use was measured using a pre-coded 24-hour diary with six main activity categories comprising 31 individual activities. The time diary is the most frequently used data collection method in child and adolescent time-use research [14, 19]. Although there is an acknowledged lack of information about the quality of time-use data captured by the different methods [54], the time diary method is considered to have acceptable reliability and validity [55, 56] and is the method recommended by the United Nations Economic Commission for Europe (UNECE) Task Force on Time-use Surveys [11].

The diary in the present study was adapted from that used by the Irish Economic and Social Research Institute (ESRI) in their 2005 survey of Irish adults' time-use [57]. The activity categories were in keeping with those used in adolescent time-use surveys internationally [53]. Participants were asked to record their main (primary) activity for each block of 15 minutes of the designated day. Participants completed one diary for a weekday and one diary for a weekend day. The focus of this study was the time-use of participants measured during the school year.

The six main activity categories were Personal Care, School/Study, Paid Work, Housework, Voluntary/Religious Activity, and Leisure. Personal Care was disaggregated into Sleep and Self-Care, as the association between sleep and HRQoL has been the focus of increased attention in recent years [52]. School/Study was also disaggregated into two distinct categories given the significance of homework and study in the lives of adolescents [58, 59]. Similar to previous studies [51, 60, 61] we computed weekly time in these eight activity categories by multiplying weekday time by 5 and adding to weekend time-use totals that were multiplied by 2.

[1] The Irish second-level school system comprises a 3-year junior cycle and a 3-year senior cycle. The first year of senior cycle is typically referred to as Transition Year, while the second year of senior cycle is referred to as Fifth Year. Sixth (final) year students were not included as informal consultation with school principals had indicated that accessing this cohort in their final State examination year would be problematic.

Health-related quality of life

HRQoL was measured using the 52-item KIDSCREEN questionnaire [62]. This instrument was developed across Europe as a self-report measure applicable for healthy and chronically ill children and adolescents (aged from 8 - 18 years) and assesses 10 domains of HRQoL, namely "physical well-being", "psychological well-being", "moods and emotions", "self-perception", "autonomy", "parent relations and home life", "social support and peers", "school environment", "social acceptance" and "financial resources". Psychometric testing has shown the KIDSCREEN to be a reliable, valid, and sensitive measure [63]. A global HRQoL score (the KIDSCREEN-10 Index) was also generated from 10 items of the KIDSCREEN-52 [64]. The KIDSCREEN-10 Index has also demonstrated good psychometric properties [65]. Cronbach's alphas for the present study were .95 (KIDSCREEN-52) and .86 (KIDSCREEN-10 Index). The KIDSCREEN instruments have been validated for children and adolescents in Ireland and Irish norm reference data are available [66]. Using the KIDSCREEN Group Europe's [67] scoring guidelines and software, Rasch scores were computed for each of the 10 KIDSCREEN-52 domains and the KIDSCREEN-10 Index. These were transformed into T-values with a mean of 50 and a standard deviation of 10; with higher scores indicating better HRQoL [68]. The HRQoL data were not normally distributed. Therefore, as recommended [67], scores within a range of plus / minus half a standard deviation of the mean were categorised as average. Scores below or above those thresholds were categorised as below average or above average, respectively.

Procedures

The first author met the participants to provide instructions for completion of the survey instrument. They completed a sample diary and could ask any questions arising. Thereafter, the class was assigned a weekday and weekend day to complete their diaries. Diary days were designated by the first author with the aim of being as close as possible in time to the day of initial diary distribution, in order to maximise accurate recall of activities. Participants were provided with special stickers to use as memory aides and were also encouraged to put reminders in their mobile phones and school journals. When the designated diary days had passed, a liaison teacher prompted participants to check their diaries for accuracy and completeness. Diaries were then sealed in individual envelopes by participants to ensure privacy prior to collection by the liaison teacher.

Statistical Analysis

We aimed to identify holistic patterns, or profiles, of time spent across eight activity categories measured by the time-use diaries, and then relate any identified profiles to HRQoL. To identify time-use profiles, we used finite mixture models to model the observed multivariate distribution of weekly time-use in the eight activity categories as a function of a single, multinomial latent profile variable. Clustering of individuals was accomplished through the assumption that the time-use variables were independent, conditional on profile membership. These models thus maximise within profile homogeneity and between profile heterogeneity in the observed indicators [69] and are often referred to as latent class or latent profile models, depending on whether the indicator variables are measured categorically or continuously.

The eight observed weekly time-use variables were all continous in nature. However, four of the variables were strongly skewed and/or had a preponderance of zeros. Consequently, to simplify model estimation, we categorised each of these variables (i.e., Study, Paid Work, Housework, and Voluntary/Religious Activity) into zero/some/more time by splitting the non-zero time at the median. Weekly minutes in the remaining four time-use categories (i.e., Sleep, Self-Care, School, and Leisure) were entered as continuous variables. To aid model estimation, the continuous scores were rescaled by dividing by 100. The multivariate probability distribution for the eight variables is thus represented by 16 parameters: two thresholds for each of the 3-level categorical variables and a mean and variance for each continuous variable.

We investigated the plausibility of models specifying one to six latent profiles, thus comparing a single profile solution to a series of more complex models. For each model all 16 parameters were freely estimated within each specified profile (one to six). Separate analyses were conducted for males and females given the significant gender differences in time-use found in this sample [70] and others [71].

Relative fit indices (Akaike Information Criterion [AIC], the Bayesian Information Criterion [BIC] and the sample size-adjusted Bayesian Information Criterion [aBIC] and statistical tests were examined to determine optimal model fit. The Lo-Mendell-Rubin adjusted likelihood ratio test (LMRT) and the parametric bootstrapped likelihood ratio test (BLRT) were examined as statistical indicators of the number of profiles that best

fitted the data. Finally the entropy criterion was considered. Entropy is an index that determines the accuracy of classifying people into their respective profiles, with higher values (i.e., closer to 1.0) indicating better discrimination between profiles. No one method for comparing models with differing numbers of latent profiles is widely accepted as best [72]. Indeed, in practice it is likely that there will be more than one "best" model identified across the different indices [72]. Taking precedence from Herman et al. [73] and Arbeit et al. [74] we examined all these indices but gave special weight to the BIC and BLRT as these have been found to be most accurate in determining the appropriate number of profiles [75].

Profile membership is probabilistic rather than deterministic [76]. Recent advances in statistical methods take this into account and allow for improved estimation of the relationship between latent profiles and auxiliary variables (covariates or distal outcomes) while all the time maintaining the uncertainty in profile membership [77]. Using these latest statistical methods [78, 79] the relationship between 24-hour time-use and HRQoL was examined. As the age range of the sample was well specified as the developmental stage of late adolescence [2] we did not stratify or otherwise adjust the model for age. In our previous analyses we adjusted for the unequal distribution of weekdays across the sample. However, we found that HRQoL did not differ by day of the week therefore we did not adjust for day of the week in the model. For the same reason we did not add social class as a covariate to the model.

Because of the large number of tests, a Bonferroni corrected *p*-value of .005 was applied when determining the statistical significance of the scores from the 10 domains of the KIDSCREEN-52 [80]. A *p*-value of .05 was used in the case of the KIDSCREEN-10 Index. All analyses were conducted using Mplus version 7.11 [81].

Results

Twenty weekday diaries and 20 weekend diaries were excluded as there was more than four hours time with no recorded activities. This was the quality measure used by McGinnity et al. [57] in their time-use study with Irish adults. Consistent with previous studies [53], a further 13 weekday diaries were removed as there was less than 60 minutes recorded at school on the designated diary day. Thus the included diaries were of high quality with less than 0.005% of unspecified time recorded. Twenty-five KIDSCREEN questionnaires were incomplete. There was some overlap in the low quality diaries and incomplete KIDSCREEN questionnaires. In total, 64 questionnaires (9%) were excluded

from the analyses. Therefore the LPA was performed on a sample of 311 males and 356 females. Mean age for males was 16.13 years and mean age for females was 15.91 years. Participants are profiled in Table 1.

A 3-profile solution was chosen for the males and a 2-profile solution for the females, based on lower BIC values, a BLRT with $p < 0.05$, and the interpretability of the solutions. Figures 1a and 1b show the fit indices for one to six solutions. Results of an LPA include two sets of parameters: probabilities of latent profile membership and the within-profile parameters for indicator variables. Interpretation of the latent profiles is based on these indicator parameter estimates [69]. Table 2 provides the model-estimated, profile-specific item response probabilities for categorical indicator variables by gender. Table 3a provides the estimated mean weekly minutes and standard deviations of the continuous variables for all males, all females and for each gender-specific profile, while Table 3b presents this data as daily time (hours:minutes) to aid interpretation.

The three male profiles separated into two larger groups and one smaller group. Profile one, which we labelled the *productive* group, accounted for 40% of males. They were more likely to spend more time in Study (58%), some/more time in Paid Work (53%), some/more time in Housework (47%), and less time in Leisure (3hr:26min). We labelled profile two (14%) as the *high leisure* group who had a higher probability of spending no time in Study (61%), Paid Work (94%) or Housework (75%); below average time in Sleep (7hr:55min), Self-Care (1hr:12min), School (4hr:56min); and higher than average time in Leisure (7hr:17min). The third profile (46%), which we labelled as *all-rounder*, was characterised by near average time in Sleep (8hr:37min), Self-Care (1hr:38min), School (5hr:15min), and slightly above average Leisure (5hr:38min). This group was likely to spend some time in Study (53%) and some/more time in Housework (47%).

The two female profiles had broadly similar time-use in Self-Care, School, Paid Work and Voluntary/Religious activity. The profiles separated around Sleep, Study, Leisure, and to a lesser extent Housework. Profile one (74%) was characterised by marginally more time in Sleep (8hr:42min) and a greater likelihood of time in Housework (63%), considerably more chance of time in Study (85%) and less time in Leisure (3hr:44min), thus we labelled this group *higher study/lower leisure*. The second profile (26%), labelled *moderate study/higher leisure,* had less time in Sleep (7hr:44min), a moderate chance of spending time in Study (61%) and higher than average time in Leisure (5hr:22min). These profiles are presented in Table 4.

While taking into account the uncertainty in profile membership [77], we examined the relationship between latent profiles and HRQoL as a distal outcome using equality tests of probabilities across profiles (Table 5). Although three significant differences emerged across the male profiles, namely in the "financial resources" domain (p = .02), "social support and peers" domain (p = .02) and "school environment" domain (p = .04), these did not remain significant post Bonferroni-correction. For the females, there were three statistically significant differences in probabilities across classes, in "physical well-being" (p = .05), "autonomy" (p = .005), and global HRQoL (p = .02), with the latter two remaining significant post correction.

We then examined the likelihood of above average HRQoL across each of the profiles (Table 6). For the males, relative to the *all-rounder* group, those in the *high leisure* group had a higher chance of above average scores in "financial resources" (p = .05) while those in the *productive* group a higher chance of above average scores in "social support and peers" (p = .04). For the females, relative to the *moderate study/higher leisure profile*, the *higher study/lower leisure* group were significantly less likely to score above average in "physical well-being" (p = .05), "autonomy" (p = .01) and global HRQoL (p = .006) and more likely to score above average for "financial resources" (p = .03). Only the female global HRQoL score remained significant post Bonferroni-correction.

Discussion

We used a model-based, person-centred approach to examine adolescent 24-hour time-use and related the identified profiles to HRQoL. We successfully identified distinct male and female profiles based on the amount of time spent in eight categories of activity. We named the male profiles *productive* (40%), *high leisure* (14%) and *all-rounder* (46%) and the female profiles *higher study/lower leisure* (74%) and *moderate study/higher leisure* (26%) (Table 4).

The three male profiles identified through the LPA are similar to three of the six/seven classes identified by Shanahan and Flaherty [40] in their study of American adolescents. They found that the majority of their participants fell into the *active workers* or *active non-workers* clusters, with the latter similar in description to the *all-rounder* profile of the present study. A smaller *high leisure* cluster also emerged from Shanahan and Flaherty's [40] analysis, in which males were over-represented, in the two younger adolescent age cohorts at least. Ferrar et al. [22] questioned whether the commonalities they observed in adolescent time-use clusters, found despite substantial between-study

differences, may reflect globalisation across the developed world; characteristic adolescent behaviour patterns that exist independent of geography or culture; or may be an artefact of the instruments used that measure similar behaviours.

In their systematic review Ferrar et al. [22] found that, of the six studies that conducted gender-specific clustering, different cluster patterns amongst males and females were noted in five cases. Our findings are in keeping with this trend. While there were few dramatic differences between males and females (for example the very high proportion of males in 2/3 profiles not engaged in paid work), there was no profile clearly shared by the sexes. This result further evidences the gendered nature of adolescent time-use [5, 70] and the need for gender-specific interventions to support the health and well-being of young people [82, 83].

Few statistically significant associations between time-use profiles and HRQoL emerged. The equality tests of probabilities across profiles (Table 5) clearly convey the complex relationship between time-use profiles and HRQoL for this group of young people. No unifying trends emerged. To illustrate with one of many possible examples, those in the male *high leisure* group had the highest probability for below average scores in "physical well-being" (41%), "psychological well-being" (42%), "parent relations and home life" (47%), "social support and peers" (54%), "school environment" (48%), "social acceptance" (44%) but the highest probability of the highest scores in "autonomy" (35%), "financial resources" (42%). Females in the *moderate study/lower leisure* profile had significantly higher "autonomy" scores. Looking more closely at the likelihood of above average HRQoL across profiles (Table 6), females in the *moderate study/higher leisure* group were more than twice as likely to have the above average global HRQoL compared to the *higher study/lower leisure* profile, a highly significant difference. Although not statistically significant, across the three male profiles, those in the *all-rounder* group had the highest probability of above average global HRQoL. Our results point to the complexities of creating health in everyday patterns of doing [9]. We are inclined to interpret our findings with caution given the number of potential associations examined, the cross-sectional nature of the data and the challenge of endogeneity or residual confounding in research on adolescent development [84]. Nonetheless, those associations that were statistically significant provide some tentative support to the association, for females, between overall HRQoL and a more balanced lifestyle, defined by Matuska and Christianen [85, p. 11] as "a satisfying pattern of daily activity that is healthful, meaningful, and sustainable to an individual within the context of his or her current life

circumstances". Håkansson, Dahlin-Ivanoff, and Sonn [86] posited that well-being is the outcome of balance in everyday life with such balance derived from respecting one's own values, needs, and resources; employing strategies to manage everyday life; and having a harmonious repertoire of personally meaningful daily activities. Perhaps, as Zuzanek [87, p. 220] suggested, the "middle ground" does indeed present "the most rewarding and helpful way to a life of ease and pleasure".

We recognise several limitations in the present study. Due to the cross-sectional nature of these data, the causal relationship between profile membership and HRQoL is uncertain. A response rate of 52% was achieved with no subsequent weighting for non-response, introducing the possibility of non-response bias. However, relevant studies in this areas show little evidence of bias due to non-response [55]. We have no information about those who chose not to participate in this study. We examined the HRQoL of the 64 excluded questionnaires and found only one difference between the two groups across the 11 HRQoL domains that remained significant after adjustment for multiple testing ("school environment", $p = .003$). Accounting for all 24 hours of a day is believed to reduce the potential for social desirability bias and recall errors associated with self-report data [88].

As Patnode et al. [89] noted, a different method of categorizing time-use could have resulted in a somewhat different latent profile structure. As they reported "while dichotomizing variables is an approach that is commonly applied in latent class methods and may help in the communication and application of findings there may be some loss of sensitivity that results from categorizing the data in this way" (p. 465). Furthermore, the extent of prior aggregation of time-use indicator variables influences the resultant profiles. Although Ferrar et al.'s [22] review demonstrated that up to 18 cluster inputs had been used successfully, we encountered difficulties with model non-identification with 19 indicator variables. This potentially resulted in the lack of identification of some frequently observed time-use profiles, particularly those characterised by time spent in physical activity or screen time. Finally, an issue acknowledged in the methodological literature [90] but notably absent in empirical studies is the compositional nature of time-use data (i.e., the total time spent in activities across the day is constrained at 24-hours) [91]. While the use of log-ratio transformations [92] can be helpful, this is less so with time-use data given the preponderance of zeros. De Leeuw et al. [90] presented a latent

time-budget model but this was based on data gathered from random spot observations rather than diaries and does not appear to have been utilised greatly since its publication nearly 25 years ago.

Notwithstanding these limitations, the present study reflects contemporary perspectives in adolescent health policy and research that favour strengths-based and population health approaches in understanding the lives of young people and that prioritise their self-report of health and well-being [45, 93-95]. We successfully identified distinct profiles of adolescent time-use and found some differences in HRQoL across profiles. This study thus extended the literature in a number of ways. In line with current best practice [2, 96], we focused on the defined quinary age band of late adolescence (15 - 19 years). We adopted a person-centred rather than a variable-centred approach to analysing time-use. Finite mixture models, such as LPA, use statistical probability-based models to detect latent categorical subgroups [72]. Model selection in mixture models is therefore less subjective than with algorithmic approaches as both relative fit indices and statistical tests are provided to determine which model solution fits the data better [72]. Furthermore, when using person-centred analyses, it is important to remember that individuals are not statically assigned to profiles for once and for all. Rather, as Magnusson [97, p. 17] stated, "the boundaries of many clusters are fuzzy and permeable" and a person may move from one profile to another over time. With that in mind latent profile analysis was chosen as it retains the probabilistic feature of person-centred analysis more explicitly. This more accurately reflects the complex and ever-changing lifestyles of adolescents [98]. Data were collected on adolescents' overall time-use using diary data as recommended by the UNECE [11]. Finally we used the latest statistical methods to examine the relationship between 24-hour time-use and HRQoL [77].

Our findings provide further evidence of the complexity of relationships between time-use profiles and HRQoL in adolescence. This is not surprising as the evaluation of adolescents' time allocation is recognised as only "one small piece of a much more complex inquiry" [99, p. 163]. Furthermore, it has been said that youth development is "not readily reducible to variables" [41, p. 1014]. Our results point to the need for a mix of variable-centred, person-centred and qualitative research [31, 82, 100, 101], to create a more complete picture of the many systems that comprise the complex "disorderly world" [98, p. 317] of today's adolescents. In addition, the quantitative and qualitative differences in male and female profiles support the gendered nature of adolescent time-

use. Our data thus reinforce the need for health promotion and disease prevention strategies to be tailored differently for males and females [70, 82, 83]. Finally, adolescent health policies increasingly call for cross-sectoral and multi-modal interventions that address multiple risk and positive health behaviours [1, 3]. Altering overall behaviour patterns rather than behaviours in isolation may lead to greater intervention success [16, 29, 102-105]. Identifying different time-use patterns amongst adolescents, and their determinants and outcomes, may thus enable the development of tailored interventions [22, 39]. Adolescents need to be educated and supported to engage in a daily round of activities that enhance their health, meet their needs, and enable them to balance the demands of a 21st century lifestyle.

Conclusion

The health, well-being, and quality of life of the world's 1.2 billion adolescents are global priorities. A focus on their profiles of time-use and how these relate to HRQoL is necessary to enhance their well-being and address the increasing burden of non-communicable diseases. We used a model-based, person-centred approach to examine adolescent 24-hour time-use and related the identified profiles to HRQoL. We successfully identified distinct male and female profiles based on the amount of time spent in eight categories of activity. The quantitative and qualitative differences in male and female profiles support the gendered nature of adolescent time-use. No unifying trends emerged in the analysis of HRQoL domains across profiles, reinforcing the complex nature of HRQoL for this group of young people. Rich mixed-method research is required to illuminate our understanding of how quantities and qualities of time-use shape lifestyle patterns and how these can enhance the HRQoL of adolescents in the 21st century.

Ethical Standards

Ethical approval was granted by the University College Cork Research Ethics Committee of the Cork Teaching Hospitals. Therefore this study has been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. All participants provided written consent/assent.

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Table 1

Demographic Characteristics of Sample (N = 667)

		Male n (%)	Female n (%)
		311 (47)	356 (53)
Age (years)		16.13	15.91
School Year	Transition Year	119 (38)	169 (48)
	Fifth Year	192 (62)	187 (52)
School Location	City	63 (20)	110 (31)
	County	248 (80)	246 (69)
Family Context	Two Parents	273 (88)	309 (87)
	One Parent	32 (10)	38 (11)
	Guardian/Not completed	6 (2)	9 (2)
Social Class	Higher Social Class	179 (58)	166 (47)
	Middle Social Class	90 (29)	122 (34)
	Lower Social Class	22 (7)	43 (12)
	Unknown/Not completed	20 (6)	25 (7)
Nationality	Irish	293 (94)	329 (92)
	Other	18 (6)	27 (8)

Table 2

Model-Estimated, Profile-Specific Item Response Probabilities (%) for Categorical Indicator Variables by Gender (N = 667)

Activity Category	Time	Males (n=311)			Females (n=356)	
		Productive (40%)	High Leisure (14%)	All-Rounder (46%)	Higher Study /Lower Leisure (74%)	Moderate Study / Higher Leisure (26%)
Study	No time	15	61	13	15	39
	Some time	27	33	53	35	52
	More time	58	07	34	50	09
Paid Work	No time	47	94	96	69	76
	Some time	25	03	04	16	10
	More time	28	03	00	15	14
Housework	No time	53	75	53	37	46
	Some time	26	05	28	33	22
	More time	21	20	20	30	33
Voluntary & Religious Activity	No time	77	87	70	73	87
	Some time	12	10	17	11	04
	More time	11	04	14	16	09

Note. Probabilities may not equal 100% due to rounding. Activities categorised into zero/some/more time by splitting the non-zero time at the median.

Table 3a

Estimated Mean (Standard Deviation) Weekly Minutes for Continous Indicator Variables by Latent Profile by Gender (N = 667)

Activity Category	Males (n=311)				Females (n=356)		
	All Males	Productive (40%)	High Leisure (14%)	All-Rounder (46%)	All Females	Higher Study /Lower Leisure (74%)	Moderate Study / Higher Leisure (26%)
Sleep	3585 (475)	3636 (438)	3324 (605)	3618 (434)	3551 (493)	3656 (374)	3251 (641)
Self Care	668 (265)	702 (303)	505 (204)	688 (224)	789 (264)	795 (268)	772 (250)
School	2216 (293)	2278 (252)	2069 (551)	2206 (176)	2225 (289)	2198 (316)	2301 (168)
Leisure	2090 (775)	1440 (427)	3062 (866)	2364 (440)	1745 (670)	1566 (504)	2254 (805)

Note. Weekly time in activity categories calculated by multiplying weekday time by 5 and adding to weekend time-use totals that were multiplied by 2.

Table 3b

Estimated Mean Daily Time (Hours:Minutes) for Continous Indicator Variables by Latent Profile by Gender (N = 667)

Activity Category	Males (n=311)				Females (n=356)		
	All Males	Productive (40%)	High Leisure (14%)	All-Rounder (46%)	All Females	Higher Study /Lower Leisure (74%)	Moderate Study / Higher Leisure (26%)
Sleep	8:32	8:39	7:55	8:37	8:27	8:42	7:44
Self Care	1:35	1:40	1:12	1:38	1:53	1:54	1:50
School	5:17	5:25	4:56	5:15	5:18	5:14	5:29
Leisure	4:59	3:26	7:17	5:38	4:09	3:44	5:22

Table 4

Descriptions of Male and Female Time Use Profiles (N = 667)

Gender	Time Use Profile (%)	Description
Male (n=311)	Productive (40%)	More likely to spend more time in Study (58%), some/more time in Paid Work (53%), some/more time in Housework (47%), and less time in Leisure (3hr:26min).
	High Leisure (14%)	Higher probability of spending no time in Study (61%), Paid Work (94%) or Housework (75%); below average time in Sleep (7hr:55min), Self-Care (1hr:12min), School (4hr:56min); and higher than average time in Leisure (7hr:17min).
	All-Rounder (46%)	Near average time in Sleep (8hr:37min), Self-Care (1hr:38min), School (5hr:15min), and slightly above average Leisure (5hr:38min). Likely to spend some time in Study (53%) and some/more time in Housework (47%).
Female (n=356)	Higher Study / Lower Leisure (74%)	Marginally more time in Sleep (8hr:42min) and a greater likelihood of time in Housework (63%), considerably more chance of time in Study (85%) and less time in Leisure (3hr:44min),
	Moderate Study / Higher Leisure (26%)	Less time in Sleep (7hr:44min), a moderate chance of spending time in Study (61%) and higher than average time in Leisure (5hr:22min).

Table 5

Distribution of Conditional Probabilities (%) and Equality Tests of Probabilities Across Profiles for the KIDCREEN-52 and KIDSCREEN-10 by Gender (N = 667)

		Male (n=311)				Female (n=356)		
		Productive (40%)	High Leisure (14%)	All-Rounder (46%)	*p*	Higher Study/ Lower Leisure (74%)	Moderate Study/ Lower Leisure (26%)	*p*
KIDSCREEN-52 Domains	Physical Well-being				.56			.05
	Below Average	31	41	25		36	16	
	Average	49	35	49		45	48	
	Above Average	20	25	26		20	36	
	Psychological Well-being				.63			.08
	Below Average	32	42	26		37	20	
	Average	36	29	40		28	43	
	Above Average	32	29	34		35	37	
	Moods & Emotions				.65			.37
	Below Average	31	36	23		31	22	
	Average	45	38	45		48	45	
	Above Average	24	26	32		20	33	
	Self Perception				.98			.83
	Below Average	35	37	36		24	35	
	Average	45	38	43		46	40	
	Above Average	21	24	21		30	25	
	Autonomy				.09			.005*
	Below Average	42	31	18		34	16	
	Average	33	34	50		48	46	
	Above Average	25	35	32		18	39	
	Parent Relations & Home Life				.24			.55
	Below Average	30	47	28		35	38	
	Average	54	33	55		39	29	
	Above Average	15	20	18		26	33	
	Financial Resources				.02			.07
	Below Average	22	37	32		30	39	
	Average	39	21	45		33	47	
	Above Average	39	42	23		37	14	
	Social Support & Peers				.02			.37
	Below Average	26	54	22		37	32	
	Average	45	35	55		29	43	
	Above Average	29	10	29		34	25	
	School Environment				.04			.12
	Below Average	28	48	12		34	34	
	Average	51	34	55		42	27	
	Above Average	21	18	33		24	39	
	Social Acceptance				.68			.57
	Below Average	40	44	33		29	36	
	Average	23	29	32		21	29	
	Above Average	37	27	35		50	35	
KIDSCREEN-10 Index	Global HRQoL				.28			.02*
	Below Average	34	45	25		38	24	
	Average	39	38	40		44	37	
	Above Average	27	17	34		18	39	

Note. Probabilities may not equal 100% due to rounding. * Remains significant after adjusting for multiple testing.

Table 6

Item-Response Probabilities (%) for Above Average HRQoL and Tests of Equality of Probabilities Across the Profiles (N = 667)

		Male (n=311)					Female (n=356)		
		Productive (40%)	High Leisure (14%)	All-Rounder (46%) [reference]	Overall Level of Significance (*p*-value)	Individual Level of Significance *(p-value)*	Higher Study/ Lower Leisure (74%)	Moderate Study/ Higher Leisure (26%) [reference]	Overall Level of Significance (*p*-value)
KIDSCREEN-52 Domains	Physical Well-being	20	25	26	.79		20	36	.05
	Psychological Well-being	32	29	34	.90		35	37	.90
	Moods & Emotions	24	26	32	.53		20	33	.20
	Self Perception	21	25	21	.91		29	27	.84
	Autonomy	24	34	33	.59		18	40	.01
	Parent Relations & Home Life	15	21	18	.80		26	33	.45
	Financial Resources	39	43	23	.05	Productive vs. All-Rounder p = .03	37	14	.03
	Social Support & Peers	29	10	23	.04	Productive vs. High Leisure p = .01	34	24	.42
	School Environment	21	19	32	.19		24	39	.09
	Social Acceptance	27	27	35	.65		50	35	.32
KIDSCREEN-10 Index	Global HRQoL	27	17	34	.15		18	40	.006*

Note. * Remains significant after adjusting for multiple testing.

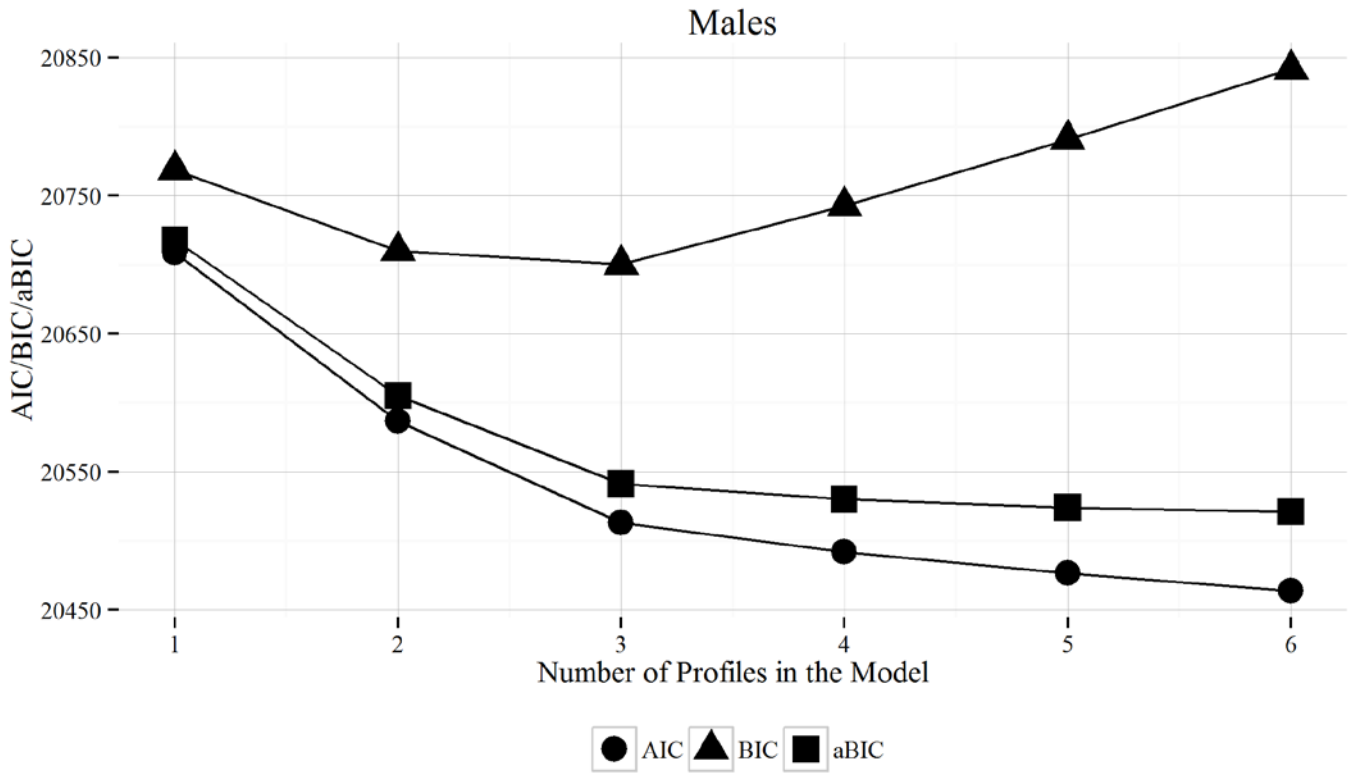

Figure 1a. Model fit indices for 1 to 6 profiles (Males)

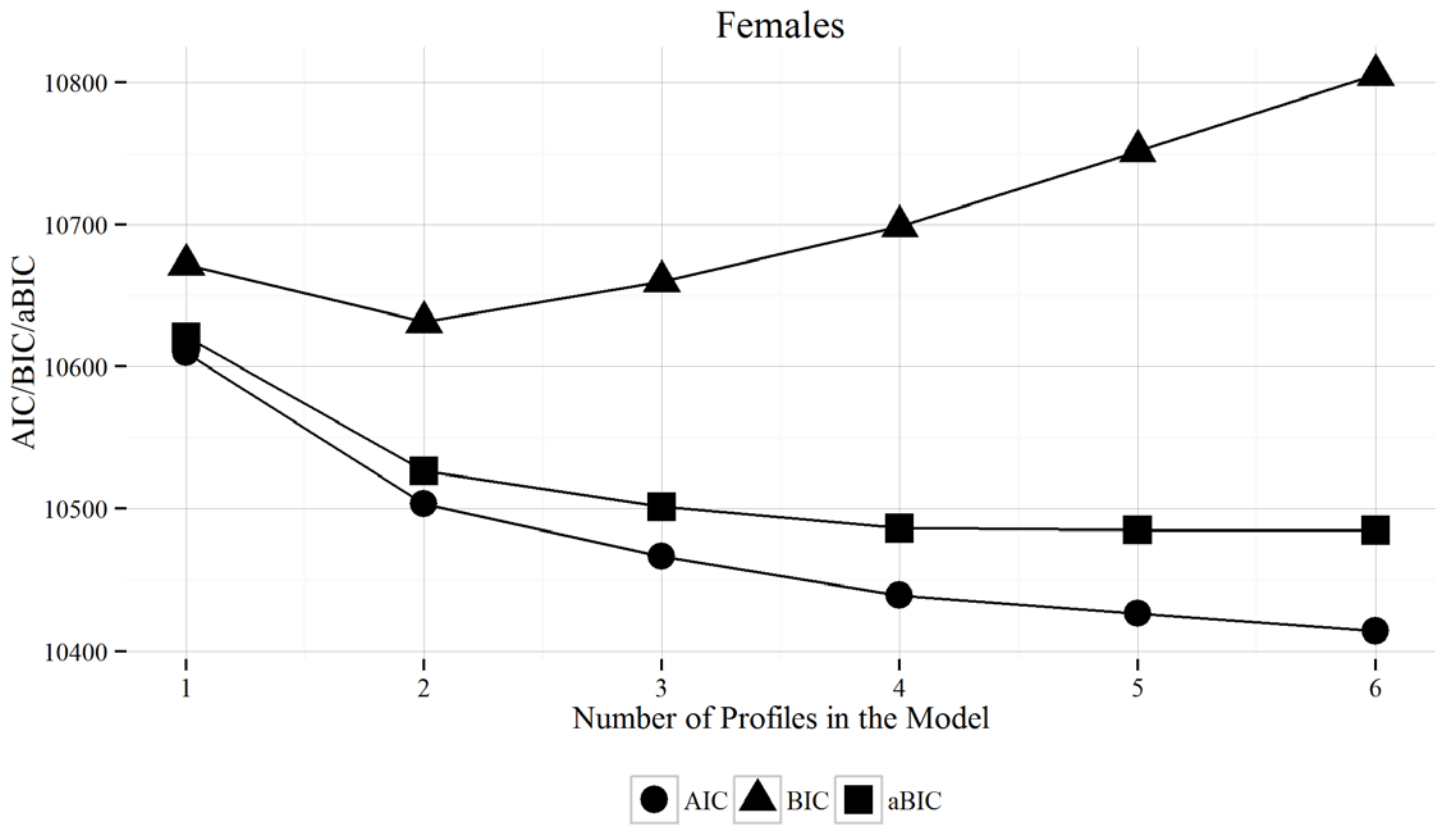

Figure 1b. Model fit indices for 1-6 profiles (Females)