

Special Issue Article

Individual, interpersonal and environmental correlates of sedentary behaviours in adults with intellectual disabilities

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Abstract

Background Sedentary behaviours have adverse health outcomes and adults with intellectual disabilities are at a higher risk of unhealthy lifestyle behaviours. The lack of knowledge relating to sedentary behaviours in adults with intellectual disabilities has impeded the development of effective interventions. This study aimed to investigate individual, interpersonal and environmental correlates that are associated with sedentary behaviours in adults with intellectual disabilities.

Method A secondary analysis of data from The UK Household Longitudinal Study (*Understanding Society*; collected 2011–2013) was conducted. Twenty-two predictor variables were included in a stepwise logistic regression, with TV hours during weekdays (≤ 3 and > 3 h/day) used as a proxy for sedentary behaviours. A sample of 266 adults, with mean age of 37.9 and range from 18 to 49 years old, with intellectual disabilities were identified. Because 63.9% were female, 62.4% had children and 28.2% were employed, the sample is likely to be most representative of more able adults with intellectual disabilities.

Results A significant interaction term between having children and neighbourhood status was found in the initial model so separate models for good and poor-quality neighbourhoods are reported. Having children only had a significant effect to lower the odds of high TV time among participants living in good quality neighbourhoods (OR 0.10, 95% CI 0.03, 0.25). However, for people living in poor quality neighbourhoods it was better quality leisure services that was associated with lower odds of high TV time (OR 0.48, 95% CI 0.23, 0.90). Being employed only significantly reduced the odds of high TV time in the good quality neighbourhood model (OR 0.35, 95% CI 0.12, 0.78). These effects highlight the importance of environmental effects on lifestyle behaviours of adults with intellectual disabilities.

Conclusions Future research should aim to expand our understanding of environmental effects on the sedentary behaviours and other lifestyle behaviours of adults with intellectual disabilities.

Keywords adults, correlates, intellectual disabilities, sedentary behaviours

Introduction

Sedentary behaviours are defined as any waking behaviour that expends energy of no more than 1.5 metabolic equivalents (METs), while in a sitting,

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reclining or lying position (Tremblay 2012; Tremblay *et al.* 2017). Proxy measures are often used to capture components of different sedentary behaviours. For example, TV or screen time is often used as a proxy measure of sedentary behaviours in large, population-based studies. Throughout this paper, the term sedentary behaviours is used to describe the broad construct (Tremblay 2012; Tremblay *et al.* 2017) and TV time is used when referring to the proxy measure of sedentary behaviours that was collected in the *Understanding Society* cohort study. Sedentary behaviour is a different construct from physical inactivity, which refers to low levels of physical activity (Leitzmann *et al.* 2018). An individual can therefore be both sedentary and physically active and these behaviours have independent impacts on health (Biswas *et al.* 2015).

Sedentary behaviours are an emerging major global health issue and research supports the link between sedentary behaviours and non-communicable diseases (NCDs; Hamburg *et al.* 2007; Wilmot *et al.* 2012; Schmid & Leitzmann 2014; Biswas *et al.* 2015) and mortality (Dunstan *et al.* 2010; Veerman *et al.* 2012; Chau *et al.* 2013; Diaz *et al.* 2017). Systematic reviews show associations between sedentary behaviours and an increased risk of diabetes and cardiovascular disease (Wilmot *et al.* 2012; Biswas *et al.* 2015). A meta-analysis of sedentary behaviours and cancer risk showed increased relative risks for colon, endometrial and lung cancer (Schmid & Leitzmann 2014). Sedentary behaviours were also found to be associated with increased all-cause mortality (Dunstan *et al.* 2010; Chau *et al.* 2013; Diaz *et al.* 2017) and reduced life expectancy (Veerman *et al.* 2012). Encouragingly, sedentary behaviours are modifiable; therefore, it is one of the key targets for reducing the burden of NCDs.

Sedentary behaviours are an area of high concern among adults with intellectual disabilities. A systematic review by Melville *et al.* (2017) reported that adults with intellectual disabilities spend approximately 522–643 min/day sedentary, which is more than adults without intellectual disabilities. This is concerning as being sedentary for more than 240 min a day is linked to an increased risk of mortality, putting adults with intellectual disabilities at high risk of the negative health outcomes associated with sedentary behaviour (Chau *et al.* 2015). Because

the prevalence of sedentary behaviours is higher in adults with intellectual disabilities than the general population, it is important to combat this with well-designed interventions.

According to the epidemiological framework (Sallis *et al.* 2000), identifying factors that influence the target behaviour, that is, sedentary behaviours, is one of the first phases in developing interventions. The goal is to identify high-risk groups and provide targets for interventions. Each phase of this framework is based on the previous phases. Therefore, the current lack of successful interventions to reduce sedentary behaviours in adults with intellectual disabilities emphasises that the limited existing knowledge relating to correlates of, and barriers to changing, sedentary behaviours is preventing effective interventions being designed (Melville *et al.* 2015). Therefore, it is essential to develop a knowledge base on factors related to sedentary behaviours in adults with intellectual disabilities that can inform evidence-based intervention development.

Investigating correlates within the socio-ecological model is beneficial for designing interventions as it puts individuals within an ecosystem that recognises personal behaviour also depends on the dynamic interactions with other determinants at interpersonal, environmental, social and political levels (O'Donoghue *et al.* 2016). A systematic review investigating correlates of sedentary behaviours categorised using the ecological model for adults with intellectual disabilities (Oppewal *et al.* 2018). Most factors in these studies were individual factors, with limited evidence on interpersonal and environmental factors. The results showed only a few, inconsistent intrapersonal correlates. Having epilepsy was associated with lower levels of sedentary behaviours. However, the results were inconsistent for the other correlates identified, for example, sex, weight status, physical and mental health, level of intellectual disabilities, and genetic syndromes. Data relating to intrapersonal and environmental correlates was sparse and therefore results were inconsistent. This results in the absence of confirmative findings regarding the influence of these wider ecological factors. In addition, it should not be assumed that the correlates of sedentary behaviours in adults without intellectual disabilities are the same as those without intellectual disabilities. In the general population, identified correlates of lower sedentary behaviours include

being in full-time employment, higher income/socioeconomic status, being physical activity and having children (O'Donoghue *et al.* 2016; Prince *et al.* 2017). However, as adults with intellectual disabilities often lead different lifestyles to the general population, for example, lower levels of employment, these correlates cannot be generalised (Ellenkamp *et al.* 2016). Therefore, there is a lack of conclusive evidence which prevents the design of evidence-informed interventions to reduce sedentary behaviours in adults with intellectual disabilities.

The evidence above suggests that, compared with adults in the general population, less is known about interpersonal and environmental correlates of sedentary behaviours in adults with intellectual disabilities. Improving our understanding of correlates of sedentary behaviours will inform the design of effective lifestyle behaviour interventions for adults with intellectual disabilities. This study aims to fill the knowledge gap by examining the individual, interpersonal and environmental correlates of sedentary behaviours in adults with intellectual disabilities. Specifically, the research question to be investigated is: which individual, interpersonal and environmental variables are associated with sedentary behaviours in adults with intellectual disabilities?

Methods

Design

This study was a secondary analysis of data from The UK Household Longitudinal Study (*Understanding Society; The UK Household Longitudinal Study*). This longitudinal study is an annual household panel survey covering a wide range of social, economic and behavioural factors of the UK population. The survey includes approximately 40 000 households. The information was collected from everyone in the household, which enables investigation into the interpersonal domain within the family.

The data were from wave 3, which was collected through interviews between 2011 and 2013. The total number of respondents at this wave was 25 008. Data were downloaded from the UK Data Archive (<http://www.dataarchive.ac.uk/>). The index screening for possible variables was done in four groups: individual variables, interpersonal variables, environmental variables and sedentary variables. Variables were

selected based on previous research and factors that require further investigation based on gaps in the existing literature (Melville *et al.* 2018).

Study population

Adults with intellectual disabilities were identified based on cognitive tests and educational attainment using methods developed in previous research (Emerson *et al.* 2014; Hatton *et al.* 2017). There were three cognitive tests done at wave 3: Number Series, Numerical Ability and Verbal Fluency (McFall 2013). The scores from these tests were standardised and extracted via principal component analysis to represent overall general intelligence. The inclusion criteria for intellectual disabilities were scoring lower than two standard deviations (SD) below the mean in the extracted component of cognitive results and reporting no educational attainment (Totsika *et al.* 2014). The total number of identified adults with intellectual disabilities in this study was 266 participants (accounting for 1.1% of the total sample).

Outcome variable

The number of hours of television (TV) watching per weekday was used as the proxy measure of sedentary behaviours in this study. The interview question include in *Understanding Society* was:

How many hours do you spend watching television on a normal weekday, that is, Monday to Friday?

The number of TV hours was transformed into binary format using a median split, resulting in low TV time (≤ 3 h per weekday) and high TV time (> 3 h per weekday). Low TV time was used as reference group in the logistic regression analysis. Throughout this paper, sedentary behaviour is used to describe the broad construct (Tremblay 2012; Tremblay *et al.* 2017) but TV time is used when referring to the proxy measure of sedentary behaviours from this study.

Predictor variables

All the relevant predictors were screened by the lead investigator (KC) and then excluded if the missing data in that variable was greater than 50%. The final decision of variables to include was made by discussion and consensus among authors.

Twenty-two variables related to individual,

interpersonal and environmental factors were included in this study, as described below. All scale variables were transformed into binary format using a median split. Categorical variables that had more than two categories were recoded into favourable or unfavourable value.

Individual variables

The five individual variables were age (18–40 years/41–49 years), sex (male/female), financial status (financially comfortable/not financially comfortable), frequency of internet use (less than everyday/everyday) and paid employment status (employed/unemployed), which did not distinguish between those who were and were not in the labour force.

Interpersonal variables

The six included interpersonal variables were living with at least one parent (yes/ no), living with sibling(s) (yes/ no), partner status (having a partner/ not having a partner), child status (having children/ no children), number of close friends (more than two/two or less), goes out socially (yes/no).

Environmental variables

There were 11 environmental variables included: number of screen devices in the household (more than seven/seven or less), belonging to a social website (yes/ no), urban or rural area (rural/urban), number of cars owned by household (more than one/one or none), perceived pollution in local area from traffic or industry (yes/ no), like the present neighbourhood (yes/ no), perceived neighbourhood quality (poor/ good), worry about being affected by crime (yes/ no), feel safe walking alone at night (yes/no), standard of public transport (poor to fair/ good to excellent), standard of local leisure services (poor/good).

Statistical analysis

All statistical data were analysed using SPSS 27 statistical package (SPSS IBM, New York, NY, USA) using complete case analysis. Descriptive statistics were used to describe characteristics of the participants. To investigate the relationships between TV time and predictor variables, logistic regression was conducted in two phases: a bivariate phase and a

multivariate phase. Purposeful selection of variables (Hosmer *et al.* 2013) was chosen as this approach has been shown to be effective at retaining significant risk factors and confounding variables (Bursac *et al.* 2008). In the exploratory bivariate analyses, all variables with $P < 0.25$ were considered to be potentially relevant to TV time and were taken forward to the phase 2 multivariate analysis (Hosmer *et al.* 2013).

For the multivariate logistic regression, variables were entered into the model using backward stepwise regression with statistical significance set at $P < 0.05$. The smaller model was compared with the larger model from the backwards stepwise regression by the change in parameter estimates (beta). If there was a change exceeding $\pm 20\%$, this indicated that one or more of the excluded variables were potentially significant and needed to be entered back to the model. The variables excluded from bivariate analyses were then added back into the model to check if they showed dependent contribution. Interactions among variables in the main effects model were assessed and any significant interaction terms were included in the preliminary final model. Included potential interactions were: child status*employment status, child status*local leisure service, child status*neighbourhood quality, employment status*local leisure service, employment status*neighbourhood quality and local leisure service*neighbourhood quality. The overall fit of the final model was checked with the Hosmer–Leshmeshow goodness of fit statistic, with a small test statistic and a large P value ($P > 0.10$) considered a good fit model. Information on missing data is presented in Table 1.

Results

Participant characteristics

Characteristics of the participants are reported in Table 1. The majority of participants were female, with children, not financially comfortable, unemployed, living in urban area and using internet less than every day. The mean (SD) of TV time in this study was 3.69 (2.73) hours per day. The mean age was 37.9 years old, range from 18 to 49 years old.

Table 1 Characteristics of participants with intellectual and analysis of factors associated with TV time

Variables	Number (n; Total n = 266)	n (%)	TV time		Odds ratio(95% CI)	P value
			≤3 h, n (%)	>3 h, n (%)		
Age	266					
18–40 years		139 (52.3)	74 (53.2%)	65 (46.8%)	REF	
41–49 years		127 (47.7)	70 (55.1%)	57 (44.9%)	0.927 (0.572, 1.503)	0.758
Missing	0					
Sex	266					
Male		96 (36.1)	45 (46.9%)	51 (53.1%)	Ref	
Female		170 (63.9)	99 (58.2%)	71 (41.8%)	0.633 (0.382, 1.047)	0.075
Missing	0					
Financial status	265					
Financially comfortable		90 (33.8)	90 (51.4%)	85 (48.6%)	REF	
Not financially comfortable		175 (65.8)	53 (58.9%)	37 (41.1%)	0.739 (0.442, 1.236)	0.249
Missing	1					
Employment status	266					
Unemployed		191 (71.8)	95 (49.7%)	96 (50.3%)	REF	
Employed		75 (28.2)	49 (65.3%)	26 (34.7%)	0.525 (0.302, 0.913)	0.023
Missing	0					
Frequency of internet use	266					
Everyday		67 (25.2)	34 (50.7%)	33 (49.3%)	REF	
Less than everyday		199 (74.8)	110 (55.3%)	89 (44.7%)	0.834 (0.479, 1.451)	0.520
Missing	0					
Interpersonal variables	Total n	n (%)				
Living with parent	266					
No		226 (85.0)	124 (54.9%)	102 (45.1%)	REF	
Yes		40 (15.0)	20 (50.0%)	20 (50.0%)	1.216 (0.620, 2.383)	0.569
Missing	0					
Living with sibling	266					
No		235 (88.3)	127 (54.0%)	108 (46.0%)	REF	
Yes		31 (11.7)	17 (54.8%)	14 (45.2%)	0.968 (0.456, 2.055)	0.933
Missing	0					
Number of close friends	254					
More than 2		101 (38.0)	61 (60.4%)	40 (39.6%)	REF	
Two or less		153 (57.5)	78 (51.0%)	75 (49.0%)	1.466 (0.881, 2.440)	0.141
Missing	12					
Goes out socially	266					
No		69 (25.9)	37 (53.6%)	32 (46.4%)	REF	
Yes		197 (74.1)	107 (54.3%)	90 (45.7%)	0.973 (0.561, 1.686)	0.921
Missing	0					
Partner status	266					
No partner		117 (44.0)	58 (49.6%)	59 (50.4%)	REF	
Having partner		149 (56.0)	86 (57.7%)	63 (42.3%)	0.720 (0.443, 1.172)	0.186
Missing	0					
Child status	266					
No children		100 (37.6)	39 (39.0%)	61 (61.0%)	REF	
Has children		166 (62.4)	105 (63.3%)	61 (36.7%)	0.371 (0.223, 0.619)	<0.001
Missing	0					
Environmental variables						
Belong to social website	266					
No		209 (78.6)	117 (56.0%)	92 (44.0%)	REF	
Yes		57 (21.4)	27 (47.4%)	30 (52.6%)	1.413 (0.785, 2.542)	0.249

Table 1. (Continued)

Variables	Number (n; Total n = 266)	n (%)	TV time		Odds ratio(95% CI)	P value
			≤3 h, n (%)	>3 h, n (%)		
Missing	0					
Urban or rural area	266					
Urban		235 (88.3)	129 (54.9%)	106 (45.1%)	REF	
Rural		31 (11.7)	15 (48.4%)	16 (51.6%)	1.298 (0.613, 2.748)	0.495
Missing	0					
Number of cars owed by household	265					
More than 1		28 (10.5)	19 (67.9%)	9 (32.1%)	REF	
One or none		237 (89.1)	124 (52.3%)	113 (47.7%)	1.924 (0.836, 4.425)	0.421
Missing	1					
Pollution	265					
No		232 (87.2)	124 (53.4%)	108 (46.6%)	REF	
Yes		33 (12.4)	19 (57.6%)	14 (42.4%)	0.846 (0.405, 1.768)	0.656
Missing	1					
Like the present neighbourhood	265					
No		25 (9.4)	9 (36.0%)	16 (64.0%)	REF	
Yes		240 (90.2)	134 (55.8%)	106 (44.2%)	0.445 (0.189, 1.047)	0.064
Missing	1					
Neighbourhood quality	255					
Good		111 (41.7)	70 (63.1%)	41 (36.9%)	REF	
Poor		144 (54.1)	68 (47.2%)	76 (52.8%)	1.908 (1.151, 3.164)	0.012
Missing	11					
Worry about being affected by crime	265					
No		184 (69.2)	103 (56.0%)	81 (44.0%)	REF	
Yes		81 (30.5)	41 (50.6%)	40 (49.4%)	1.241 (0.735, 2.095)	0.420
Missing	1					
Feel safe walking alone at night	266					
No		109 (41.0)	58 (53.2%)	51 (46.8%)	REF	
Yes		157 (59.0)	86 (54.8%)	71 (45.2%)	0.939 (0.575, 1.533)	0.801
Missing	0					
Standard of public transport	264					
Good to excellent		163 (61.3)	97 (59.5%)	66 (40.5%)	REF	
Poor to fair		101 (38.0)	45 (44.6%)	56 (55.4%)	1.829 (1.107, 3.021)	0.018
Missing	2					
Standard of local leisure services	244					
Good		138 (51.9)	88 (63.8%)	50 (36.2%)	REF	
Poor		106 (39.8)	46 (43.4%)	60 (56.6%)	2.296 (1.368, 3.852)	0.002
Missing	22					
Number of screen devices in the household	266					
More than seven		71 (26.7)	41 (57.7%)	30 (42.3%)	REF	
Seven or less		195 (73.3)	103 (52.8%)	92 (47.2%)	1.221 (0.705, 2.113)	0.476
Missing	0					

REF, reference category; CI, confidence interval.

Bivariate relationships with TV time

Out of 22 variables, 11 bivariate associations between individual, interpersonal and environmental variables and TV time were statistically significant at $P < 0.25$ (Table 1) and so were taken forward to the multivariate analysis- sex, partner status, child status, financial status, employment status, like the present neighbourhood, number of close friends, belonging to a social website, neighbourhood quality, standard of public transport and quality of local leisure services.

Final multivariate model

Of the 11 variables with a P value of <0.25 carried forward from the bivariate analyses, only four retained statistical significance ($P < 0.05$): child status, employment status, neighbourhood quality and standard of local leisure services. The percentage change in the parameter estimates between the smaller and larger models was not greater than 20%, indicating no missing significant contributing variables.

One interaction term, child status*neighbourhood quality, was significant (OR 4.408 95% CI 2.001, 9.711; $P < 0.01$). Table 2 provides the raw numbers and percentages, to illustrate the direction of the interaction between child status and neighbourhood quality. This shows that the interaction term is driven by individuals with children, who live in good quality neighbourhoods, and have a lower risk of being in the high sedentary behaviour group.

Because the interaction term between having children and neighbourhood quality is significant, separate models are provided for good- and poor-quality neighbourhood status in Tables 3 and 4, respectively. In these models, low TV time is used as the reference category, so the odds ratios provided represent the odds of being in the high TV time group- with an odds ratio less than one representing a

Table 3 Final logistic regression model for high TV time for adults with intellectual disabilities living in good quality neighbourhood

Variables	B	Odds ratio		P value
		SE	(95% CI)	
Children status				
No children	REF	REF	REF	REF
Has children	-2.40	0.52	0.10 (0.03, 0.25)	<0.001
Employment status				
Unemployed	REF	REF	REF	REF
Employed	1.04	0.54	0.35 (0.12, 0.7)	0.050
Standard of local leisure services				
Poor	REF	REF	REF	REF
Good	-0.65	0.50	0.52 (0.20, 1.37)	0.187

Nagelkerke's $R^2 = 0.356$; Hosmer-Lemeshow goodness of fit statistic $P = 0.33$.

REF, reference category; SE, standard error; CI, confidence interval.

lower odds of being in the high TV time. Table 3 shows that for individuals living in good quality neighbourhoods, individuals with children (OR 0.10, 95% CI 0.03, 0.25) and in employment (OR 0.35, 95% CI 0.12, 0.7) are at a lower odds of being in the high TV time. However, the standard of local leisure services is no longer significant in the good-quality neighbourhood model. This contrasts with the poor-quality neighbourhood model (Table 4), where individuals reporting a better standard of local leisure service have a lower odds of being in the high TV time (OR 0.48, 95% CI 0.23, 0.99). Given the small sample sizes for the results reported in Table 2, these results need to be interpreted with caution. However, the potential implications of these results will be interpreted further in the discussion because this is one of the first studies to examine individual, interpersonal and environmental variables associated with sedentary behaviours of adults with intellectual disabilities.

Table 2 Modification of the effect of having children on sedentary behaviour by neighbourhood quality

	Has children		No children	
	Low/high TV time (N)	High TV hours (%)	Low/high TV hours (N)	High TV hours (%)
Poor neighbourhood quality	47/45	49%	21/31	59%
Good neighbourhood quality	55/13	19%	15/28	65%

Table 4 Final logistic regression model for high TV time for adults with intellectual disabilities living in poor quality neighbourhood

Variables	B	SE	Odds Ratio (95% CI)	P value
Children status				
No children	REF	REF	REF	REF
Has children	-2.65	0.39	0.77 (0.36, 1.63)	0.491
Employment status				
Unemployed	REF	REF	REF	REF
Employed	0.68	0.43	1.96 (0.85, 4.55)	0.115
Standard of local leisure services				
Poor	REF	REF	REF	REF
Good	-0.74	0.37	0.48 (0.23, 0.99)	0.047

Nagelkerke's $R^2 = 0.081$; Hosmer–Lemeshow goodness of fit statistic $P = 0.98$.

REF, reference category; SE, standard error; CI, confidence interval.

Discussion

Principal findings

This is the first study to investigate the relationship between sedentary behaviours and individual, interpersonal and environmental variables, based on the socio-ecological model, in a population-based sample of adults with intellectual disabilities. The interaction between child status and perceived neighbourhood quality was statistically significant and examining separate models for good and poor-quality neighbourhoods highlighted some important findings relevant to an ecological model of sedentary behaviours.

Comparisons with previous studies

For time spent watching TV, the data in this study has a median value of 3 h per day, which is similar to the 21.8 h per week of TV time reported in a sample living in French institutions (Mikulovic *et al.* 2014). However, in a UK population-based community sample, Melville *et al.* (2018) reported median total screen time (TV, DVDs, videos and computers) of 4–5 h per day. These differences are probably caused by the different measures used for sedentary behaviours, that is, TV time versus total screen time. Because the widespread availability of laptops, tablets and other digital media has diversified opportunities

to spend sedentary time looking at screens beyond just TV, it is important that future studies should include questions that capture total screen time.

In the bivariate analysis of interpersonal and environmental correlates age was found to have no association with TV time, consistent with a previous systematic review (Oppewal *et al.* 2018). Sex was not significantly associated with TV time in bivariate analysis. Two studies reported men were more sedentary than women (Hsieh *et al.* 2017; Melville *et al.* 2018), one reported women were more sedentary than men (Finlayson *et al.* 2011), while two more studies reported no significant difference in sedentary behaviour between men and women with intellectual disabilities (Nordstrøm *et al.* 2013; Oviedo *et al.* 2017). This inconsistency could be attributed to different methods used to measure sedentary behaviour, as subjective (Hsieh *et al.* 2017; Melville *et al.* 2018) and objective (Finlayson *et al.* 2011; Nordstrøm *et al.* 2013; Oviedo *et al.* 2017) methods have been used. The inconsistency in sex differences relating to sedentary behaviour levels was also reported in a recent systematic review in adults with intellectual disabilities (Westrop *et al.* 2019) and the inconsistencies are not specific to people with intellectual disabilities, it has also been reported for the general population (O'Donoghue *et al.* 2016).

In the final model, there was a significant interaction between child status and neighbourhood quality. When separate models for good- and poor-quality neighbourhoods were examined, having children and being employed were retained as significantly reducing the odds of being in the high TV time group for people living in good-quality neighbourhoods. However, in the poor-quality neighbourhood model, only having better standard local leisure services was significantly associated with a reduced odds of being in the high TV time group. No previous studies have examined the effect of having children on the sedentary behaviours of adults with intellectual disabilities. However, our finding is similar to studies reporting that adults with children, who do not have intellectual disabilities, engage in less sedentary behaviours (O'Donoghue *et al.* 2016; Müller *et al.* 2020). What is most interesting in the results reported in the present study is that this association is only observed among individuals living in good quality neighbourhoods. This suggests that the effect on sedentary behaviours in people with

children is likely to be dependent on there being places for people with intellectual disabilities with children to visit in their local neighbourhood, such as parks and accessible indoor spaces. In contrast, it seems individuals with children who live in a poor-quality neighbourhood are only able to replace sedentary behaviours with more active behaviours if there are better quality local leisure services available. It could be that people with children want to be more active with their children but do not feel safe in poor quality neighbourhoods so visit local leisure services instead.

The effects of neighbourhood quality and the standard of local leisure services on TV time reported here could be simply explained through behavioural economics theory (Biddle 2011) as better experiences outside the home are associated with more reward for the individual. Therefore, having good quality neighbourhoods and local leisure services motivates people to use these facilities and hence spend less time engaged in sedentary behaviours. These findings need to be replicated in bigger samples but highlight the relevance of neighbourhood and built environment effects on the sedentary behaviours of adults with intellectual disabilities. This is particularly important because previous research has suggested that the participation of adults with intellectual disabilities in physical activity is very likely to be impeded by accessibility barriers in the local environment (Bodde & Seo 2009; Bossink *et al.* 2017). Research on the importance of environmental variables to sedentary behaviours and physical activity patterns of older adults is well established but there is almost no previous research exploring this in the lives of adults with intellectual disabilities. Our findings suggests that researchers should look beyond individual variables when trying to understand the correlates and determinants of sedentary behaviours of adults with intellectual disabilities (Oppewal *et al.* 2018).

Our finding that being employed lowered the odds of being in the high TV hours group is consistent with one previous study that investigated interpersonal and environmental correlates (Hsieh *et al.* 2017). What is unique to our study is that this effect was only reported in individuals living in good quality neighbourhoods. Again, this finding needs to be replicated in a larger-scale study but understanding this effect may inform policies and interventions to

improve the employment levels and health of adults with intellectual disabilities. A recent systematic review of systematic reviews on secondary health conditions and employment in people with intellectual disabilities (Iwanaga *et al.* 2021) found three systematic reviews on employment and health (Jahoda *et al.* 2008; Dean *et al.* 2018; Robertson *et al.* 2019). These studies all concluded that employment has a positive association with quality of life and better health, but none reported specifically on employment and sedentary behaviours. Therefore, we believe that future research on the links between employment status and health of adults with intellectual disabilities should explore the impact of environmental variables, such as neighbourhood quality.

Strengths and limitations

This study is the first that aims to fill the gap of knowledge on individual, interpersonal and environmental influences on sedentary behaviour in adults with intellectual disabilities. This study used a population-based sample of adults with intellectual disabilities, which could include more participants from hard-to-reach groups than the convenience sampling (Emerson 2011).

This study's limitations are consistent with those in previous research involving adults with intellectual disabilities and the Understanding Society survey (Emerson *et al.* 2014, 2016; Hatton *et al.* 2017). The identification of intellectual disabilities was based on tests of cognitive ability combined with indirect evidence based on an assumption that the lack of educational attainment implies early in life impairments. Adults with severe/profound intellectual disabilities may be excluded due to residency in institutional settings, outside the sampling framework of general households. Moreover, in the interview process, they could be further excluded due to the inability to give informed consent. Furthermore, compared with most population-based samples of adults with intellectual disabilities, the study sample reported here included a significantly higher number of women than men, a higher proportion of adults with children and a higher proportion of people in employment. Therefore, we believe the study sample is most likely to be representative of more able adults with intellectual disabilities. The lack of

representativeness of the sample constrains the generalisability of results. In addition, because the same interview questions were used for all respondents in Understanding Society, and there were no adjustments made for individuals with cognitive and communication difficulties, the participants with intellectual disabilities may have experienced difficulties understanding some of the interview questions.

The final sample size of individuals with intellectual disabilities in the *Understanding Society* cohort is smaller than we expected ($n = 266$). As a consequence, there is a risk that including 22 variables in the multivariate analyses threatens the validity of the findings, particularly with the addition of several interaction terms into the model. Therefore, the findings presented here should be interpreted with caution and require replication. More broadly, this issue flags up the need for ways to be found to improve the data relevant to the lives of disabled people in population cohorts to examine the complex contributions that neighbourhood and environmental factors can have on health (Abualghaib *et al.* 2019).

Finally, studies in both people with intellectual disabilities and without intellectual disabilities have found that different sub-domains of sedentary behaviours showed different associated influencers (Chastin *et al.* 2015; Oppewal *et al.* 2018). This study focussed on TV time in weekdays as a proxy for sedentary behaviours; therefore, the reported associations may not be fully generalisable to sedentary behaviours.

Implications for future research

Unlike physical activity, there is no consensus on the maximum amount of time per day or week that a person should spend engaged in sedentary behaviours. As a result, previous studies have used different cut points to define low/high sedentary behaviour time, which limits comparability. The gathering of more background pathophysiology and synthesis of standard cut points are required. Additionally, the neighbourhood quality and local leisure service variables used in this study included many facets of facilities (malls, parks, museums, gyms etc.). The reported link with sedentary behaviours cannot be attributed to one type of

facility and therefore future studies should investigate which aspects of the neighbourhood and local services are most associated with reduced sedentary behaviours to help inform intervention development.

Conclusion

This study investigated individual, interpersonal and environmental variables that are associated with sedentary behaviours in adults with intellectual disabilities. The interaction term between child status and neighbourhood quality highlighted the potential complexity of ecological models of sedentary behaviours. However, we have shown the importance and relevance of environmental variables to modelling lifestyle behaviours, which we hope future researchers will build upon to inform the design of future interventions to reduce the sedentary behaviours of adults with intellectual disabilities.

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Conflict of interest

The authors declare no conflicts of interest.

Ethics statement

The Medical, Veterinary & Life Sciences College Ethics Committee waived the need for ethics approval and the need to obtain consent for the collection, analysis and publication of the retrospectively obtained and non-identifiable data for this non-interventional study.

Data availability statement

The data that support the findings of this study are available from <https://beta.ukdataservice.ac.uk/datacatalogue/series/series?id=2000053>. Restrictions apply to the availability of these data, which were used

under license for this study. Data are available from the authors KC with the permission of <https://www.understandingsociety.ac.uk>.

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