A comparison of the prevalence of health problems among adults with and without intellectual disability: a total administrative population study

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Abstract

Introduction: There is considerable international research indicating health disparities between people with and without intellectual disabilities. It is important that comparative studies use representative population samples. This study compares a total administrative population of adults with intellectual disability to a random stratified general population sample in Jersey.

Methods: A total administrative population of 217 adults with intellectual disability and a random stratified sample of 2,350 adults without intellectual disability participated. A questionnaire using the International Classification of Diseases (ICD-10) Chapter Headings was administered to all participants to enable a like-for-like comparison across both populations.

Findings: Unadjusted comparisons identified that adults with intellectual disability have a greater prevalence of health problems. However, they were less likely to experience cancers and musculoskeletal diseases. The only significant impact of adjusting for between-group differences in age and gender was that a difference in genitourinary disorders became non-significant.

Conclusions: These findings are consistent with the hypothesis that adults with intellectual disabilities generally have greater prevalence rates of health problems than the general population.

Introduction

It is well documented that in high-income countries people with intellectual disability have poorer health than the general population (Emerson, Hatton, Baines & Robertson, 2016; Heslop & Glover, 2015), with people dying on average 20 years earlier than their non-disabled peers (O'Leary, Cooper, & Hughes-McCormack, 2018; Glover, Williams, Heslop, Oyinlola, & Grey, 2017; Heslop et al. 2014; Learning Disability Mortality Review, 2018; Troller, Srasuebkul, Xu, & Howlett, 2017; Lauer & McCallion, 2015; McCarron, Carroll, Kelly, & McCallion, 2015).

There is substantial variation in the prevalence rates of major health problems for people with intellectual disabilities reported across different studies and how they compare to people without intellectual disabilities. For example, studies that have investigated cancer (Bonell, 2010; Tyler & McGrother, 2009; Patja, Molsa Livanainen, 2001; Duff et al. 2001; Cooke 1997) diabetes (Mac Rae et al. 2015; de Winter et al. 2012; Tyler et al. 2010; McDermott, Platt, & Dasari, 2006) and mental health problems (Hughes-McCormack et al. 2017; Buckles, Luckasson, & Keefe, 2013) have reported varying prevalence rates in people with intellectual disabilities. A range of potential methodological reasons for this principally focus on the inconsistent definition of intellectual disabilities; the diverse diagnosis tools, and small sample sizes used in studies. Although there is a growing body of research that uses representative samples of people with and without intellectual disabilities (Balogh, Brownell, Ouellette-Kuntz, & Colantonio, 2010; Hosking et al., 2016; Hughes-McCormack et al. 2018; Morin, Mérineau-Côté, Ouellette-Kuntz, Tassé, & Kerr, 2012), this continues to be one of the most important methodological limitations in intellectual disability research more broadly (Emerson & Hatton, 2014; Hogg, & Tuffrey-Wijne, 2008; Hughes-McCormack et al., 2017).

Acknowledging such methodological limitations, the aim of this brief report was to build upon and integrate existing literature to estimate the current prevalence of health problems using ICD-10 classification headings in a total administrative population of adults with intellectual disabilities and a comparison random stratified general population sample in Jersey. The same variables were used to facilitate comparison across people with and without intellectual disabilities.

Method

Measures

A survey was developed based on ICD-10 (2015) English online version (https://icd.who.int/browse10/2015/en) chapter headings I to XV: viral or infective diseases; cancers, diseases of the blood; endocrine, nutritional or metabolic conditions; mental health illnesses or behavioural problems; neurological conditions; diseases of the eye; diseases of the ear; diseases of the circulatory system; diseases of the respiratory system; diseases of the digestive system; diseases of the skin; diseases of the musculoskeletal system; diseases of the genitourinary system; malformations or genetic problems; and injuries to your body as a result of trauma or poisoning. For the purpose of this paper, classification headings only were used to enable direct comparisons between groups in both populations. A dichotomous variable was created (yes/no) asking participants if they had diseases or disorders of the classification headings from these chapters. In each classification heading we provided examples of the most common diseases that were representative of that group. We included an open question for participants to record any other disease or disorders that they have not mentioned in the survey. For the intellectual disability sample, all electronic health and nursing notes held on Care Partner (an electronic health and social care database) by Jersey's Health and Community Services were reviewed. Demographic variables were collected on both surveys that mirrored the Jersey Opinions and Lifestyle Survey (States of Jersey, 2017). This data is reflective of the local population.

Ethics

Ethical approval was granted from Lancaster University and by the Government of Jersey, Health and Community Services Ethics Committee in January and March 2017. The consent process and accompanying documentation was designed using guidance from the Mental Capacity Act (2005) and the National Research Ethics Service (NRES) (http://www.nres.nhs.uk/). Full details of the consenting procedure for adults with an intellectual disability are outlined previous studies following the same methodology (x and y study - blinded for review).

Intellectual disability population

A total administrative sample of adults with intellectual disability known to services in Jersey were contacted to participate (i.e. people who were receiving, or had received, support from intellectual disability services in Jersey). 217 adults with intellectual disabilities participated (age range 18-85 [male n=122, female n=95]), a response rate of 76% (sampling frame n=285). Approximately 50% of participants were administratively defined by Jersey's Health and Community Services as having a mild intellectual disability (n =108), 25.8% (n = 56) as having a moderate intellectual disability, 15.7% as having a severe intellectual disability (n=34) and 8.8% (n=19) as having a profound intellectual disability.

All information was collected by face-to-face interviews with the participants themselves or through proxy respondents. In this regard, 132 (60.8%) adults were consented though proxy procedures and they answered on behalf of the person with an intellectual disability, whilst 85 (39.2%) participants consented and answered independently. All health records held on Care Partner were checked to corroborate findings. To receive a health and social service in Jersey individuals with an intellectual disability have a yearly assessment and they have a current care plan that includes a health assessment; therefore, this served as robust measure to identify the prevalence of disease in this population. However, in a pragmatic manner, where it was self-reported by the person or a proxy had a disease but there was no evidence to support this on Care Partner, their community nurse was requested to confirm. In this instance, if the finding was not corroborated it was excluded for our analysis.

General population

A random stratified sample approach was used to recruit general population adults. Jersey's 12 parishes were divided into strata. Each parish was weighted in terms of population considering the most recent population census and allowing for net inward migration (States of Jersey, 2011). Addresses were drawn at random from the list of residential, active addresses for each parish on the Jersey Land Property Index excluding any household which was sampled for one of the previous 2015,

2016, 2017 social surveys or the Disability Survey in 2015 - there were 28,000 households in the overall sampling frame. Eight thousand surveys were posted to cover the entire adult population at random. This was based on the initial estimation of having a +/-2 percentage point confidence interval and assuming a 30% response rate. The household member who next celebrated their birthday, and who was aged 18 years or over, was asked to complete the survey. A total of 2,415 (30.2% [age range 18 – 105, male n-941, female n-1,394]) surveys were returned with 65 of the these being unusable*.* In total, 2,350 general population responses were included in the analysis.

Analysis

Initially, descriptive statistics and the frequency of ICD-10 disease presentation in the two populations were examined. To investigate the scale of any differences in disease prevalence between the intellectual disability and general population, Odds Ratios with 95% confidence intervals were calculated. Secondly, binary logistic regression analysis was undertaken to estimate the strength of any differences in disease prevalence between the intellectual disability and general population groups (odds ratios), once gender (binary variable) and age (split at the median [over and under 57 years]) were taken into account. Thirdly, an interaction term was fitted to determine if the effects of age and or gender differed across the intellectual disability and general populations. Finally, we matched 206 participants according to age and gender to determine if there was a difference in the frequency of health problems in both populations. This matching procedure was undertaken in SPSS using the case matching procedure.

There were no missing data in the intellectual disability dataset and less than 3% (range 2%-2.7%) across the general population dataset. The pregnancy complications variable was excluded from analysis as no person with an intellectual disability was pregnant during the study. Data were analysed using SPSS 25 and graphs were produced in ‘R’. Effect sizes for Odds Ratios for 2x2 comparisons are interpreted as; small (OR < =0.82 or > =1.22), medium (OR < =0.54 or > =1.86), large (OR < =0.33 or > =3.00) [Olivier & Bell, 2013].

Results

Bivariate comparisons of health problems

The first stage of analysis involved simple bivariate comparisons between participants with and without intellectual disability with regard to the ICD-10 Chapter Headings. Odds Ratios were calculated and associated 95% confidence intervals with significance levels.

********* Table 1 about here **********

In summary, our main results suggest participants with intellectual disability were more likely than the general population to have: viral or infective diseases; mental health illnesses and behavioural problems; neurological disorders; diseases of the genitourinary system and malformations or genetic problems. In contrast, participants with intellectual disability were statistically less likely than the general population to have cancers and diseases of the musculoskeletal system, representing a medium and small effect size respectively. It was not possible to distinguish between mental health and behavioural disorders due to the lack of comparative data. Nevertheless, 33.6% of the intellectual disability sample have had a mental health diagnosis at some stage in their life.

See the Figure 1 Forest Plot (malformations or genetic problems are excluded from the Forest Plot as the OR of 47.14 is extreme) for a representation of these differences.

+++ Insert Figure 1 Here +++

Binary logistic regression results

+++ Insert Table 2 Here +++

After adjusting for age, gender and presence of intellectual disability our principle results suggest that females are more likely to have cancers and circulatory disorders but less likely to have endocrine, nutritional and metabolic disorders mental Illness and behavioural disorders or neurological disorder. Females with an intellectual disability without were significantly more likely to have mental illness and behavioural disorders but less likely to have diseases of the ear than females without an intellectual disability. Furthermore, increasing age increased the chances of having cancer; endocrine and metabolic disorders; neurological disorders; disorders of the eye; disorders or he ear; disorders of the circulatory system; disorders of the respiratory system; diseases of the digestive system and musculoskeletal disorders. In contrast, younger age increased the chances of having mental illnesses and behavioural disorders and disorders of the skin. Further statistically significant results are outlined in Table 2.

Matched sample comparison results

In the final stage of analysis, case control matching was used to compare the general and intellectual disability sample according to age and gender in an attempt to further minimise confounding and improve precision (Rothman, Greenland, &

Lash, 2008). A total of 206 individuals were matched on a like-for-like basis. It can be concluded that people with intellectual disabilities (n=206) had a greater number of health problems, median (IQR) 3 (2,6) than the general population (n=206), median (IQR) 1 (0,2) and the difference in these distributions is significant (U = 32836, p < .001) (Figure 2).

+++ Insert Figure 2 Here +++

We also compared age bands (less than 35 years, 35-55 years and over 55 years) across the two populations and used the cumulative number of ICD-10 conditions as the dependent outcome variable. Across all three age band categories, people with intellectual disabilities had a greater prevalence of ICD-10 conditions and these were statistically significant: less than 35 years (U = 3048, p < .001); 35-55 years (U = 5182, p < .001); over 55 years (U = 3027, p < .001) (Figure 3).

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Discussion

Consistent with the results of previous epidemiological research our results indicate that in unadjusted comparisons, adults with intellectual disabilities have considerably greater prevalence rates of viral or infective diseases; diseases of the blood; endocrine, nutritional and metabolic conditions; mental health illnesses and behavioural disorders; neurological disorders; diseases of the eye; diseases of the respiratory system; diseases of the digestive system; diseases of the skin; diseases of the genitourinary system and malformations or generic problems (Heslop et al. 2014; Bonell, 2010; Robertson et al. 2015; Straetmans *et al.* 2007; Hughes-McCormack et al. 2017; Timmeren et al. 2017; Henderson et al. 2009; Janicki &

Dalton, 1998). Nevertheless, adults with intellectual disability were less likely to have cancers and diseases of the musculoskeletal system. No difference was observed between prevalence rates for diseases of the ear, diseases of the circulatory system or injuries to the body as a result of trauma or poisoning.

These results are consistent with previous research and are reflective of the health inequalities that adults with intellectual disabilities experience (Emerson & Baines, 2011; Emerson & Hatton, 2014; Krahn & Fox, 2014). Only diseases of the genitourinary system became non-significant after accounting for age and sex. Further adjusted comparisons identified a different topography of prevalence with regard to gender with cancers and circulatory disorders being more prevalent in females. In contrast, endocrine, nutritional and metabolic disorders, mental illness and behavioural disorders and neurological disorders were more prevalent in males. Our analysis only found two significant associations in the interaction component insofar as females with an intellectual disability were more likely to have mental illnesses and behavioural disorders but less likely to have diseases of the ear than their non-disabled peers. The age adjustment finding is not unique and suggests that older age increased the chances of having certain diseases. Notwithstanding, the age interaction effect between the general population and intellectual disability population identified that increasing age in the intellectual disability population increases the incidence of disorders of the eye, whereas reduced age in the general population identifies a lower prevalence of viral and infective diseases, mental illnesses and behavioural disorders and disorders of the skin. The matched sample analysis also highlights that people with an intellectual disability experience greater levels of ill health at a younger age and this trajectory continues throughout their life.

These results consolidate and extend existing knowledge about the health inequalities faced by people with intellectual disability in a number of ways. First, the use of a total administrative population in the intellectual disability sample is a strength of this study. Having access to participants' health records ensure accuracy of health data. Similarly, the random stratified sample that covered the whole residential address population of Jersey ensured a representative general population comparison sample of considerable numbers, although we were unable to check

health data on the health system database due to large numbers of respondents and lack of consent.

Second, this study supports other evidence that cancer is less prevalent in the intellectual disability population (Cooke, 1997, Bonell, 2010) whilst mental health and behavioural disorders are more prevalent (Cooper *et al.* 2007; Hughes-McCormack et al. 2017; Bowring *et al.* 2017). This analysis did not distinguish between mental health and behaviours that challenge to ensure like-for-like comparison with the general population. The 33.6% prevalence rate for mental health disorders reported in this study is higher than two of most influential papers in this area that cite a 22.4% (Cooper *et al.* 2007) and 23.4% (Hughes-McCormack *et al.* 2017) prevalence rate respectively. This may be due to this study's total administrative population approach insofar as those known to services may have more health-related problems. In addition to the increased prevalence rate of the other conditions, these findings are not new and support the consistently highlighted poorer health of this population (Hoskings *et al.* 2016; Heslop *et al.* 2014) that are aligned to well-known determinants of health and wellbeing (Emerson & Hatton, 2014). In addition to this, the trajectory of ill-health and disease in the intellectual disability population needs to be considered from an age perspective. There is clear evidence in this study that people at a younger age experience a greater number of health problems. Medical advancements have meant that sustaining life in infancy has become more achievable and children who were born extremely premature or with complex needs are now living into adulthood where once they would have died. The consequence of such treatment can have a marked impact of these persons' health meaning they experience many morbidities earlier which continue throughout life. This potentially polarises the finding that younger age in the general population may not be a protective factor for people with an intellectual disability. Future research should use population level longitudinal evidence from universally standardised health coding systems to identify the burden of ill-health in both children and adults with an intellectual disability.

Four principle limitations need to be kept in mind when considering these results. Firstly, the ICD-10 classification structure used in this study does not specify what specific disease the person has as it groups disorders under an anatomical and

physiological systems approach. Although examples of specific illnesses were used to assist the general population to correctly identify and match their disease to the correct heading, we acknowledge there is the potential for error as we could not cross-check results as it was an anonymous postal questionnaire. Second, although the use of a random stratified sampling approach ensured that the sampling frame is highly representative of the general population, there was only a 30% response rate. Third, this study has used two different methods to recruit participants. Although we acknowledge that this is a significant limitation in itself, we are also of the firm belief that general population cohort surveys are wholly exclusive for individuals with intellectual disabilities with greater needs. Therefore, in making reasonable adjustments to include as many people as possible with intellectual disabilities, we have produced this limitation. Fourth, this study has included adults known to services and there may be a 'hidden majority' such as adults with mild intellectual disability who do not access intellectual disability services (Emerson & Hatton, 2014).

Although these four limitations introduce a source of methodological bias into the findings, there is a substantial evidence base that substantiates the prevalence of the reported disease in this study as it is broadly similar to other Jersey estimates over the last ten years (States of Jersey, 2012; 2014; 2016). Additionally, there was no evidence of any nonresponse variable correlation (Johnson & Wislar, 2012), and missing values were less than 2.7% across all variables. This goes a significant way to mitigate against the first and second limitations. Concerning the third and fourth limitation, the evidence-base in intellectual disability research continues to be challenged over how should individuals with an intellectual disability be included in general population cohort surveys (Hughes-McCormack et al. 2017; Emerson et al. 2014). Overcoming such challenges is inevitably going to create issues where sampling procedures are disconnected to a certain degree. Therefore, the use of a total population sample is considered an appropriate response to include people with intellectual disabilities in comparative research who have significant needs while ensuring the general population is equally representative. Our findings are suggestive of it appropriateness as is substantiates and integrates the existing literature.

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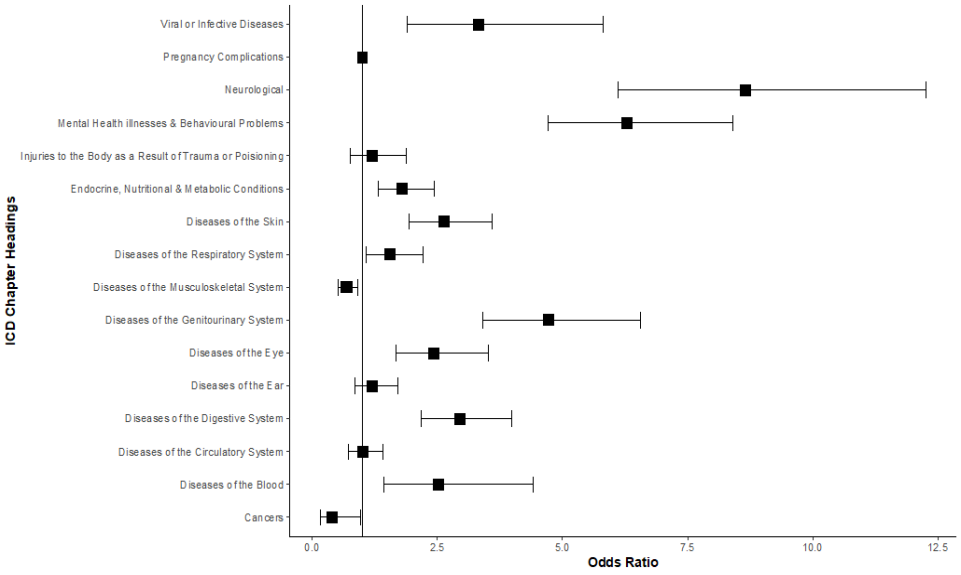
Table 1: Prevalence of Diseases in the Intellectual Disability and General Population with Associated ORs and 95% CI and P-Values

Variable		Intellectual Disability	General Population	Odds Ratio	95% CI	P Value
Participants		n = 217	n = 2,350			
Viral or infective diseases	Yes No *Missing data*	n = 17 (7.8%) n = 200 (92.2%) *n = 0 (0%)*	n = 57 (2.5%) n = 2284 (97.5%) *n = 66 (2.8%)*	3.3	1.90-5.81	p < 0.001
Cancers	Yes No *Missing data*	n = 5 (2.3%) n = 212 (97.7%) *n = 0 (0%)*	n = 130 (5.7%) n = 2164 (94.3%) *n = 56 (2.4%)*	0.39	0.16-0.97	p = 0.036
Diseases of the blood	Yes No *Missing data*	n = 16 (7.4%) n = 201 (92.6%) *n = 0 (0%)*	n = 70 (3.1%) n = 2217 (96.9%) *n = 63 (2.7%)*	2.52	1.44-4.42	p < 0.001
Endocrine, nutritional or metabolic conditions	Yes No *Missing data*	n = 67 (30.9%) n = 150 (69.1%) *n = 0 (0%)*	n = 456 (19.9%) n = 1837 (80.1%) *n = 57 (2.4%)*	1.80	1.33-2.44	p < 0.001
Mental health illnesses or behavioural problems	Yes No *Missing data*	n = 114 (52.5%) n = 103 (47.5%) *n = 0 (0%)*	n = 343 (15%) n = 1950 (85%) *n = 56 (2.4%)*	6.29	4.70-8.41	p < 0.001
Neurological conditions	Yes No *Missing data*	n = 65 (30%) n = 152 (70%) *n = 0 (0%)*	n = 108 (4.7%) n = 2185 (95.3%) *n = 57 (2.4%)*	8.65	6.10-12.26	p < 0.001
Diseases of the eye	Yes No *Missing data*	n = 41 (18.9%) n = 176 (81.1%) *n = 0 (0%)*	n = 201 (8.8%) n = 2093 (91.2%) *n = 56 (2.4%)*	2.43	1.67-3.51	p < 0.001
Diseases of the ear	Yes No *Missing data*	n = 42 (19.4%) n = 175 (80.6%) *n = 0 (0%)*	n = 383 (16.6%) n = 1919 (83.4%) *n = 48 (2%)*	1.20	0.84-1.71	p = 0.307
Diseases of the circulatory system	Yes No *Missing data*	n = 49 (22.6%) n = 168 (77.4%) *n = 0 (0%)*	n = 514 (22.4%) n = 1784 (77.6%) *n = 52 (2.2%)*	1.01	0.73-1.41	p = 0.943

Diseases of the respiratory system	Yes No *Missing data*	n = 42 (19.4%) n = 175 (80.6%) *n = 0 (0%)*	n = 308 (13.4%) n = 1989 (86.6%) *n = 53 (2.3%)*	1.55	1.08-2.21	p = 0.016
Diseases of the digestive system	Yes No *Missing data*	n = 75 (34.6%) n = 175 (65.4%) *n = 0 (0%)*	n = 350 (15.2%) n = 1949 (84.8%) *n = 51 (2.2%)*	2.94	2.17-3.98	p < 0.001
Diseases of the skin	Yes No *Missing data*	n = 67 (30.9%) n = 150 (69.1%) *n = 0 (0%)*	n = 332 (14.5%) n = 1957 (85.5%) *n = 61 (2.6%)*	2.63	1.93-3.59	p < 0.001
Diseases of the musculoskeletal system	Yes No *Missing data*	n = 76 (35%) n = 141 (65%) *n = 0 (0%)*	n = 1014 (44%) n = 1288 (56%) *n = 48 (2%)*	0.69	0.51-0.91	p = 0.010
Diseases of the genitourinary system	Yes No *Missing data*	n = 65 (30%) n = 152 (70%) *n = 0 (0%)*	n = 190 (8.3%) n = 2101(91.7%) *n = 59 (2.5%)*	4.73	3.41-6.55	P < .001
Malformations or genetic problems	Yes No Missing data	n = 64 (29.5%) n = 153 (70.5%) n = 0 (0%)	n = 20 (0.9%) n = 2267 (99.1%) n = 63 (2.7%)	47.41	27.96-80.40	p < 0.001
Injuries to your body as a result of trauma or poisoning	Yes No Missing data	N = 24 (11.1%) n = 193 (88.9%) n = 0 (0%)	n = 215 (9.4%) n = 2074 (90.6%) n = 61 (2.6%)	1.20	0.77-1.88	p = 0.561

Figure 1: Forest Plot of ICD Chapter Headings and Associated Odds Ratios (with 95% CI)



Malformations or Generic Problems OR is 47.14 (95% CI 27.96-80.40) and had been omitted from this Forest Plot as it distorts interpretation

Table 2: Logistic Regression Model with Statistically Significant Results

		Nagelkerke R^2	β	S.E.	Wald's X^2 (df 1)	Sig.	OR	95% CI for Odds Ratio Lower	Upper
Viral & Infective Diseases	General/ Intellectual Disability Population*Age	0.035	-1.185	.593	4.00	*	0.30	0.10	0.97
Cancers	Gender	0.069	0.391	.183	4.572	*	1.48	1.03	2.11
	Age		-1.276	.213	35.804	***	0.28	0.18	0.42
Diseases of the Blood	General/ Intellectual Disability	0.027	-1.226	.461	7.062	**	0.29	0.12	0.72
Endocrine Nutritional & Metabolic Disorders	Gender	0.064	-.328	.111	8.725	**	0.72	0.58	0.89
	Age		-.937	.111	71.463	***	0.39	0.32	0.49
	General/ Intellectual Disability		-.840	.257	10.688	**	0.43	0.26	0.71
Mental Illness & Behavioural Disorders	Gender	0.122	-451	.127	12.571	***	0.64	0.50	0.82
	Age		.611	.122	24.953	***	1.84	1.45	2.34
	General/ Intellectual Disability		-1.853	.226	66.976	***	0.16	0.10	0.24
	General/ Intellectual Disability Population*Gender		.785	.306	6.572	*	2.20	1.20	3.99
	General/ Intellectual Disability Population*Age		-1.318	.361	13.339	***	0.27	0.13	0.54
Neurological	Gender	0.137	-.491	.214	5.240	*	0.61	0.40	0.93
	Age		-.589	.204	8.353	**	0.56	0.37	0.83
	General/ Intellectual Disability		-2.592	.313	68.744	***	0.08	0.04	0.14
Eye	Age	0.077	-1.351	.174	60.282	***	0.26	0.18	0.36
	General/ Intellectual Disability		-1.564	.310	25.547	***	0.21	0.11	0.38

	General/ Intellectual Disability Population*Age		1.072	.434	6.093	*	2.92	1.24	6.85
Ear	Age	0.061	-1.056	.122	65.477	***	0.35	0.27	0.44
	General/ Intellectual Disability Population*Gender		-.930	.373	6.174	*	0.40	0.19	0.82
Circulatory Disorders	Gender	0.145	.233	.107	4.757	*	1.26	1.02	1.56
	Age		-1.626	.118	190.147	***	0.20	0.16	0.25
Respiratory Disorders	Age	0.013	-.329	.124	7.059	**	0.72	0.57	0.92
Digestive Disorders	Age	0.057	-.665	.121	30.251	***	0.51	0.41	0.65
	General/ Intellectual Disability		-.996	.250	15.981	***	0.37	0.23	0.60
Skin	Age	0.031	0.300	.120	6.208	*	1.35	1.07	1.71
	General/ Intellectual Disability		-.537	.250	4.606	*	0.59	0.36	0.93
	General/ Intellectual Disability Population*Age		-.849	.361	5.541	*	0.43	0.21	0.87
Musculoskeletal Disorders	Age	0.067	-.927	.087	113.840	***	0.40	0.33	0.47
Malformations & Genetic Problems	General/ Intellectual Disability	0.379	-.3.647	.465	61.614	***	0.03	0.01	0.07

*p < 0.05, **p < 0.01, ***p < 0.001

Note: Any variables with a p-value > 0.05 are excluded. Each of the final models was assessed against the Hosmer–Lemeshow goodness of fit test statistic (Hosmer,Lemeshow, & Sturdivant, 2013). For each model, apart from diseases of the genitourinary system, a p-value above .10 was observed along with a small test statistic identifying that the models provided a good fit to the data.

Injuries to your body as a result of trauma or poisoning excluded as they were not statistically significant

Figure 2: A Matched Comparison Sample (n-206) Identifying the Cumulative Number of ICD-10 Conditions

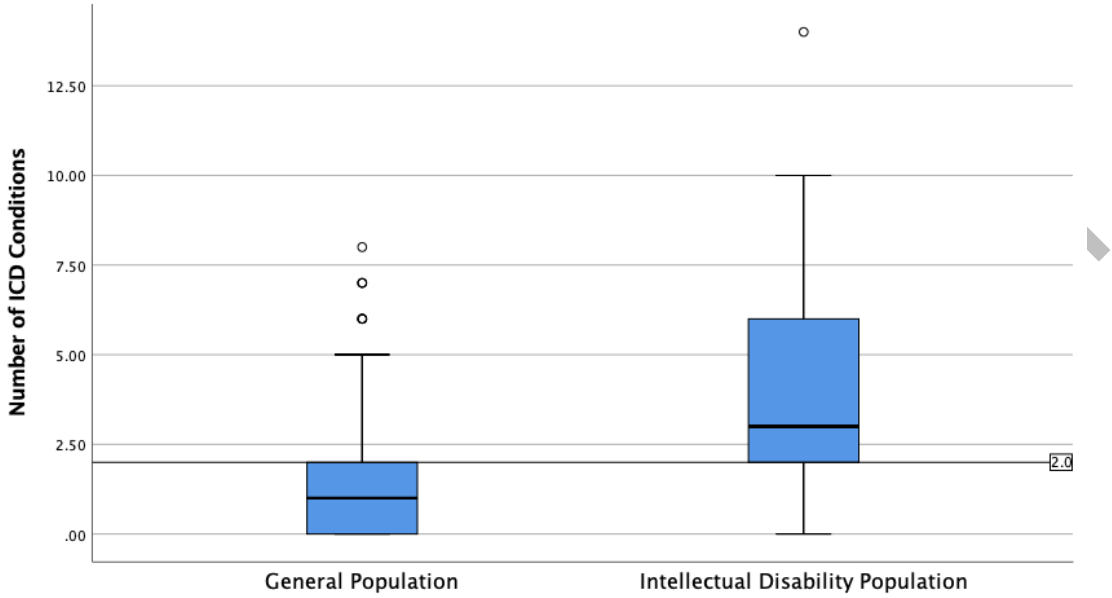


Figure 3: A Matched Comparison Sample (n-206) Identifying the Cumulative number of ICD-10 Conditions Filtered by Age Categories