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TITLE

Prevalence of and factors associated with edentulousness (no natural teeth) in adults with intellectual disabilities

ABSTRACT

Introduction: Poor oral health is largely preventable. Prevention includes toothbrushing and regular dental checks. Oral health has important consequences for general nutrition, chewing, communication, wider systemic disease, self-confidence and participation in society. This study investigated the prevalence of edentulousness (no natural teeth) in adults with intellectual disabilities compared with the general population, and associated factors.

Methodology: An adult cohort with intellectual disabilities residing in Greater Glasgow and Clyde (GG&C), Scotland, underwent detailed health assessments between 2002-2004. Between

2004-2006, a subsample had an oral check. Data on edentulousness in the cohort were compared with adult participants from GG&C in the 2008 Scottish Health Survey. Within the intellectual disabilities cohort, binary logistic regression analyses investigated potential relationships between edentulousness and demographic and clinical factors.

Results: 560 adults with intellectual disabilities were examined (53.2% (298) male, mean age=46.3y, range 18–81y), and compared with 2,547 general population: edentulousness was 9% versus 1% aged 25-34y; 22% versus 2% aged 35-44y; 39% versus 7% aged 45-54y; 41% versus 18% aged 55-64y; and 76% versus 34% aged 65-74y. In both groups, edentulousness increased with age. After stratification for age, rates of edentulousness were consistently higher in the ID cohort. Odds ratios within age strata were not homogenous (M-H test $p < 0.0001$). Edentulousness was more likely in those with more severe intellectual disabilities (Adjusted Odds Ratio (AOR)=2.36; 95% Confidence interval (CI)=[1.23 to 4.51]); those taking antipsychotics (AOR=2.09; 95% CI=[1.25 to 3.51]) and those living in the most deprived neighbourhoods (AOR=2.69; 95% CI=[1.11 to 6.50]), , There was insufficient evidence for associations with sex, type of accommodation/support, antiepileptics, problem behaviours, or autism.

Conclusions: Adults with intellectual disabilities have a high prevalence of edentulousness, and need supported daily oral care to reduce the need for extractions. Despite previous reports on poor oral care, and the move towards person-centred care, carers and care-giving organisations need greater support to implement daily oral care. Prescribers need awareness of the potentially contributory role of antipsychotics, which may relate to xerostomia.

Keywords: intellectual disabilities, oral health, edentulousness, toothlessness, no natural teeth, antipsychotics

INTRODUCTION

Poor oral health is largely preventable through supportive oral care, including toothbrushing with fluoride toothpaste and regular dental checks (Faculty of Dental Surgery, 2012). It has important consequences for general nutrition, chewing, communication, wider systemic disease, self-confidence and participation in society. Some evidence suggests people with intellectual disabilities experience more tooth decay, gum disease, untreated dental disease, extractions, and loose teeth. It is less clear if this has improved in recent years, with deinstitutionalisation and more provision of home-based person-centred support. Poor oral health is largely preventable and unjust (O'Hara, McCarthy and Bouras, 2011), so any differences between people with intellectual disabilities and their non-disabled peers represents a health inequality (U.S Department of Health and Human Services, 2000; Department of Health and Social Care, 2012).

People with intellectual disabilities are largely dependent on the knowledge, attitudes, and practices of their carers for their oral care (Cumella *et al.*, 2000). Studies also suggest their oral health may be influenced by age (Oredugba and Akindayomi, 2008; Waldman and Perlman, 2012), medications (Fleming *et al.*, 1996; O'Dwyer *et al.*, 2016), physical limitations impeding daily oral care (Mac Giolla Phádraig *et al.*, 2014; Chadwick *et al.*, 2017), poor dental hygiene knowledge, and poverty (Glassman and Miller, 2006). However, most studies have biased sampling, restricting their interpretation.

Oral health care is a fundamental part of personal care, and a priority for the World Health Organization (World Health Organization, 2014). Measuring and understanding oral health is therefore a pressing need in adults with intellectual disabilities, with implications for provision of support.

The aims of this study were to identify in adults with intellectual disabilities:

1. the prevalence of edentulousness (complete absence of natural teeth),
2. how levels of edentulousness compare with the same-aged general population,
3. which factors are associated with edentulousness.

MATERIALS AND METHODS

Ethical approval was from Local Research Ethics Committee of the NHS Greater Glasgow Primary Care Trust (Ref 01/44). Individual consent was in keeping with Scottish law.

Participants

Adults with intellectual disabilities in the NHS Greater Glasgow and Clyde Health Board (NHS GG&C) area were identified from social work services, Local Authority recipients of paid support, specialist intellectual disabilities health services, the Health Board, Government statistical data, and general medical practitioners. Between 2002-2004, n=1,201 had a detailed general and mental health assessment, conducted by nurses, general practitioners, and intellectual disabilities psychiatrists (Author paper 2007; Author paper 2018). Two years later (2004-2006), a further study was undertaken (Author paper 2007), from which 581 participants were invited to an oral check at a research assessment conducted by two research assistants who counted participants' teeth.

General population data

Findings were compared with data collected from 2,547 adults from GG&C in the Scottish Health Survey (SHeS) in 2008 (Corbett *et al.*, 2008). The SHeS is a cross sectional survey of a nationally representative general population sample. All were invited to participate in the first stage interview, and a sub-sample were invited to a second stage visit from a nurse (Author paper., 2008). Participants' self-reported number of natural teeth was extracted from nurse interviews.

Variables

The primary outcome was whether individuals were edentulous. Factors at the time of the initial health assessment were investigated for relationships with edentulousness in the intellectual disabilities cohort at the time of the oral check. These were age, sex, neighbourhood deprivation using the Carstairs Index (Carstairs and Morris, 1989), living circumstances, level of intellectual disabilities, having Down syndrome, autism, problem behaviours, using antipsychotics, and using antiepileptics. We selected these variables to investigate the influence of type of carer on dental hygiene, possible effects of behaviour on carer support for tooth-brushing and dental examinations, drugs with high prevalence of prescription in this population and which can cause xerostomia, anatomical differences, and

in view of the different influence of neighbourhood deprivation on health reported in this population compared with that seen in the general population.

Analysis

Analyses were undertaken using Stata Statistical Software (StataCorp, 2017). The percentages who were edentulous in the intellectual disabilities and SHeS cohort, stratified by age group, were calculated, and Mantel-Haenszel test (H-M test) for homogeneity of odds ratios conducted. Initially, univariable binary logistic regressions were undertaken between the outcome, edentulousness, and each separate factor. A multivariable logistic regression model investigated factors independently associated with edentulousness. Unadjusted and Adjusted Odds ratios and 95% confidence intervals were calculated.

RESULTS

Demographics

560/581 (96.4%) had the oral check. Their characteristics were similar to the full 1,201 (Table 1). Mean age of the 560 was 46.3 years (range 18-81) at the time of the oral check.

-insert table 1 about here-

Edentulousness

Table 2 compares the proportion who were edentulous in each cohort, stratified by age. Edentulousness increased with increasing age in both cohorts. Among those with intellectual disabilities, 9% aged 25-34 years were edentulous, 22% aged 35-44 years, 39% aged 45-54 years, 41% aged 55-64 years, and 76% aged 65-74 years (numbers too small to infer for 75+ year age group). For the same aged general population, rates of edentulousness were lower at 1% aged 25 – 34 years, 2% aged 35-44 years, 7% aged 45-54 years, 18% aged 55-64 years, and 34% at 65-74 years.

There was evidence that odds ratios for edentulousness were not homogenous across age groups (M-H test for homogeneity; $p < 0.0001$), but there was no clear pattern with age.

-insert table 2 about here-

Factors associated with edentulousness in adults with intellectual disabilities

Table 3 shows the logistic regression analyses. Compared to mild intellectual disabilities, adults with severe (AOR=2.36 [1.23 to 4.51]) or profound (AOR=2.21 [1.05 to 4.67]) intellectual disabilities had greater odds of being edentate. Adults taking antipsychotics had greater odds of being edentate (AOR=2.09 [1.25 to 3.51]) compared to those not taking them. Referenced to the least deprived neighbourhoods, adults in the most deprived neighbourhoods had greater odds of being edentate (AOR (95% CI)=2.69 [1.11 to 6.50]), although there was not a linear gradient across the extent of area deprivation (U-shaped curve). Down syndrome, autism, problem behaviours, living circumstances and anti-epileptic medication were not associated with being edentate.

-insert table 3 about here-

DISCUSSION

Adults with intellectual disabilities were more likely to be edentate than the same aged general population. We believe our study is the largest to date across the full adult age-range to demonstrate the extent of this preventable inequality in a representative cohort (as opposed to non-generalisable samples). There are many quality of life problems related to tooth-loss, and loss of functional dentition causes problems chewing, so it is conceivable that this

contributes to avoidable/amenable death through choking, but further evidence is needed. Greater levels of edentulousness observed in adults with intellectual disabilities most likely reflects their poorer oral health, however other factors including barriers to accessing dental care (Oliviera *et al.*, 2013) and difficulties communicating dental pain leading to late presentations (Hennequin *et al.*, 2000) increase the likelihood of dental extractions being necessary. Adults less likely to tolerate oral hygiene input and dental treatment may receive fewer preventive interventions or simple items of treatment, and problems tolerating a prolonged appointment for complex restorative care, or high levels of dental anxiety (Cumella *et al.*, 2000; Fallea *et al.*, 2016), may necessitate the use of sedation or general anaesthesia (Petrovic *et al.*, 2011). Where pharmacological interventions are required, dental treatment planning may be more radical (more extractions) to reduce likelihood of a repeat procedure (Hennequin *et al.*, 2000).

More severe intellectual disabilities and using antipsychotics also increased the odds of edentulousness. Taking antipsychotics causes xerostomia (dry mouth), with loss of the protective effect of saliva increasing the risk of dental caries, which may account for the higher odds of being edentate. Alternatively it is possible that the reasons people are prescribed antipsychotics (e.g. problem behaviours such as biting) renders them more likely to have their teeth removed; we are not aware of any local deliberate practice of this. There is growing awareness of inappropriate antipsychotic prescribing for some adults with intellectual disabilities, many of whom do not have psychosis (Riaz *et al.*, 2011, Cooper *et al.*, 2007; Ervin and Dye, 2009). If there was any historical practice of routine dental clearance for people with intellectual disabilities, one would expect the disparity between adults with intellectual disabilities and the general population to be greatest in the oldest age groups, however our statistical tests did not find this. Prescribers need a greater awareness of the potential impact on oral health.

Neighbourhood deprivation is strongly associated with oral health and edentulousness in the general population (Jagger *et al.*, 2013). Our study differed. Whilst there were higher odds of edentulousness in the most deprived neighbourhoods compared with the most affluent, there was not a linear gradient across levels of neighbourhood deprivation. This has previously been reported in other studies with adults with intellectual disabilities: extent of neighbourhood deprivation measured by post-code, does not necessarily reflect background origin, lifestyles, nor their current family and other contacts and supports (Cooper *et al.*, 2011).

Strengths and limitations of study

Study strengths are the comprehensive population ascertainment of adults with intellectual disabilities, large sample size, high participation rate, systematic and detailed health assessments at the first time point, and oral assessment (rather than relying on proxy carer reports). The adults with intellectual disabilities who had the oral assessment were representative of the wider cohort with intellectual disabilities.

The study was, however, only conducted in one area. Variables were measured at the time of the health assessment and patients may already have been edentulous at this point, or there may have been previous circumstances contributing to tooth loss. Medications did not account for dose, duration, or previous use. The SHeS does not report whether it included people with intellectual disabilities. In Scotland, 0.5% of the adult population have intellectual disabilities (Hughes-McCormack *et al.*, 2017) so if included, we underestimated the extent of disparity with the general population, but the overall effect is small.

CONCLUSIONS

We highlight the extent of the disparity in edentulousness between a representative sample of adults with intellectual disabilities and the general population. Smaller studies previously highlighted increased rates, and demonstrate that these inequalities have not yet been addressed despite the previous reports, and more person-centred care. There is thus an urgent need to address oral health and focus on a preventative agenda, for all adults with intellectual disabilities. Access to dental services – typically initiated by carers - is essential for routine preventive dental care and to ensure prompt treatment to avoid suffering and reduce the need for extractions. Prescribers should be aware of the potential impact of antipsychotics on oral health. Most importantly, carers and care-giving organisations require a heightened awareness of the importance of oral health for all adults with intellectual disabilities and their role in maintaining oral health on a daily basis as an integral part of their fundamental care.

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Table 1. Demographics and characteristics of the 560 participants who had an oral assessment compared with the full cohort at the first time point

	Full cohort	Received oral health check
Participants	N (1,201)	N (560)
	%	%
Gender		
Male	677 (56.4%)	298 (53.2%)
Female	524 (43.6%)	262 (46.8%)
Age		
18-24	116 (9.7%)	44 (7.9%)
25-34	180 (15%)	82 (14.6%)
35-44	306 (25.5%)	132 (23.6%)
45-54	283 (23.6%)	134 (23.9%)
55-64	200 (16.7%)	106 (18.9%)
65-74	83 (6.9%)	51 (9.1%)
75 and above	21 (1.7%)	11 (2%)
Level of intellectual disabilities		
Mild	451 (37.6%)	225 (40.2%)
Moderate	320 (26.6%)	162 (28.9%)
Severe	238 (19.8%)	98 (17.5%)
Profound	192 (16%)	75 (13.4%)
Accommodation type		
Lives with family carer	427 (35.6%)	223 (39.8%)
Lives independently	109 (9.1%)	49 (8.8%)
Lives with paid support	566	252

	(47.1%)	(45%)
Lives in congregate setting	99 (8.2%)	36 (6.4%)
Down Syndrome		
No	1001 (83.3%)	448 (77.1%)
Yes	200 (16.7%)	112 (20%)
Autistic Spectrum Disorder		
No	1119 (93.2%)	527 (94.1%)
Yes	242 (20.1%)	33 (5.9%)
Problem Behaviour		
No	959 (79.9%)	451 (80.5%)
Yes	242 (20.1%)	109 (19.5%)
Taking antipsychotic medication		
No	909 (75.7%)	436 (77.9%)
Yes	292 (24.3%)	124 (22.1%)
Taking antiepileptic medication		
No	867 (72.2%)	422 (75.4%)
Yes	334 (27.8%)	137 (24.5%)

Table 2. Proportion of edentulous participants in intellectual disabilities and SHeS cohorts

Age group	% edentulous (n)		M-H σ	95%CI
	ID cohort	SHeS cohort		
18-24	2% (1/44)	0% (0/213)	4.95	0.3 to 81.7
25-34	9% (7/82)	1% (4/371)	8.56	2.38 to 30.7
35-44	22% (29/132)	2% (8/476)	16.5	6.92 to 39.2
45-54	39% (52/134)	7% (34/472)	8.17	4.8 to 13.9
55-64	41% (43/106)	18% (68/381)	3.14	1.94 to 5.1
65-74	76% (39/51)	34% (117/346)	6.36	3.1 to 13.02
75+	64% (7/11)	53% (153/288)	1.54	0.44 to 5.4

M-H test for homogeneity of odds ratios across age strata: $p < 0.0001$

Table 3. Odds Ratios (unadjusted and adjusted) (95% confidence intervals) of factors for edentulousness in adults with intellectual disabilities

Factor	% edentulous (n)	Unadjusted OR [95% CI]	Adjusted OR [95% CI]	p-value
Sex				0.082
Male	29.9 (89/298)	1 (ref)		
Female	34 (89/262)	1.21 (0.85 to 1.73)	1.46 (0.95 to 2.23)	
Age group				<0.001
16-24 years	2.3 (1/44)	1 (ref)		
25-34 years	8.5 (7/82)	4.01 (0.48 to 33.72)	4.55 (0.53 to 39.11)	
35-44 years	22 (29/132)	12.22 (1.60 to 91.72)	13.27 (1.69 to 104.00)	
45-54 years	38.8 (52/134)	27.27 (3.64 to 204.09)	28.48 (3.66 to 221.56)	
55-64 years	40.6 (43/106)	29.35 (3.89 to 221.28)	29.62 (3.73 to 235.56)	
65-74 years	76.5 (39/51)	139.75 (17.36 to 1124.82)	152.55 (17.71 to 1313.65)	
75+ years	63.6 (7/11)	75.25 (7.30 to 775.25)	62.00 (5.50 to 698.42)	
Carstairs Index Decile				0.11
1-2 (least deprived)	25 (33/132)	1 (ref)		
3-4	30.4 (14/46)	1.63 (1.03 to 2.60)	1.90 (1.11 to 3.28)	
5-6	28.2 (11/39)	1.54 (0.79 to 2.96)	1.46 (0.68 to 3.13)	
7-8	33.9 (21/62)	1.18 (0.53 to 2.63)	1.27 (0.51 to 3.16)	
9-10 (most deprived)	35.2 (99/281)	1.31 (0.63 to 2.76)	2.69 (1.11 to 6.50)	

Down Syndrome					0.74
Yes	25 (28/112)	0.66 (0.41 to 1.06)	0.91 (0.52 to 1.60)		
No	33.5 (150/448)	1 (ref)			
Accommodation situation					0.53
Lives with family carer	18.8 (42/223)	1 (ref)			
Lives independently	46.9 (23/49)	3.81 (1.98 to 7.33)	1.87 (0.80 to 4.33)		
Lives with paid support	38.9 (98/252)	2.74 (1.80 to 4.18)	1.11 (0.64 to 1.91)		
Lives in congregate setting	41.7 (15/36)	3.08 (1.47 to 6.47)	1.23 (0.51 to 2.96)		
Level of intellectual disability					0.04
Mild	30.2 (68/225)	1 (ref)			
Moderate	29 (47/162)	0.94 (0.61 to 1.47)	1.32 (0.76 to 2.29)		
Severe	40.8 (40/98)	1.59 (0.97 to 2.61)	2.36 (1.23 to 4.51)		
Profound	30.7 (23/75)	1.02 (0.58 to 1.80)	2.21 (1.05 to 4.66)		
Autistic Spectrum disorder					0.08
Yes	15.2 (5/33)	0.37 (0.14 to 0.96)	0.37 (0.12 to 1.12)		
No	32.8 (173/527)	1 (ref)			
Problem Behaviour					0.55
Yes	31.3 (140/448)	1.13 (0.73 to 1.75)	0.84 (0.47 to 1.50)		
No	33.9 (38/112)	1 (ref)			
Taking antipsychotic medication					0.005
Yes	48.4 (60/124)	2.53 (1.68 to 3.81)	2.09 (1.25 to 3.51)		
No	27.1 (118/436)	1 (ref)			
Taking antiepileptic medication					0.65
Yes	31.4 (43/137)	0.98 (0.65 to	0.89 (0.53 to		

			1.49)		1.49)		
No		31.8 (134/422)	1 (ref)				

***ORs adjusted for all factors**