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Brief Report

Dental attendance, restoration and extractions in adults with intellectual disabilities compared with the general population: a record linkage study

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Abstract

Background Oral health may be poorer in adults with intellectual disabilities (IDs) who rely on carer support and medications with increased dental risks.
Methods Record linkage study of dental outcomes, and associations with anticholinergic (e.g. antipsychotics) and sugar-containing liquid medication, in adults with IDs compared with age–sex–neighbourhood deprivation-matched general population controls.
Results A total of 2933/4305 (68.1%) with IDs and 7761/12 915 (60.1%) without IDs attended dental care: odds ratio (OR) = 1.42 [1.32, 1.53]; 1359 (31.6%) with IDs versus 5233 (40.5%) without IDs had restorations: OR = 0.68 [0.63, 0.73]; and 567 (13.2%) with IDs versus 2048 (15.9%) without IDs had dental extractions: OR = 0.80 [0.73, 0.89]. Group differences for attendance were greatest in younger ages, and restoration/extractions differences were greatest in older ages. Adults with IDs were more likely prescribed with anticholinergics (2493 (57.9%) vs. 6235 (48.3%): OR = 1.49 [1.39, 1.59]) and sugar-containing liquids (1641 (38.1%) vs. 2315 (17.9%): OR = 2.89 [2.67, 3.12]).
Conclusion Carers support dental appointments, but dentists may be less likely to restore teeth, possibly extracting multiple teeth at individual appointments instead.

Keywords dental health, health disparities, intellectual disability, oral health, special care dentistry

Introduction

Oral health is fundamental to well-being and integral to overall general health. Despite this, adults with intellectual disabilities (IDs) have poorer oral health compared with the general population (Morgan *et al.* 2012; Mac Giolla Phádraig *et al.* 2015), although many studies are of children rather than adults, and with non-representative populations, for example,

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dental clinic attenders. Most studies report a high prevalence of untreated dental caries (Ward *et al.* 2019), even though this can be prevented through regular toothbrushing with high-fluoride toothpaste and a good oral hygiene education. Adults with IDs have physical and sensory impairments, behavioural and/or cognitive problems, which, when coupled with biological risk factors relating to oral health (e.g. malocclusion), accumulate to a vital dependence on caregivers' assistance for effective oral hygiene. Polypharmacy is common in adults with IDs and may affect oral health. Some medications have anticholinergic properties, causing xerostomia (dry mouth) and contribute to dental disease (caries, stomatitis and mucositis) (Ciancio 2004; Lalloo *et al.* 2013), and many liquid medications are sugar containing, which also contributes (Nirmala *et al.* 2015). Once present, dental caries require restoration (e.g. filling) or tooth extraction. When adults with IDs obtain dental caries, teeth may be extracted rather than restored to reduce future dental treatment (Crowley *et al.* 2005). This may be the best treatment option for those with dental anxiety, which is highly prevalent in this patient group (Fallea *et al.* 2016), but there are evidence-based solutions to provide alternative treatments. For example, increased communication using a structured visual guide (Morisaki *et al.* 2008) and cognitive behavioural interventions (Prangnell and Green 2008) both report success in Special Care Dentistry. Adults with IDs are at least twice as likely to be edentulous (toothless) compared with the general population (Mac Giolla Phádraig *et al.* 2015; Kinnear *et al.* 2019). However, dental treatment changes over time with changing social and dental policies, warranting up-to-date robust large population studies.

We aimed to investigate dental attendance, restorations and extractions, and associations between medication and dental extractions in adults with IDs compared with a matched general population.

Methods

Scotland's Public Benefit and Privacy Panel for Health and Social Care approved the project (reference 1516-0281).

Three routinely collected datasets were linked for patients in NHS Greater Glasgow and Clyde Health Board area, which serves 22% of Scotland's population:

- *Primary Care Intellectual Disabilities Register*, 2014, to identify the adults with IDs. This was created from multiple sources and updated annually since 2014 between primary care and the IDs service; 73% of the general practices within NHS Greater Glasgow and Clyde approved its use in this research.
- *Management Information and Dental Accounting System*, 2015–2017, for dental attendance (individual having interacted with a dentist), restoration (having experienced any restoration treatment) and extractions data (having experienced any extraction treatment). This records primary care dental services (including special care dental services), originally created as a payment system.
- *Prescribing Information System*, 2009–2017, for drugs with anticholinergic properties and/or sugared liquids prescription data. This records all community-dispensed prescriptions and is a payment system. The modified Anticholinergic Risk Scale (Sumukadas *et al.* 2014) was updated and used.

Adults with IDs (aged 17+) on the Primary Care Intellectual Disabilities Register were each matched on year of birth, sex and neighbourhood deprivation [Scottish Index of Multiple Deprivation (SIMD) 2016] with three adults from the general population, using Scotland's unique patient identifiers (Community Health Index numbers) before linking to their corresponding Management Information and Dental Accounting System and Prescribing Information System data. Once linked, Community Health Index numbers were removed, and the pseudonymised linked datasets were available to the research team via the Safe Haven.

Descriptive data for each group were summarised, using counts and percentages for categorical variables. Dental outcomes and medications were compared between the groups using mixed-effects binary logistic regression models with a fixed effect for group and a random effect for matched cluster. Models were extended to include the main effect and a two-way interaction between group and age category and SIMD separately, and if interactions were significant, group effects within each subgroup

(age category/SIMD) were provided. Odds ratios (OR) are reported for the group effect with corresponding 95% confidence intervals (CI) and *P*-values. Statistical software used were SAS (version 9.4, SAS Institute Inc., Cary, NC, USA) and R (3.6.0, R Foundation for Statistical Computing, Vienna, Austria).

Results

There were 4305 adults with IDs and 12 915 controls; 41.8% were female, and mean age was 47.0 (±16.0 years) (Table 1).

Between 2015 and 2017, 2933 (68.1%) with IDs had attended their dentist, compared with 7761 (60.1%) general population: OR = 1.42 [1.32, 1.53], $P < 0.001$; 1359 (31.6%) with IDs had restorations, compared with 5233 (40.5%) general population: OR = 0.68 [0.63, 0.73], $P < 0.001$; and 567 (13.2%) with IDs had extractions, compared with 2048 (15.9%) general population: OR = 0.80 [0.73, 0.89], $P < 0.001$. There were significant interactions between group and each of age ($P < 0.001$) and SIMD ($P < 0.001$) for attendance; age ($P < 0.001$) and SIMD ($P = 0.034$) for restorations; and age ($P < 0.001$) but not SIMD ($P = 0.470$) for extractions. The results for IDs compared with general population controls for each outcome are presented for each age and SIMD subgroup (Tables 2,3).

Table 1 General demographics for each group

		Intellectual disabilities	General population
Total	*n* (17 220)	4305	12 915
Sex	Female	1801 (41.8%)	5403 (41.8%)
	Male	2504 (58.2%)	7512 (58.2%)
Age	17–25	403 (9.4%)	1209 (9.4%)
	25–34	811 (18.8%)	2433 (18.8%)
	35–44	673 (15.6%)	2019 (15.6%)
	45–54	965 (22.4%)	2895 (22.4%)
	55–64	794 (18.4%)	2382 (18.4%)
	65–74	464 (10.8%)	1392 (10.8%)
	75+	195 (4.5%)	585 (4.5%)
SIMD (2016)	1 – most deprived	1462 (34.0%)	4386 (34.0%)
	2	831 (19.3%)	2493 (19.3%)
	3	449 (10.4%)	1347 (10.4%)
	4	399 (9.3%)	1197 (9.3%)
	5	243 (5.6%)	729 (5.6%)
	6	302 (7.0%)	906 (7.0%)
	7	150 (3.5%)	450 (3.5%)
	8	199 (4.6%)	597 (4.6%)
	9	167 (3.9%)	501 (3.9%)
	10 – least deprived	103 (2.4%)	309 (2.4%)

SIMD, Scottish Index of Multiple Deprivation.

Dental attendance was higher for the adults with IDs, with the OR greatest in younger age groups, and no statistically significant group differences over age 65. Dental restorations were generally lower for the adults with IDs, being lower at age 17–24 years, not statistically significantly different between 25 and 44 years, and then progressively lower in each age category thereafter. Dental extractions were not significantly different between groups at ages 17–54 years and then progressively lower for the adults with IDs at each age category over 55.

Dental attendance was statistically significantly greater for adults with IDs compared with controls in all SIMD categories except SIMD4; there was no clear gradient across SIMD categories, but the greatest difference was in the most affluent neighbourhoods (SIMD10), and apart from category 4, the least difference was in the most deprived neighbourhood (SIMD1). Dental restorations were less common for adults with IDs compared with controls in all SIMD categories except for SIMD3, SIMD7 and SIMD10; there was no consistent gradient across SIMD categories.

Between 2009 and 2017, 2493 (57.9%) with IDs were exposed to anticholinergic medication, compared with 6235 (48.3%) general population controls: OR = 1.49 [1.39, 1.59], $P < 0.001$; 1641 (38.1%) with IDs were exposed to sugar-containing liquid medication, compared with 2315 (17.9%) general population controls: OR = 2.89 [2.67, 3.12], $P < 0.001$; and 1148 (26.7%) with IDs took medications that were both anticholinergic and sugar-containing liquids, compared with 1758 (13.6%) general population controls: OR = 2.36 [2.17, 2.58], $P < 0.001$. Having taken any anticholinergic medication between 2009 and 2017 was positively statistically significantly associated with dental extractions, independent of group effect: OR = 1.16 [1.07, 0.27], $P < 0.01$. However, there was a significant interaction between anticholinergic medication and group ($P < 0.001$), with no

Table 2 Group differences for dental attendance, restoration and extraction by age

	Attendance			Restoration			Extraction		
Age category	**Intellectual disabilities**	**General population**	**OR [CI], *P*-value**	**Intellectual disabilities**	**General population**	**OR [CI], *P*-value**	**Intellectual disabilities**	**General population**	**OR [CI], *P*-value**
17–24	280 (69.5%)	702 (58.1%)	1.67 [1.30, 2.13], $P < 0.001$	96 (23.8%)	79 (31.3%)	0.68 [0.53, 0.89], $P = 0.004$	29 (7.2%)	110 (9.1%)	0.77 [0.50, 1.18], $P = 0.231$
25–34	593 (73.1%)	1455 (59.8%)	1.83 [1.54, 2.18], $P < 0.001$	294 (36.3%)	883 (36.3%)	1.00 [0.85, 1.18], $P = 0.983$	101 (12.5%)	334 (13.7%)	0.89 [0.70, 1.14], $P = 0.349$
35–44	482 (71.6%)	1243 (61.6%)	1.58 [1.30, 1.91], $P < 0.001$	261 (38.8%)	839 (41.6%)	0.89 [0.74, 1.07], $P = 0.204$	113 (16.8%)	284 (14.1%)	1.23 [0.97, 1.56], $P = 0.085$
45–54	681 (70.6%)	1803 (62.3%)	1.46 [1.24, 1.71], $P < 0.001$	352 (36.5%)	1290 (44.6%)	0.71 [0.62, 0.83], $P < 0.001$	158 (16.4%)	529 (18.3%)	0.88 [0.72, 1.06], $P = 0.182$
55–64	516 (65.0%)	1447 (60.7%)	1.20 [1.01, 1.42], $P = 0.033$	227 (28.6%)	1060 (44.5%)	0.50 [0.42, 0.60], $P < 0.001$	116 (14.6%)	478 (20.1%)	0.68 [0.54, 0.85], $P < 0.001$
65–74	274 (59.1%)	805 (57.8%)	1.05 [0.85, 1.30], $P = 0.644$	106 (22.8%)	577 (41.5%)	0.42 [0.33, 0.53], $P < 0.001$	45 (9.7%)	223 (16.0%)	0.56 [0.40, 0.79], $P < 0.001$
75+	107 (54.9%)	306 (52.3%)	1.11 [0.80, 1.54], $P = 0.535$	23 (11.8%)	205 (35.0%)	0.25 [0.16, 0.40], $P < 0.001$	5 (2.6%)	90 (15.4%)	0.14 [0.06, 0.36], $P < 0.001$

OR, odds ratio; CI, 95% confidence interval.

Table 3 Group differences for dental attendance and restoration by SIMD (2016) deciles

	Attendance			Restoration		
SIMD	**Intellectual disabilities**	**General population**	**OR [CI], *P*-value**	**Intellectual disabilities**	**General population**	**OR [CI], *P*-value**
1	913 (62.4%)	2494 (56.9%)	1.26 [1.12, 1.43], $P < 0.001$	473 (32.4%)	1770 (40.4%)	0.71 [0.62, 0.80], $P < 0.001$
2	550 (66.2%)	1500 (60.2%)	1.30 [1.10, 1.53], $P = 0.002$	265 (31.9%)	1027 (41.2%)	0.67 [0.56, 0.79], $P < 0.001$
3	320 (71.3%)	813 (60.4%)	1.63 [1.29, 2.06], $P < 0.001$	164 (36.5%)	531 (39.4%)	0.88 [0.71, 1.10], $P = 0.276$
4	255 (63.9%)	750 (62.7%)	1.06 [0.83, 1.33], $P = 0.652$	111 (27.8%)	519 (43.4%)	0.49 [0.38, 0.64], $P < 0.001$
5	180 (74.1%)	470 (64.5%)	1.57 [1.14, 2.17], $P = 0.006$	77 (31.7%)	320 (43.9%)	0.59 [0.43, 0.81], $P < 0.001$
6	241 (79.8%)	559 (61.7%)	2.45 [1.79, 3.35], $P < 0.001$	92 (30.5%)	358 (39.5%)	0.67 [0.51, 0.89], $P = 0.005$
7	107 (71.3%)	272 (60.4%)	1.68 [1.11, 2.54], $P = 0.015$	52 (34.7%)	167 (37.1%)	0.90 [0.16, 1.33], $P = 0.588$
8	153 (76.9%)	390 (65.3%)	1.77 [1.22 2.56], $P = 0.003$	53 (26.6%)	246 (41.2%)	0.52 [0.36, 0.74], $P < 0.001$
9	130 (77.8%)	330 (65.9%)	1.82 [1.21, 2.74], $P = 0.004$	44 (26.3%)	197 (39.3%)	0.54 [0.36, 0.80], $P = 0.002$
10	84 (81.6%)	183 (59.2%)	3.04 [1.76, 5.27], $P < 0.001$	28 (27.2%)	98 (31.7%)	0.80 [0.48, 1.32], $P = 0.384$

SIMD1, most deprived; SIMD10, least deprived; OR, odds ratio; CI, 95% confidence interval; SIMD, Scottish Index of Multiple Deprivation.

association observed for adults with IDs: OR = 0.88 [0.74, 1.06], $P = 0.175$, and an increased odds of dental extraction for taking anticholinergic medication in the control group: OR = 1.26 [1.14, 1.38], $P < 0.001$. Having taken sugar-containing liquid medication was not associated with dental extractions, independent of group effect: OR = 1.10 [0.99, 1.22], $P = 0.063$. However, there was a significant interaction between taking sugar-containing liquid medication and group ($P < 0.001$), with subgroup results showing reduced odds of dental extraction in the adults with IDs group: OR = 0.77 [0.64, 0.94], $P < 0.01$, and increased odds of dental extraction in the general population controls: OR = 1.28 [1.14, 1.44], $P < 0.001$.

Discussion

We found that more adults with IDs had attended their dentist compared with general population controls (OR = 1.42 [1.32, 1.53], $P < 0.001$), particularly in younger age groups, but they had fewer dental restorations (OR = 0.68 [0.63, 0.73], $P < 0.001$) particularly in older age groups and fewer dental extractions (OR = 0.80 [0.73, 0.89], $P < 0.001$) particularly in older age groups. Whilst one interpretation is that the adults with IDs have better oral health than the matched general population, we think the most likely interpretation is that carers are proactively supporting people with IDs to attend dental appointments, whereas some of the general population may attend only when they need treatment. At the same time, dentists may be less likely to try to preserve teeth in the adults with IDs than they do for the general population, providing fewer restorations and instead extracting multiple teeth/partial dental clearances at individual appointments for extractions (our data did not include the number of extractions at each appointment). This interpretation aligns with the observed effect of age, with the adults with IDs having fewer teeth at older ages, therefore even fewer restorations and extractions relative to the general population controls particularly at older ages.

It has previously been demonstrated that dental attendance alone does not eliminate the high burden of dental disease experienced by adults with IDs (Morgan *et al.* 2012; Finkelman *et al.* 2014). We can tentatively support this: our evidence shows that although adults with IDs interact with their dentist (via attendance) more than controls, they receive different treatment patterns. Much of the ID oral health literature include small samples with informative, but non-representative clinical dental data, reporting results by individual teeth (e.g. Decayed Missing Filled Teeth indices) rather than prevalence, making comparisons difficult. Our overall prevalence of restorations is similar to

previously reported findings (Brister *et al.* 2008), but extraction data are unknown. Turner *et al.* (2008) report on data from the Special Olympics, concluding practice may be changing with a lack of fillings (restorations) *not* associated with an increase in extractions, stating more conservative dental treatment is given. However, our adults are a representative sample (rather than younger well-supported athletes with IDs), and we report a lower experience of restorative dental care compared with the general population.

It is well established that extent of neighbourhood deprivation is associated with poorer dental health in the general population. We found that the associations between SIMD with dental attendance, restoration and extractions were not the same in the two groups, as has been previously reported for other health conditions and services (Cooper *et al.* 2011). The findings for the general population in this study are not the same as for the general population as a whole, as they are younger, more male and more likely to be living in more deprived areas given the matched design (reflecting the characteristics of the ID population). It is worth considering whether the high dental attendance is because dental check-ups are free for everyone in Scotland (both groups). Those with IDs are likely to be exempt from paying for subsequent treatment (i.e. restorations or extractions) due to disability related benefits/income support. However, given the lack of pattern within the ID cohort and SIMD, it appears that deprivation and/or payment for dental treatment has no significant impact on the dental experiences of adults with IDs.

The adults with IDs were more likely to be exposed to anticholinergic medicine than the general population controls (OR = 1.49 [1.39, 1.59], $P < 0.001$) and to sugar-containing liquid medication (OR = 2.89 [2.67, 3.12], $P < 0.001$). These medications, for example, antipsychotic drugs and anti-epileptic drugs, are often used over prolonged periods/decades in adults with IDs. Taking anticholinergic medicine was associated with increased odds of a dental extraction in the general population, but not in the adults with IDs. Taking sugar-containing liquid medication was associated with increased odds of a dental extraction in the general population but reduced odds in the adults with IDs. This supports our earlier interpretation of the data, that is, that multiple dental extractions are occurring at individual appointments for the adults with IDs at young ages, and hence, the problems these medications cause are less apparent in the adults with IDs as more of their teeth have already been extracted. An alternative explanation might be that carers are more proactive in supporting dental hygiene in adults with IDs than the general population for itself, but we think this unlikely in view of the 24-h effects that these medications have. It seems implausible that the drugs cause a different extent of xerostomia and sugar-induced caries in the two populations.

Whilst our study has the strengths of being large scale, with a representative population of adults with IDs and a matched general population, it also has limitations. The most important limitation is that we do not know the number of teeth each adult has. The data also exclude private dental appointments and use data routinely collected for payments so may include some human error. Additionally, whilst manufacturers state the contents of liquid medicines, they normally omit the actual amount of sugar (in whatever form) in a liquid drug, and for both types of medications of interest, we did not predetermine a required dosage or duration. Lastly, these data represent approximately 22% of Scotland's population but are specific to the Glasgow area, which limits the generalisability to more rural areas of the UK. We acknowledge that these results may not be representative of international dental healthcare experience for adults with IDs as service care provision differs significantly between countries. Future data linkage studies investigating the oral health profile of adults with IDs should include a detailed clinical assessment of an appropriately sized representative subsample; this would address the current gaps in the evidence relating to oral health outcomes.

To conclude, we present administrative oral health data on a representative population of adults with IDs. Although adults with IDs appear to value their oral health based on the dental attendance results, they receive different dental treatment compared with a matched general population. They are prescribed much higher rates of medicines potentially negatively impacting oral health. Dental caries are preventable, and the importance of good oral hygiene needs to be continually communicated.

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Conflicts of Interest

The authors report no potential conflicts of interest.

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