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What are the major patterns of paediatric neurological disease in British Columbia (BC), and how and why do they differ from those in the UK?

There is little specific research into the epidemiology of paediatric neurological disease^{*}, and even less published data at a country or provincial level. Multiple factors contribute to this. In both BC and the UK paediatric neurology is a relatively small speciality, so research tends to focus on therapy rather than epidemiology. A second factor is that the boundaries of what is specifically *neurological* paediatric disease are unclear (consider simple febrile seizures and global developmental delay – undeniably neurological, but usually managed by general or community paediatricians).

I spent four weeks on the neurology inpatient ward at the British Columbia Children's Hospital (BCCH). During this time, the most common reason for admission was seizure control (> 50%), typically secondary to one of the rarer epileptic syndromes (e.g. Dravet syndrome) or structural disease (e.g. Tuberous Sclerosis). The next most common reason (~30%) was investigation and management of acute neurological symptoms – mainly headache, weakness and sensory symptoms. In these patients the most common diagnoses were migraine and conversion disorder, but inflammatory and immune disease (e.g. chronic inflammatory demyelinating polyneuropathy, and myositis) were also seen. The remainder included a wide variety of rare conditions, such as several types of mitochondrial disease, Sydenham's chorea and several congenital structural disorders.

My experience broadly tallies with the available published data. The period prevalence of epilepsy in BC is 5.5 per 1000¹, similar to Canada as a whole². Migraine is more common, with an estimated prevalence among adolescents of 50 per 1000, but more than 50% of these patients do not require medical therapy and even fewer require inpatient care³. The Canadian Paediatric Surveillance Program⁴ (CPSP) has country wide data for several other neurological conditions, citing a minimum incidence for conversion disorder of 1.7 per 10000; other neurological diseases surveyed are rare in children – for example, fewer than 221 cases of acute demyelination and fewer than 57 cases of myaesthesia over 3 years in Canada. Interestingly, CPSP data shows that there were only 59 new cases of “progressive neurological and intellectual deterioration” recorded in Canada over three years, but I saw five in four months – clearly these patients have high healthcare needs and are “overrepresented” in the inpatient population. My experience was also likely biased towards conditions requiring inpatient care. For example, the prevalence of cerebral palsy in BC is 2.68 per 1000 live births⁵ and that of autistic spectrum disorders in Canada is almost 6 per 1000⁶, but I saw none of the former and only one of the latter, as they are both largely managed in the community.

How might these figures differ from the UK? Broadly, they are similar – the UK prevalence of epilepsy, migraine, CP and ASD is similar to that in Canada and BC⁷⁻¹⁰. This likely reflects that fact that the UK and Canada are both developed countries with similar population profiles and healthcare systems (see sections 2 and 3). Factors such as differences in population make up and geography may lead to differences in the patterns of paediatric neurological disease; for example, the First Nations population of Canada may have distinct patterns of epilepsy¹¹. Whether such subtle differences have effects at a population level has yet to be investigated.

^{*}Here I focus on neurological rather than neurosurgical disease; my elective was based largely on the former, and particularly in the paediatric population, inclusion of the latter would significantly increase the scope of this report.

How are tertiary services, specifically Paediatric Neurology, organised and delivered in British Columbia? Discuss this in relation to Canada's healthcare system, and compare and contrast this with the NHS.

In Canada, tertiary healthcare is delivered largely at a provincial level. The BCCH is the only dedicated paediatric neurology inpatient centre in BC with fourteen beds serving a population of just under one million children¹². BCCH employs fifteen attending paediatric neurologists and has the only specific paediatric neurology residency programme in BC. As well as the range of services a tertiary neurological centre would usually provide, BCCH delivers specialist care such as the ketogenic diet programme, a specialised electrophysiology department and epilepsy surgery. Much care for patients also takes place at the Sunny Hill Centre for Child development. The Vancouver paediatric hospice, Canuck Place, also frequently admits children with neurological disease.

This takes place in the context of a healthcare system which is largely publicly funded. One contrast with the NHS is that healthcare is less centralised in Canada – under the Canada Health Act it is the responsibility of individual provinces to provide universal healthcare, via an insurance system open to all residents. This is funded both by the provinces and the federal government. In practice, individuals often supplement their public insurance with private insurance – either to pay for things not covered by public insurance such as optometry, or to access private clinics with shorter waiting lists. As paediatric neurology is a very small speciality there is little private provision available in BC; however, in other areas of medicine private clinics are controversial.

If we contrast this system with the UK, one striking feature is that in the UK there are many more tertiary centres. For example, in London – which has a population roughly equivalent to that of BC – paediatric neurological services are split over numerous tertiary centres, including Great Ormond Street, the Evelina Children's hospital and many more. Whether this impacts on health outcomes has not been researched.

What social factors influence paediatric disease in British Columbia? How do the social determinants of health differ from the UK, and what role does public policy play in both countries?

The social determinants of health – which can be defined as “the conditions in which people are born, grow, live, work and age – conditions that together provide the freedom people need to live lives they value”¹³ - play a crucial role in determining health and illness across populations. Lower social status is a risk factor for ill health independently of lifestyle factors^{14,15}. This is equally true for paediatric disease. One recent meta-analysis has shown that in highly developed countries socio-economic deprivation is associated with a 1.42 relative risk of cerebral palsy and a 1.38 relative risk of epilepsy¹⁶; in Canada, migraine and epilepsy are both more common in households reporting food insecurity^{17,18}.

One striking example of this is the Canadian First Nations. A historically marginalised group – traditional ceremonies were banned until 1951 and the franchise was denied until 1960 – First Nations people are still economically and socially deprived. Health outcomes are correspondingly poor. Infant mortality is the highest of any Canadian group, and First Nations children suffer from higher rates of a host of diseases including tuberculosis, obesity, diabetes and psychiatric illness^{19,20}. Rates of acute rheumatic fever - a disease almost unheard of in developed countries - are amongst the highest in the world; a First Nations child has a seventy-five fold increased risk of

ARF²¹. Interestingly, much of the discourse around reducing these health inequalities focuses not just on the biomedical (e.g. immunisation programmes) or economic (e.g. improving housing) but the cultural and interpersonal elements of the First Nations experience. Both in the literature and in my (brief) experience there is a real focus on education of healthcare providers and attempting to understand how the erasure of culture still affects how First Nations individuals interact with healthcare professionals²⁰.

This is an area without an obvious parallel in the UK. However, the UK does have its own healthcare inequalities. Too often discussion of these (and accompanying policy prescriptions) focuses on simplistic explanations such as lifestyle factors. Although it is self-evidently important to address these factors, to entirely account for social disparities of health in terms of such factors misses the point – only when people feel that they have real agency in their lives and the ability to fulfil their potential in all areas will they be in best health. This is the fact which is gradually being acknowledged in regards to the First Nations in Canada; it is time we began to do so in the UK.

Personal Development Objectives

1. To improve my clinical skills and knowledge in the area of paediatric neurology, in particular to develop confidence in completing a neurological examination in children of different ages and to gain familiarity in diagnosing common neurological conditions in childhood.

2. To gain clinical experience to help make decisions regarding a possible future career in neurology, and to gain a more well rounded experience of the specialty.

I certainly feel I have accompanied both of these objectives. My knowledge of paediatric neurology has improved, both through day to day activities and attendance at formal teaching sessions on subjects including the epileptic encephalopathies and paediatric stroke. Clinically, I was regularly responsible for clerking new patients and formulating an initial management plan; I thus gained much more experience than I previously had in performing neurological examinations of children and managing common conditions such as paediatric seizures. One area I could improve on for the future is neurological examinations of neonates – I was certainly less confident in these, and perhaps had more medical knowledge of children and young teenagers in comparison.

Regarding my future career choice, my time at BCCH has reinforced my desire to train in neurology. It was very interesting to spend time on a paediatric ward, as specific paediatric neurological experience is rarely part of training programmes in the UK, yet children with neurological disease are increasingly surviving longer and thus coming under the care of adult neurologists. Experience in applying the logical deductive process of neurological diagnosis to the often messy world of paediatrics is something that I feel will stand me in good stead for the future.

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