Title: Variation in paediatric clinical practice: a review of care in inpatient, outpatient and emergency department settings.

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Purpose

In his 2010 editorial in the British Medical Journal, Albert Mulley, Chief of the General Medicine Division at Massachusetts General Hospital Boston, noted: *“If all variation were bad then solutions would be easy. The difficulty is in reducing bad variation, which reflects the limits of professional knowledge, and failures in its application, whilst preserving the good variation that makes care patient centred.”*¹

Variation in care refers to variation in diagnostic and treatment practices, including medications prescribed, imaging and pathology ordered, procedures and interventions performed, and referrals made. It is important because it inevitably reflects variation in quality of care and associated costs. Whilst the BMJ editorial statement is undoubtedly true, there is little published about variation in paediatric clinical practice. Before paediatricians and policy makers can begin to sort ‘good’ or warranted from ‘bad’ or unwarranted variation, we need a deeper understanding within paediatric practice of where variation occurs, what aspects are considered to be warranted or unwarranted, and whether there are modifiable, systems-based factors that can reduce the latter.

To this end, NSW Kids and Families commissioned a rapid review of the evidence of variation in paediatric clinical care in inpatient, outpatient and emergency department (ED) settings. The full review was published in November 2014 and is available at <https://www.saxinstitute.org.au/publications/evidence-check-library/variation-in-paediatric-clinical-practice/>.² A rapid review is a form of knowledge synthesis in which components of the systematic review process are simplified or omitted to produce information in a timely

manner (eg omission of study quality ratings, as per this review).³ The review focused on variation in care in developed countries for 16 common child health conditions and systemic factors associated with this variation. The following databases were searched: Ovid MEDLINE, CINAHL (EBSCO), PsychInfo, Cochrane library, and PubMed, as well as published reviews, and references of retrieved, relevant articles. This paper presents an executive summary of the review along with research and policy implications arising.

Executive Summary

Variation in paediatric clinical care is common. It occurs across diseases, clinicians, and settings. Wennberg's framework is the most common framework used to understand variation in clinical care.⁴ It describes both warranted and unwarranted variation; with unwarranted variation being defined as "variation that cannot be explained by type or severity of illness or by patient preferences." Unwarranted variation is further categorised as variation in:

- *effective care* i.e. when proven, clinically effective care is not used;
- *preference-sensitive care* i.e. where there are two or more choices for care and the choice made is ideally be driven by patient preferences; and
- *supply-sensitive care* i.e. when variation arises not due to evidence but due to supply of healthcare resources such as doctors or diagnostic services.

The review found widespread variation across conditions, clinicians, health settings, and geographical regions. The most common form of variation was unwarranted variation in effective care including overuse of care that is not evidence based (e.g. antibiotics in bronchiolitis⁵) and underuse of care that has been shown to be effective (e.g. oral sucrose to

alleviate pain in infants⁶). Preference-sensitive unwarranted variation was noted, particularly in conditions where the evidence for best practice is limited. Supply-sensitive care was not commonly examined or reported. There was a dearth of Australian data. Most studies used secondary data analysis, followed by chart review and surveys of clinician practice. In the inpatient setting, more variation was usually associated with higher health care costs and increased length of stay. A summary of the relevant articles follows below:

Inpatient care – 27 studies; asthma was the most common condition studied (six studies), followed by tonsillectomy & adenoidectomy (five), bronchiolitis (four), and pneumonia, appendicitis, and analgesia/ sedation (three each). Only one study was from Australia. Only one study reported warranted variation. Most variation was unwarranted and concerned inappropriate use of investigations and/or over-prescription of inappropriate treatments. For example, use of chest x-rays and antibiotics was common for bronchiolitis as was use of blood cultures, C-reactive protein and erythrocyte sedimentation rates for community acquired pneumonia. Increased number of investigations was associated with longer length of stay and costs.⁷

Outpatient care – 20 studies; attention-deficit/hyperactivity disorder and asthma were the most common conditions (four studies each), followed by food allergy, obesity, and pneumonia (two each). Two studies were from Australia. In contrast to inpatient care, variation in effective outpatient care often concerned under-management. For example, in data sourced from a US insurance company, receipt of psychology therapy by children with attention-deficit/hyperactivity disorder varied by county from 6.3%–38.1% and this variation

occurred even across counties with a similar number of psychologists.⁸ Use of an otoscope or tympanometry to diagnose otitis media in Aboriginal children was also underutilised.⁹

ED care – 24 studies; asthma was the most common condition (seven studies), followed by bronchiolitis and fever (four each), pneumonia (three), analgesia/sedation and concussion (two each). Three studies were from Australia. Only three studies reported warranted variation. Unwarranted variation in effective care occurred in antibiotic use (e.g. use of second or third vs first generation antibiotics for community acquired pneumonia) and asthma, fever and bronchiolitis (e.g. use of chest x-rays).

Factors associated with variation in care.

Over 60 factors were discussed in association with variation in care; the most common being factors for unwarranted variation in care and proposed / theoretical rather than documented / empirical factors. Factors associated with preference-sensitive care were less common, possibly because of the challenges in carrying out research into variation in care where clear, evidence-based treatment recommendations are not available.

Common factors associated with *increased* variation included:

- lack of or awareness of or poorly written (user unfriendly) clinical practice guidelines (proposed and documented);
- lack of high quality evidence to inform practice (proposed);
- physician preference for care (proposed), and;
- differences between local and regional primary care systems e.g. resource (primary care doctors) availability (proposed).

Common factors associated with *reduced* variation in effective care included:

- hospital type i.e. children's hospital compared with generalist hospital;
- clinician workplace i.e. hospitalists (ie those principally working in the hospital setting) compared with non-hospitalists;
- age of clinician i.e. younger clinicians versus older clinicians;
- documented adherence to clinical practice guidelines; and
- use of electronic order sets within electronic medical records to guide clinician practice.

Doctors working predominantly within a hospital may be more up to date with evidence-based practice and more used to using clinical practice guidelines, than their community-based peers. Similarly, younger doctors and those working in children's hospitals may be more aware of and more likely to adhere to clinical guidelines than older doctors or those working in general hospitals, respectively.

Variation in *preference-sensitive care* was next most commonly researched. This largely occurred due to lack of good quality evidence as to what care children should receive. Such variation was particularly noted for obesity¹⁰, elective tonsillectomy and adenoidectomy¹¹, and attention-deficit/hyperactivity disorder.¹² Disease severity was also associated with variation in preference-sensitive care. For example, care of mild to moderate asthma was generally adherent to clinical practice guidelines whilst care for severe asthma was not. This likely reflects the lack of good quality evidence for care of more severe presentations and thus clinician deviation from guidelines which are consensus rather than evidence-based.

Policy and Research Implications.

If we are to reduce unwarranted variation in paediatric clinical care in Australia, we first need to document where this variation is occurring and whether it is associated with adverse outcomes such as poorer child health, increased costs, or inequity of access to care. To do this in a sustainable, robust and cost-effective manner, we need to be able to routinely collect and analyse data across inpatient, outpatient, ED and community/primary care settings. The most robust findings in this review came from secondary data analysis of the large, US national database - Paediatric Health Information Systems - encompassing discharge data from inpatient stays in 42 free-standing children's hospitals.¹³ Australia has similar national databases for both inpatient (public and private hospitals)¹⁴ and ED (public hospitals only)¹⁵ care. However, we could find no publications on practice variation arising from these databases. Australia also collects data on neonatal intensive care but this was beyond the scope of our review. Key steps in reducing unwarranted variation in care therefore, would be to make existing data more readily available to clinicians and researchers for analysis, evaluation and publication in peer-reviewed journals as well as to continue to progress the detail and accuracy of the data collected from both public and private settings.

Whilst Australian data on hospital inpatient and ED care exist, data for outpatient care are fragmented and limited. A coordinated, system-wide approach to documenting care in hospital outpatient services is needed if we are to reduce variation in this setting. Furthermore, across all settings, systems of data linkage need to be in place to feed information back into health care systems on all aspects of patient care (e.g. medications,

imaging, pathology, family satisfaction etc). In this way, interventions that aim to reduce variation can be rigorously monitored and rapidly evaluated in terms of cost, health and process outcomes.

Measuring health outcomes, especially in the longer term, remains a major challenge across health systems. Patient-related outcomes such as satisfaction and quality of life were not reported in the publications within this review. Some study findings could be assumed to be associated with poorer short-term patient outcomes (e.g. less use of effective analgesia) or long-term outcomes (e.g. poorer health due to not regularly measuring body mass index). There is a clear need to expand outcomes to include patient- and family-centred measures. Increasingly, patient reported outcomes of health status and specific/practical improvements consequent to health service interventions are being promoted internationally. The International Consortium for Health Outcomes Measurement has engaged with several Australian organisations in this pursuit (What Matters Most: Patient Outcomes and the Transformation of Health Care; ISBN 978-0-578-15264-6 or www.ichom.org).

If international data can be extrapolated to the Australian health care setting, then attempts to reduce variation in care may need to focus on training for older doctors and those working outside specialist children's hospitals. This may require hospital-wide policies, training and accreditation. The development, introduction and uptake of electronic order sets in electronic medical records is expected to facilitate reduction in unwarranted variation in effective care. Similarly, increased access to and uptake of clinical practice guidelines at the "point-of-care"

may also reduce unwarranted variation in care, particularly if electronic and smart-phone technology can facilitate this.

There is increasing interest in opportunities to investigate and reduce unwarranted variation in clinical care in Australia, as demonstrated by the Australian Commission on Safety and Quality in Healthcare's Australian Atlas on Healthcare Variation¹⁶ and the Choosing Wisely Australia¹⁷ campaign. This work is drawing upon existing data sources and includes some paediatric conditions. However, in the shadow of an aging Australian population, the challenge is to ensure an appropriate focus is maintained on the healthcare of children and the adults they will become. Furthermore, researchers should interrogate current data sources in partnership with policy makers and clinicians. Together, we should advocate for improvements in the systematic collection of health service data across all the sectors where children receive care, as well as explore initiatives to measure and monitor health outcomes.

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