

Appendix 2: Additional details relating to study methods

The main CTK paper[1] and its associated online appendix detail the methods of the larger study, which generated the data reported in this paper. Selected methods specifically relevant to abdominal pain are described below.

Sample size

A survey was defined as the aggregated set of condition-specific indicators as applied to an occasion of care (for inpatient care, an occasion of admitted care; for Emergency Department (ED) care, a single presentation; and for General Practitioners (GPs), a consultation). Without adjustment for the design effect, a minimum of 400 surveys per condition was required to obtain national estimates with 95% Confidence Interval (CI) and precision of +/- 5% at condition level. It was anticipated that loss of precision due to design effects would be largely offset by additional surveys generated by the secondary sampling.

Sampling Process

A multistage stratified random sampling process was implemented. For logistical efficiency, sampling was targeted at three states, Queensland (QLD), New South Wales (NSW) and South Australia (SA), which together comprise 60.0% of the Australian population aged 15 years or younger in the 2012 and 2013 calendar years. All six paediatric tertiary hospitals (two in QLD, three in NSW, and one in SA) were targeted as they have state-wide coverage. State Departments of Health organize care within Administrative Units (AUs): Hospital Health Services in QLD, Local Health Districts in NSW, and Local Health Networks in SA. For QLD, we targeted five AUs (two metropolitan, three regional), in NSW four AUs (two metropolitan, two regional), and in SA three AUs (two metropolitan, one regional).

Recruitment of health care providers

Within the selected AUs, we approached all public hospitals, or private hospitals providing public services under contract, that had patient volumes of $\geq 2,000$ ED presentations and ≥ 500 paediatric separations per year; we also advertised the study to GPs, and approached all the providers we could identify through internet searches, and via personal contacts. Within the selected health care providers (HCPs), we sampled medical records for each condition targeted at that HCP.

Allocation of surveys to sampling units

The number of abdominal pain records targeted at each HCP was determined by a nominal allocation of the 400 records targeted, informed by data available at the time, supplemented by expert opinion, with planned over-sampling of HCPs where fewer occasions of care were expected.[1, 2] For hospitals, a fixed number was targeted at each site; for GPs, different combinations of conditions were targeted at each site, to simplify the logistics of sampling.

Data collection

Nine experienced paediatric nurses were employed across the three states, with all nine assessing occasions of care for abdominal pain. The surveyors undertook a one-week training program, prior to data collection. A surveyor manual was developed which included instructions, condition-specific definitions, inclusion and exclusion criteria, and guidance for assessing eligibility of each encounter for relevant indicators.

A web-based tool, originally developed for the CareTrack Adults study[3, 4], was designed to enter data during medical record review. Algorithms to filter indicators by HCP type, and by age, were

embedded in the tool. There was one age- and two HCP-specific filters for abdominal pain: ABDO04 was restricted to girls aged 13 years and over; while ABDO16 and ABDO21 were restricted to ED presentations and inpatient admissions.

Surveyors undertook criterion-based medical record reviews using the data collection tool. Surveyors assessed the record for evidence that the participant presented for management of [condition] in the years 2012 and 2013. The surveyors responded to each indicator as 'Yes' (care provided during the encounter was consistent with the indicator), 'No', or 'Not Applicable' (NA; the indicator was not eligible for assessment). For example, a surveyor assessing an occasion of care for a child that presented with acute abdominal pain that was severe, would record 'NA' to indicator ABDO17 which only applies to children presenting with acute mild abdominal pain.

Analysis

Survey or register-derived data were used to estimate the proportion of occasions of care for abdominal pain.[5-10] The number of occasions of healthcare for each condition was thereby estimated for each HCP site, and sampling weights were calculated using the methods detailed in eAppendix 4 of the broader CTK study (this Appendix can be accessed by request via the corresponding author, if required).[1]

State and HCP-type were specified as strata, and the primary sampling unit (AU) was specified as the clustering unit. Domain analysis was used for analysing both indicators, packages and sub-packages.[11, 12]

References:

1. Braithwaite J, Hibbert PD, Jaffe A, White L, Cowell CT, Harris MF, et al. Quality of health care for children in Australia, 2012-2013. *JAMA*. 2018;319(11):1113-24.
2. Hooper TD, Hibbert PD, Mealing N, Wiles LK, Jaffe A, White L, et al. CareTrack Kids-part 2. Assessing the appropriateness of the healthcare delivered to Australian children: study protocol for a retrospective medical record review. *BMJ Open*. 2015;5(4):e007749.
3. Hunt TD, Ramanathan SA, Hannaford NA, Hibbert PD, Braithwaite J, Coiera E, et al. CareTrack Australia: assessing the appropriateness of adult healthcare: protocol for a retrospective medical record review. *BMJ Open*. 2012;2(1):e000665.
4. Runciman WB, Coiera E, Day RO, Hannaford NA, Hibbert PD, Hunt TD, et al. Towards the delivery of appropriate health care in Australia. *Med J Aust* 2012;197(2):78-81.
5. Britt H, Miller GC, Henderson J, Bayram C, Valenti L, Harrison C, et al. General Practice Activity in Australia 2012-13: BEACH: Bettering the Evaluation and Care of Health. Sydney, AU: Sydney University Press; 2013.
6. Harrison C. BEACH 2012-13 weighted data on frequency of management of selected conditions, for children aged 0-15, by General Practitioners. Sydney, AU: Menzies Centre for Health Policy, School of Public Health, The University of Sydney; 2017.
7. Australian Institute of Health and Welfare. Australian hospital statistics 2012–13: Emergency Department care. Canberra, AU: AIHW; 2013.
8. Queensland Health, New South Wales Health, South Australian Department of Health. Emergency Department data on frequency of management of selected conditions, for children aged 0-15. 2017.
9. Australian Institute of Health and Welfare. Australian hospital statistics 2012–13. Canberra, AU: AIHW; 2014.
10. Australian Institute of Health and Welfare. Inpatient separations for selected conditions, as identified by ICD-10 principal diagnoses 2017. Available from: <http://www.aihw.gov.au/hospitals-data/principal-diagnosis-data-cubes/>.
11. Lohr S. Sampling: design and analysis. Second ed. Boston, MA: Brooks/Cole; 2009.
12. Heeringa SG, West BT, Berglund PA. Applied survey data analysis. Boca Raton, FL: CRC Press; 2010.