Challenges of using asthma admission rates as a measure of primary care quality in children:
an international comparison

Supplement 1: additional tables and figures
| Jurisdiction | Hospital database                                                                                                                                 | Denominator population – data source | Definition of hospital admission | Definition of primary diagnosis | Hospital reimbursement mechanism | Outcomes available | Years of data available |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------|--------------------------------|--------------------------------|------------------|------------------------|
| Sweden       | https://www.ncbi.nlm.nih.gov/pubmed/21658213  
http://www.socialstyrelsen.se/register/halsodataregister/patientregistret/inglehish                       | http://www.socialstyrelsen.se/publikationer2003/2003-112-3  
https://link.springer.com/article/10.1007%2Fs10654-016-0117-y                  | Overnight stay                       | • Not formally defined but understood to reflect the main cause of care at the time of discharge | • Hospitals are reimbursed through a mixture of global budgets from county councils, hospital activity based case payment systems, and patient contributions. | • Primary  
• Any  
• ED | 2008-2012                  |
| England      | https://digital.nhs.uk/data-services/hospital-episode-statistics                                                                                   | https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland | All finished consultant episodes with admission date <=1 day after previous discharge date were included in the same admission. All hospital activities allocated an NHS bed are counted as an admission, including day cases and admissions | • The main condition treated or investigated during the relevant episode of care or main symptom when no diagnosis | • All NHS hospitals are reimbursed through an activity based case payment system | • Primary  
• Any | 2009-2013                  |
| Country | Website/Source | Length of Stay | Description | Funding | Notes |
|---------|----------------|----------------|-------------|---------|-------|
| Finland | [https://thl.fi/en/web/thlfi-en/statistics/information-on-statistics/register-descriptions/care-register-for-health-care](https://thl.fi/en/web/thlfi-en/statistics/information-on-statistics/register-descriptions/care-register-for-health-care) | Overnight stay | Reflects the diagnosis or procedure accounting for the highest cost to the hospital (determined at discharge) | Services are covered from user charges (<10%) and municipalities which make annual contracts with district hospitals based on an activity-based case payment system | • Primary  
• Any  
2009-2013 |
| Austria | [https://www.gesundheitsplanung.at/](https://www.gesundheitsplanung.at/) | Discharge after >1 day (night included) admission | Reflects the diagnosis or procedure accounting for the highest cost to the hospital (determined at discharge) | State level funding (there are 9 states in Austria) financed by a mixture of funds, including the state government through activity based allocation system insurance companies and others. | • Primary  
2010-2014 |
| Country | Iceland | Ontario |
|---------|---------|---------|
| Data Source 1 | https://www.landlaeknir.is/tolfraedi-og-rannsoknir/gagnasafn/itemi12464/Vistunarska-keilbrigdisstofnana. | https://www.cihi.ca/en |
| Data Source 2 | https://www.landlaeknir.is/english/statistics/population/inhabitants/ | https://www.ontario.ca/data/registered-persons-database-rpdb |
| | https://statice.is/statistics/population/inhabitants/ | |
| | | |
| Admission Criteria | At least one night | Finished consultant episode with admission date >=1 day after previous discharge |
| Length of Stay | Reflects the main reason for care (laboratory analysis or treatment) but not required. If an external injury is the cause for admission, two codes are to be provided. | Reflects the main reason for admission; what contributes to the greatest length of stay or use of resources |
| Funding | No direct payment for specific services; hospitals receive an annual budget by the government and are state-run | Hospitals are funded through a mixed model including on global funding; health based allocation model (predicted costs based on patient demographics); and quality-based procedure model (payment bundles) |
| Primary/ED | Primary | Primary |
| | ED | ED |
| Time Period | 2011-2015 | 2009-2015 |
| Victoria | https://www2.health.vic.gov.au/hospitals-and-health-services/data-reporting/health-data-standards-systems/data-collections/vaed | http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/3101.0Main+Features1Sep%202018?OpenDocument | Follows a clinical decision that a patient requires a hospital stay (could be same-day, overnight or multi-day care or treatment) [https://www2.health.vic.gov.au/about/publications/policiesandguidelines/Victorian-Admitted-Episodes-Dataset-manual-2019-2020](https://www2.health.vic.gov.au/about/publications/policiesandguidelines/Victorian-Admitted-Episodes-Dataset-manual-2019-2020) VAED Manual, Section 2 | • Reflects the main reason for an episode of admitted patient care, residential care or attendance at a healthcare establishment | • Public hospitals are reimbursed through an activity based case payment system | • Primary • Any | 2009-2012 |

1. Mihailovic N, Kocic S, Jakovljevic M. Review of Diagnosis-Related Group-Based Financing of Hospital Care. *Health services research and managerial epidemiology* 2016;3:. doi: 10.1177/2333392816647892
Table S2: Incidence rate ratios (IRRs)* with 95% confidence intervals (CIs) for asthma admission rates by jurisdiction compared to Sweden (baseline), according to whether asthma was recorded as the primary or any diagnosis

| Jurisdiction | Primary diagnosis | Any diagnosis |
|--------------|-------------------|--------------|
| Sweden       | 1 (baseline)      | 1 (baseline) |
| England      | 7.19 (6.79, 7.61) | 10.84 (10.45, 11.23) |
| Finland      | 1.44 (1.33, 1.56) | 1.22 (1.16, 1.29) |
| Austria      | 2.55 (2.38, 2.73) | No data |
| Iceland      | 0.32 (0.20, 0.51) | No data |
| Ontario      | 1.94 (1.83, 2.07) | 1.24 (1.19, 1.29) |
| Victoria     | 8.20 (7.71, 8.72) | 3.58 (3.43, 3.74) |

*Adjusted for age group and sex
| Jurisdiction | Gender | Age (years) | Asthma admission rate / 1000 child years (95% CI) | Asthma admission rate / 1000 child years (95% CI) | ED attendance rate / 1000 child years (95% CI) |
|--------------|--------|-------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
|              |        |             | Asthma admission rate / 1000 child years (95% CI) | Primary diagnosis                              | any diagnosis                                 |
| Austria      | Boys   | 6 to 9      | 1.09 (1.03-1.17)                                | -                                             | -                                             |
|              |        | 10 to 12    | 0.91 (0.84-0.99)                                | -                                             | -                                             |
|              |        | 13 to 15    | 0.46 (0.41-0.51)                                | -                                             | -                                             |
|              | Girls  | 6 to 9      | 0.61 (0.56-0.67)                                | -                                             | -                                             |
|              |        | 10 to 12    | 0.37 (0.33-0.43)                                | -                                             | -                                             |
|              |        | 13 to 15    | 0.48 (0.42-0.53)                                | -                                             | -                                             |
| England      | Boys   | 6 to 9      | 2.96 (2.91-3.00)                                | 8.92 (8.85-8.99)                               | -                                             |
|              |        | 10 to 12    | 2.07 (2.03-2.11)                                | 8.19 (8.10-8.27)                               | -                                             |
|              |        | 13 to 15    | 1.27 (1.24-1.31)                                | 7.80 (7.72-7.88)                               | -                                             |
|              | Girls  | 6 to 9      | 1.84 (1.81-1.87)                                | 5.44 (5.38-5.50)                               | -                                             |
|              |        | 10 to 12    | 1.60 (1.56-1.64)                                | 5.54 (5.47-5.61)                               | -                                             |
|              |        | 13 to 15    | 1.38 (1.35-1.42)                                | 7.69 (7.61-7.77)                               | -                                             |
| Finland      | Boys   | 6 to 9      | 0.72 (0.66-0.79)                                | 1.40 (1.31-1.50)                               | -                                             |
|              |        | 10 to 12    | 0.37 (0.31-0.43)                                | 0.843 (0.76-0.93)                              | -                                             |
|              |        | 13 to 15    | 0.27 (0.23-0.32)                                | 0.68 (0.61-0.76)                               | -                                             |
|              | Girls  | 6 to 9      | 0.38 (0.33-0.43)                                | 0.74 (0.67-0.81)                               | -                                             |
|              |        | 10 to 12    | 0.23 (0.19-0.28)                                | 0.54 (0.48-0.62)                               | -                                             |
|              |        | 13 to 15    | 0.21 (0.17-0.26)                                | 0.55 (0.48-0.62)                               | -                                             |
| Iceland      | Boys   | 6 to 9      | 0.24 (0.12-0.44)                                | -                                             | 5.70 (4.50-6.48)                              |
|              |        | 10 to 12    | 0.12 (0.03-0.32)                                | -                                             | 4.98 (5.24-5.81)                              |
|              |        | 13 to 15    | 0.06 (0-0.22)                                   | -                                             | 5.47 (4.70-6.34)                              |
| Region  | Group  | Age  | ETS     | AIC     | AUC     |
|---------|--------|------|---------|---------|---------|
| Ontario | Boys   | 6 to 9 | 0.02 (0.0-0.13) | - | 2.79 (2.32-3.34) |
| Girls   | 10 to 12 | 0 (0-0.12) | - | 2.94 (2.37-3.60) |
|         | 13 to 15 | 0.03 (0-0.19) | - | 4.87 (4.12-5.74) |
|         | Girls   | 6 to 9 | 0.99 (0.95-1.03) | 1.46 (1.41-1.52) | 7.68 (7.56-7.79) |
|         | 10 to 12 | 0.51 (0.48-0.55) | 0.82 (0.78-0.87) | 5.53 (5.42-5.64) |
|         | 13 to 15 | 0.21 (0.19-0.23) | 0.49 (0.46-0.52) | 3.15 (3.07-3.23) |
|         | Boys    | 6 to 9 | 0.66 (0.63-0.69) | 0.96 (0.92-1.00) | 4.24 (4.15-4.33) |
| Girls   | 10 to 12 | 0.35 (0.32-0.38) | 0.56 (0.52-0.60) | 3.31 (3.22-3.40) |
|         | 13 to 15 | 0.19 (0.17-0.21) | 0.50 (0.47-0.54) | 3.24 (3.16-3.33) |
|         | Boys    | 6 to 9 | 0.48 (0.44-0.52) | 0.94 (0.87-1.00) | 3.65 (3.53-3.77) |
|         | 10 to 12 | 0.24 (0.20-0.28) | 0.69 (0.62-0.75) | 3.26 (3.12-3.40) |
|         | 13 to 15 | 0.14 (0.11-0.17) | 0.59 (0.54-0.65) | 2.01 (1.91-2.12) |
|         | Girls   | 6 to 9 | 0.32 (0.28-0.36) | 0.62 (0.57-0.68) | 2.15 (2.06-2.25) |
|         | 10 to 12 | 0.15 (0.12-0.19) | 0.49 (0.44-0.55) | 1.97 (1.86-2.08) |
|         | 13 to 15 | 0.17 (0.14-0.21) | 0.61 (0.55-0.67) | 2.03 (1.92-2.14) |
| Sweden  | Boys    | 6 to 9 | 4.1 (3.98-4.32) | 4.47 (4.29-4.65) | - |
|         | 10 to 12 | 1.98 (1.85-2.12) | 2.21 (2.07-2.36) | - |
|         | 13 to 15 | 0.92 (0.83-1.02) | 1.06 (0.97-1.17) | - |
|         | Girls   | 6 to 9 | 2.72 (2.58-2.86) | 3.03 (2.88-3.18) | - |
|         | 10 to 12 | 1.46 (1.34-1.59) | 1.61 (1.48-1.74) | - |
|         | 13 to 15 | 0.99 (0.90-1.10) | 1.11 (1.01-1.23) | - |
Table S4: Incidence rate ratios (IRRs)* with 95% confidence intervals (CIs), asthma admission rates by jurisdiction to Sweden, according to with asthma recorded as the primary diagnosis and no zero day admissions

| Jurisdiction | IRR (95% CI)    |
|--------------|-----------------|
| Sweden       | 1 (baseline)    |
| England      | 4.61 (4.30-4.94)|
| Finland      | 1.43 (1.32, 1.55)|
| Austria      | 2.53 (2.36, 2.70)|
| Iceland      | 0.32 (0.20, 0.51)|

*Adjusted for age group and sex
Figure S1. Asthma admission rates (by age and gender) including and excluding zero day admissions in England