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TECHNICAL NOTES

Ontario Antimicrobial Stewardship Program and Antimicrobial Resistance (ASP & AMR) Comparison Tool

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Background

Antimicrobial stewardship is an Accreditation Canada Required Organizational Practice (ROP) for facilities providing inpatient acute care, inpatient cancer, inpatient rehabilitation and complex continuing care services.[1] In 2020, Health Standards Organization (HSO) released the CAN/HSO 5030:2020 (E) Antimicrobial Stewardship Program Standard, which is a resource to support organizations in quality improvement related to antimicrobial use and antimicrobial resistance.[2]

To understand the changing landscape of antimicrobial stewardship programs (ASP), Public Health Ontario (PHO) periodically conducts surveys of hospitals in Ontario. As part of each survey, hospital corporations are able to authorize the sharing of their information on the PHO website for the purpose of providing corporations a means to share information regarding their antimicrobial stewardship activities and insights into how ASPs are advancing in peer hospitals. The Ontario Antimicrobial Stewardship Program and Antimicrobial Resistance (ASP & AMR) Comparison Tool summarizes this and other provincial level data about antimicrobial use (AMU) and antimicrobial resistance.[3]

Data Sources

Hospital ASP activities and hospital AMU are provided by hospitals via the PHO Ontario ASP Landscape Survey. This voluntary online survey, which is conducted every 2-3 years. The survey is distributed to all hospital corporations in Ontario, except for those that primarily deliver mental health or ambulatory services. Distribution is targeted to reach the individual most responsible for antimicrobial stewardship in each hospital/corporation, usually an ASP pharmacist or physician. The intent is to obtain one response per hospital/corporation unless the organization has multiple sites and wished to submit separate site-specific responses.

In addition to participating in the survey, organizations may authorize PHO to share their ASP, AMU and/or antibiogram data on the ASP/AMR Comparison Tool. The representativeness of the data continues to change over time, as organizations are able to decide to participate or withdraw their participation at any time. Each hospital profile includes a date which indicates when the information was last updated.

Antimicrobial use from non-hospital settings is provided by IQVIA from the Geographic Prescription Monitor (GPM) database. The GPM database includes dispensing data from community pharmacies,

insurance claims, and sales data. A geo-spatial algorithm is applied to estimate prescription counts from pharmacies not included in the database to project to 100% of the Ontario population.[4]

Antimicrobial susceptibility data are provided in the Ontario Antibiogram. Please see the separate technical notes for this tool.[5]

Data Limitations

All data with the exception of hospital type and region are self-reported. Due to the self-reported nature of this data, the presence or absence of a formalized ASP may not be synonymous with Accreditation Canada's ROP criteria. For example, it is possible that a site reported not having a formalized ASP in this survey despite technically meeting the major and minor criteria of Accreditation Canada's Antimicrobial Stewardship ROP and vice-versa.[1]

Data is generally reported at a hospital corporation level unless site-specific responses were provided. All information is provided on an "as-is" basis. PHO cannot and does not warrant or represent that the information is accurate, complete, reliable or current.

Missing Data

The Ontario ASP & AMR Comparison Tool only contains information about hospitals/corporations that have responded to the Ontario ASP Landscape survey and authorized PHO to share their data.

Therefore, no assumptions regarding the presence or absence of an ASP, strategies that are in place and the availability of AMU should be made about hospitals/corporations that are not listed within the tool. Hospitals/corporations can withdraw at any time. The term "not available" means that an organization has not provided data for a particular field; "not applicable" means that the data field is not relevant based on an organization's ASP structure. Any hospitals/corporations that would like to participate can contact asp@oahpp.ca.

Hospital ASP Information

Hospital ASP

1. There are six data tabs:

- **Program Structure** – This table compares structural elements of ASPs and provides contact information.
- **Clinical** – This table compares the implementation status of clinical strategies* at each hospital/corporation.
- **Prescribing Guidance** – This table compares the implementation status of prescribing guidance strategies* at each hospital/corporation.
- **Microbiology** – This table compares the implementation status of microbiology-related strategies* at each hospital/corporation.
- **Formulary** - This table compares the implementation of formulary-related strategies* at each hospital/corporation.

- **Structural/Process** - This table compares the implementation of structural/process strategies* at each hospital/corporation.

  *Definitions and details about each of the 32 strategies are available on the Antimicrobial Stewardship Strategies webpage.[6]

2. Results can be filtered by:
   - Hospital/Corporation name
   - Ontario Hospital Association (OHA) hospital type (acute teaching, large community, small community, complex continuing care & rehabilitation)
   - Region
3. The comparison table can be sorted by clicking on any of the column headers. Clicking on the Hospital/Corporation name within the comparison table will open the Hospital/Corporation Profile.

Hospital/Corporation Profiles

1. The profile displays detailed information about an individual hospital/corporation's ASP.
2. Clicking on the individual ASP strategies will open the corresponding PHO Antimicrobial Stewardship Strategy document in a new window.

Hospital Antibiotic Use Comparison

Participating hospitals provided antibiotic use data at the hospital level. Antibiotic use data represents all antibacterial agents in the World Health Organization (WHO) Anatomic Therapeutic J01 classification.[7]

The denominator is inpatient days. The metric is expressed as Defined Daily Doses (DDDs) per 1000 patient days or Days of Therapy (DOTs) per 1000 patient days.

1. Results are presented as unadjusted DDD or DOT.
2. Results can be filtered by the following:
   - Antibiotic Use Outcome (Defined Daily Dose [DDD] or Days of Therapy [DOT])
   - Hospital Name
   - Hospital Type
   - Region
3. Data are summarized visually in a dynamic chart, based on the hospitals selected from the filter. Hospital type and regional averages include an aggregate sum of all hospitals that provided data. Whereas individual hospital data will only appear for hospitals that agreed to be identified. Aggregate sum across hospital types and regions was weighted by patient days for each facility that provided data.
4. The comparison table can be sorted by clicking on the Hospital column header. Clicking on the Hospital name within the comparison table will open the Hospital Profile
5. All antibiotic use data can be downloaded in CSV/Excel format by clicking link on top right of page.

Hospital AMU Metrics

Defined Daily Dose (DDD) is "the assumed average maintenance dose per day for a drug used for its main indication in adults," as specified by the WHO.[7] DDD are often standardized to 1,000 patient days (DDD/1,000 patient days) to allow comparison between hospitals or services of different sizes.

Days of Therapy (DOT) is the number of days that a patient receives an antimicrobial agent (regardless of dose). Any dose of an antibiotic that is received during a 24-hour period represents 1 DOT. The DOT for a given patient on multiple antibiotics will be the sum of DOT for each antibiotic that the patient is receiving. DOT is often standardized to 1,000 patient days (DOT/1,000 patient days) to allow comparison between hospitals or services of different sizes.

Observed DDD or DOT refers to hospital reported antibiotic use data.

Hospital AMU Risk Adjustment

Expected DDD or DOT refers to predicted antibiotic use based on characteristics of the facility's patient population. A negative binomial regression model was developed to identify factors associated with antibiotic use across participating facilities. Hospital data for all patients discharged in each corresponding year were extracted from the Discharge Abstract Database (DAD), National Rehabilitation Reporting System (NRS), Ontario Mental Health Reporting System (OMHRS) and Continuing Care Reporting System (CCRS). Two separate models were developed for hospitals reporting DDDs and hospitals reporting DOTs. The following most important variables were included in the model:

- Proportion of visits that include an ICU stay (neonatal ICU visits were excluded)
- Proportion of patients less than 18 years of age
- Proportion of patients receiving rehabilitation, complex continuing care, and mental health medical services

Observed vs. Expected Ratio (O:E ratio) is the ratio of observed to expected antibiotic use for a specific hospital and is calculated by dividing the observed antibiotic use by the expected antibiotic use. For example, if a hospital's observed (actual) use is 500 DOT/1000 patient days, but its predicted use is 400 DOT/1000 patient days, the O:E ratio would be 1.25. The O:E ratio can be viewed by hovering over the observed data for each facility.

- O:E ratio **> 1** indicates that a hospital's antibiotic use is higher than expected
- O:E ratio **=1** indicates that a hospital's antibiotic use is similar to expected
- O:E ratio **< 1** indicates that a hospital's antibiotic use is less than expected

Given that there is uncertainty in the expected antibiotic use, the O:E ratio includes a 95% confidence interval to account for this uncertainty. In situations where O:E ratio does not cross 1, this indicates the hospital's observed use differs significantly from expected. However, statistical significance should be interpreted with caution and does not necessarily equate to a clinically significant difference.
For more information on how these metrics are calculated, please visit PHO's Metrics Examples document.[8]

Data Sources for Risk Adjustment:

- Inpatient Discharges (DAD), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO.

- Continuing Care Reporting System (CCRS), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO.Adult Mental Health (OMHRS), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO
- Inpatient Rehabilitation (NRS), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO.

Community Antibiotic Use Information

Community antibiotic use data is provided for oral systemic antibacterial agents (J01 Anatomic Therapeutic Chemical Classification System as per WHO)[6] and measured as prescriptions per 1000 population for each year. Ontario population data is from the Ontario Ministry of Finance.[9] In addition to year, data are stratified by:

- Provider speciality
  - General Practitioner/Family Medicine (GP/FM)
  - Dentist
  - Other (non-GP/FM) or other healthcare provider
  - All
- Patient Sex
  - Male
  - Female
  - All
- Age Group
  - <18 years
  - 18-64 years
  - 65+ years
  - All
- Antibiotic category
  - Penicillin without beta-lactamase inhibitor (e.g., amoxicillin)
  - Penicillin with beta-lactamase inhibitor (e.g., amoxicillin-clavulanate)
  - First-generation cephalosporin (e.g., cephalexin)
  - Second- and third-generation cephalosporins (e.g., cefuroxime, cefixime)
  - Second-generation fluoroquinolones (e.g., ciprofloxacin)
  - Third-generation fluoroquinolones (e.g., levofloxacin)
  - Macrolides (e.g., azithromycin)
  - Trimethoprim and/or sulfonamides (e.g., trimethoprim-sulfamethoxazole)

- Tetracyclines (e.g., doxycycline)
- Lincosamides (i.e., clindamycin)
- Nitrofurantoin
- Metronidazole
- Other agents (e.g., fosfomycin)
- All agents combined

Users can select variables each of the above variables to compare by and/or filter.

Data are summarized in a table as well as line graph showing antibiotic prescriptions per 1000 population associated with the corresponding selection.

All antibiotic use data can be downloaded in CSV/Excel format by clicking link on top right of the display area.

References

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Contact

For more information, please contact asp@oahpp.ca.

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Public Health Ontario

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