

WHO methodology for point prevalence surveys on antibiotic use in hospital

#### **SEAR 2022 AMS Webinar Series**

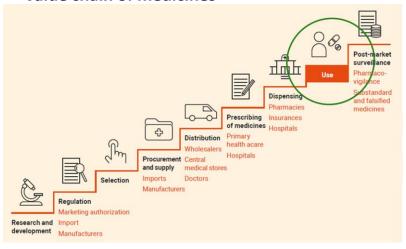
Hospital Antimicrobial Consumption Surveillance and Point Prevalence surveys on antibiotic use

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## Antimicrobial use data

- Estimates derived from patient-level data sources: patient records, electronic health records
- Disaggregation of data based on:
  - patient characteristics (gender, age, risk factors) indication, diagnosis route of administration, dose, duration
- Detailed information on prescribing practices
  - Determine the patients' symptoms, physician diagnoses and medications prescribed.
  - Assessment of clinical practice against agreed protocols and treatment guidelines
- Different study designs
  - Retrospective study
  - Prospective study
  - Cross-sectional study ⇒ Point Prevalence Ssurvey (PPS)

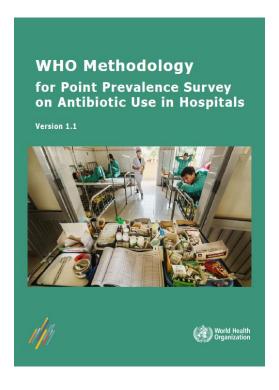
#### Value chain of medicines





## WHO methodologies for Point Prevalence Survey on antibacterial use in Hospitals





https://www.who.int/publicatio ns/i/item/WHO-EMP-IAU-2018.01

- WHO PPS methodology published in February 2019
  - Based on existing methodologies
  - ➤ Adapted to LMIC while comparable with data collected in HIC
  - Cross sectional : provides a "snapshot" of antibiotic use at one point in time to:
    - → assess use of antibiotics and appropriateness of therapies
    - → inform antimicrobial stewardship interventions
    - → if repeated, to assess the impact of interventions
  - Protocol associated to a pilot data collection and analysis tool
- It has been applied in many countries in Africa, America, Eastern Mediterranean and West Pacific - > methodology will be revised based on the initial phase





# WHO Point Prevalence Survey: Overall principles



#### METHODOLOGY

Cross-sectional survey -> Snapshot

#### SCOPE

- Single center surveys
- Multicenter (global / regional / national) surveys

#### TARGET POPULATION / INCLUSION CRITERIA

- ➤ Only acute care hospitals
- Only acute care inpatient wards
- > Patients hospitalized as inpatients at or before the defined hour (e.g., 8 am) regardless of whether they are on antibiotic therapy
- > Antibiotics for oral, parenteral, rectal, inhalation administration that are part of ongoing treatment at the defined hour (e.g., 8 am)

#### SOURCE OF DATA

- National statistics
- ➤ Hospital statistics
- ➤ Patients' documentation (e.g., medical records, drug charts, temperature charts)





# Sampling framework



- HOSPITALS: for multicenter National surveys:
  - ➤ Census
  - ➤ Convenience sampling
  - ➤ Representative Sampling: WHO PPS methodology is based on the ECDC PPS methodology

#### WARDS:

- >ALWAYS includes all the acute care inpatients ward
- PATIENTS: depend on the hospital size and it is applied withing the wards
  - > Hospitals < 500 total inpatient beds: include all eligible patients
  - ➤ Hospitals 500 to 800 total inpatient beds: include one out of two patients
  - ➤ Hospitals over 800 total inpatient beds: include one out of three patients

https://www.ecdc.europa.eu/en/healthcare-associated-infections-acute-care-hospitals/surveillance-disease World Healthcare data/database

# Sampling design for representative sample of the hospitals

- Information needed: list of all acute care hospitals and for each the number of acute hospital beds (and eventually type of hospital)
- Calculation of the Sample Size:

Methodology for sample size for proportion in a population

- Population size: total national number of acute hospital beds
- National expected prevalence of AMU: 40% (precision ± 4%)
- Design effect: hospitals are clusters of patients. Depend on the country-average hospital size (i.e., average acute hospital beds).
  Based on PPS conducted in acute care hospitals in the European Union

Hospital size: country average acute hospital beds	Design effect for antibiotic use
< 80 beds	6.5
80 - 139 beds	10.1
140 - 229 beds	11.7
229 - 379 beds	16.7
≥ 380 beds	18.7

## **Example in country A**

- Number of inpatient beds: 23 114
- ➤ Number of acute care hospitals: 127
- > Average hospital size: 182 beds (23114/127)
- > Design effect: 11.7

Open Epi tool: <a href="http://www.openepi.com/Menu/OE">http://www.openepi.com/Menu/OE</a> Menu.htm

Sample Size(n) for Various Confidence Levels

ConfidenceLevel(%)	Sample Size
95%	6579
80%	2853
90%	4667
97%	8021
99%	11164
99.9%	17756
99.99%	24198

Equation

Sample size  $n = [DEFF*Np(1-p)]/[(d^2/Z^2_{1-\alpha/2}*(N-1)+p*(1-p)]$ 

Sample size

N beds: 6579 (at a 95% confidence level).

N hospitals: at least 51 (6579/182)



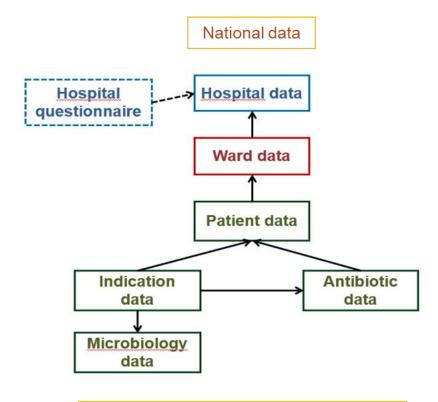


Surveillance System

# Data elements

- Country data: information on the number and type of hospitals in the country and the sampling strategy adopted for the survey. Overview of the representativeness for the hospitals included in multicenter / national survey
- **Hospital data:** describe the type of hospital, the volume of activity and provide information on the survey. It allows interpreting differences across hospitals
- Hospital questionnaire: optional, but allows to collect information on structural, policy and monitoring indicators related to diagnostic, prescriptions and stewardship practices
- **Wards data:** describe the wards included in the survey by type of wards and volume of patients present or eligible for the survey
- **Patients-indication-antibiotic data:** a set of patients' demographic and risk factors data, information on the indication (s) for the treatment and of the antibiotic(s) the patient is on the day of the survey.





**Relational database** 





# Data collection and analysis tool



- Data collection: it is a relational data base
- WHO developed a pilot IT tool for countries to:
  - enter and validate the PPS data in a relational data base
  - access predefined analytical reports at facility and country level
  - download their data
  - submit anonymous data to WHO
- WHO will develop a new platform based on the pilot experience
  - Internal discussion on how to provide the tools to everyone later





# Main types of outputs

- Description of hospitalized patients
  - Demographic (age /gender)
  - Presence of risk factors (surgery since admissions, transfer from other facilities, comorbidities, invasive devices)
- Proportion of patients on antibiotic therapy overall and by:
  - Hospital characteristics, Ward characteristics
  - Patient characteristics : Age, gender
  - Risk factors / comorbidities surgery, invasive devise, comorbidities...
- Antibiotics prescription profile by:
  - Antibiotic substances:
    - Hospital characteristics
    - Ward characteristics
    - Patient characteristics: Age, gender, surgery, invasive devise, comorbidities...
    - Type of indications and diagnosis
    - AWaRe
- Optional:
  - Missed doses and reason
  - Compliance with guidelines Dosage regimes





# Conducting the PPS survey

#### Planification:

- Establish the framework (national vs hospital)
- > Establish the coordination national/hospital
- Define Hospital sampling strategy and hospital selection (if multicenter)
- > Adapt the WHO protocol and data collection tools (paper-base and or electronic)
- > Ethical committee (national/hospital)
- ➤ Budget: ensure cost for preparation and implementation phases (papers if paper-based data collection, internet if online data-collection, manpower, logistics of the external investigation teams (transport, accommodation...)

#### Preparation:

- Establish investigators team: one national team vs. several hospital teams
- > Training: National->Hospital coordinators-> investigation teams
- **➢** Pilot

#### • Implementation:

- > Actual survey (day to day management, daily ward surveys) > not more than 3 weeks per hospital
- ➤ Data entry / validation
- Data analysis

#### Dissemination of the results:

hospitals / nationally / internationally







# Antibiotics Antivirals Antifungals Antiparasitics

# Sampling design for representative sample of the hospitals

- Sample selection representative by the sample size
- List of all hospitals in the country in ascending order according to the number of beds
- Sample interval: divide the total number of hospitals by the number of hospital to be sampled
- Choose a random number I between 1 and k and select the ith hospital, the ith +k hospital, the ith +2k hospital, the ith +3k hospital, etc.
- If the first selected hospital declines participation, select the next hospital on the list (ith+1 hospital, ith+k +1 hospital, etc.).

Hospital size: country	
average acute hospital	Design effect for
beds	antibiotic use
< 80 beds	6.5
80 - 139 beds	10.1
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229 - 379 beds	16.7
≥ 380 beds	18.7

ECDC table of design effects for antibiotic use based on PPS conducted in acute care hospitals in the European Union

## **Example**

- ➤ Number of inpatient beds: 23 114
- ➤ Number of acute care hospitals: 127
- ➤ Average hospital size: 23 114/127= 182 beds

## Sample size

N beds: 6579 (at a 95% confidence level).

**N hospitals:** at least 36 (6579/182)

## **Hospital selection**

- List the 127 hospitals according to the number of inpatient beds
- The sampling interval k is 127/36 = 3 (3.5 rounded down to 3)
- The random number i is chosen between 1 and 3.
- If the random number is 3, then you select the 3rd, 6th, .... 126th



# Data elements

## **Country:**

For national or supranational surveys

TotalNumberHospital
NumberPublicHospital
NumberNonPublicHospital
NumberTertiaryHospital
NumberSecondaryHospital
NumberPrimaryHospital
NumberSpecialityHospital
NumberSpecialityHospital
NationalHospitalGroups
HospitalSampling
HospConvenSampling
InvitedHospital
NationalGuideline
LocalGuideline

## **Hospital:**

For all included hospitals

HospitalID

Group

GroupCode

GroupAllSitesIncluded

Type

TypeSpeciality

Ownership

HospitalTotalBeds

HospitalAcuteBeds

HospitalICUBeds

HospitalHighRiskBeds

HospitalAnnualAdmissions

Hospital Annual Patient Days

SurveyStartDate

SurveyEndDate

HospitalIncludedBeds

**HospitalEligiblePatients** 

HospitalIncludedPatients

**PatientSampling** 

## Ward: For all included wards

HospitalID WardID

Type

Specialty (up to 5)

Investigator

WardSurveyDate
WardTotalPatients

WardEligiblePatients
WardIncludedPatients

### **Patient:**

For ALL included patients

HospitalID WardID

PatientID

Gender

AgeYear

AgeMonth PreTermBirth

Child12YearWeight

NeonatesBirthWeight

AdmissionDate

SurgerySinceAdmission

TypeSurgerySinceAdmission

CentralVascularCatheter

PeripheralVascularCatheter

UrinaryCatheter

Intubation

PatientOnAntiobitic

**PatientNumberAntibiotics** 

MalariaStatus

TuberculosisStatus

**HIVStatus** 

HIVOnART

HIVCD4Count

McCabeScore

MalnutritionStatus

COPDStatus

TransferFromHospital

Hospitalization90Days

TransferFromNonHospital

Indication(s):

For patients on antibiotic. One or more per patient

HospitalID

WardID

**PatientID** 

IndicationCounter

IndicationType

SurgicalProphylaxisDuration

SurgicalProphylaxisSite

Diagnosis

StartDateTreatment

ReasonInNotes

CultureSampleTaken

SpecimenType

CultureResults

**ASTResults** 

Microorganism

ResistantPhenotype

Antibiotic(s): For patients on antibiotic. One or more per indication

HospitalID WardID

PatientID

IndicationCounters
AntibioticCounter

StartDateAntibiotic

AntibioticNotesName

AntibioticWrittenInINN AntibioticCombination

UnitDoseFrequency

AdministrationRoute

ParenteralType

OralSwitch

PrescriberType

MissedDoses

NbMissedDoses

MissedDosesReason GuidelinesCompliance

AntibioticINNName

UnitDose

UnitDoseMeasureUnit



Core data elements – relation across database

**Core data elements** 

**Optional data elements** 



**NationalAMS**