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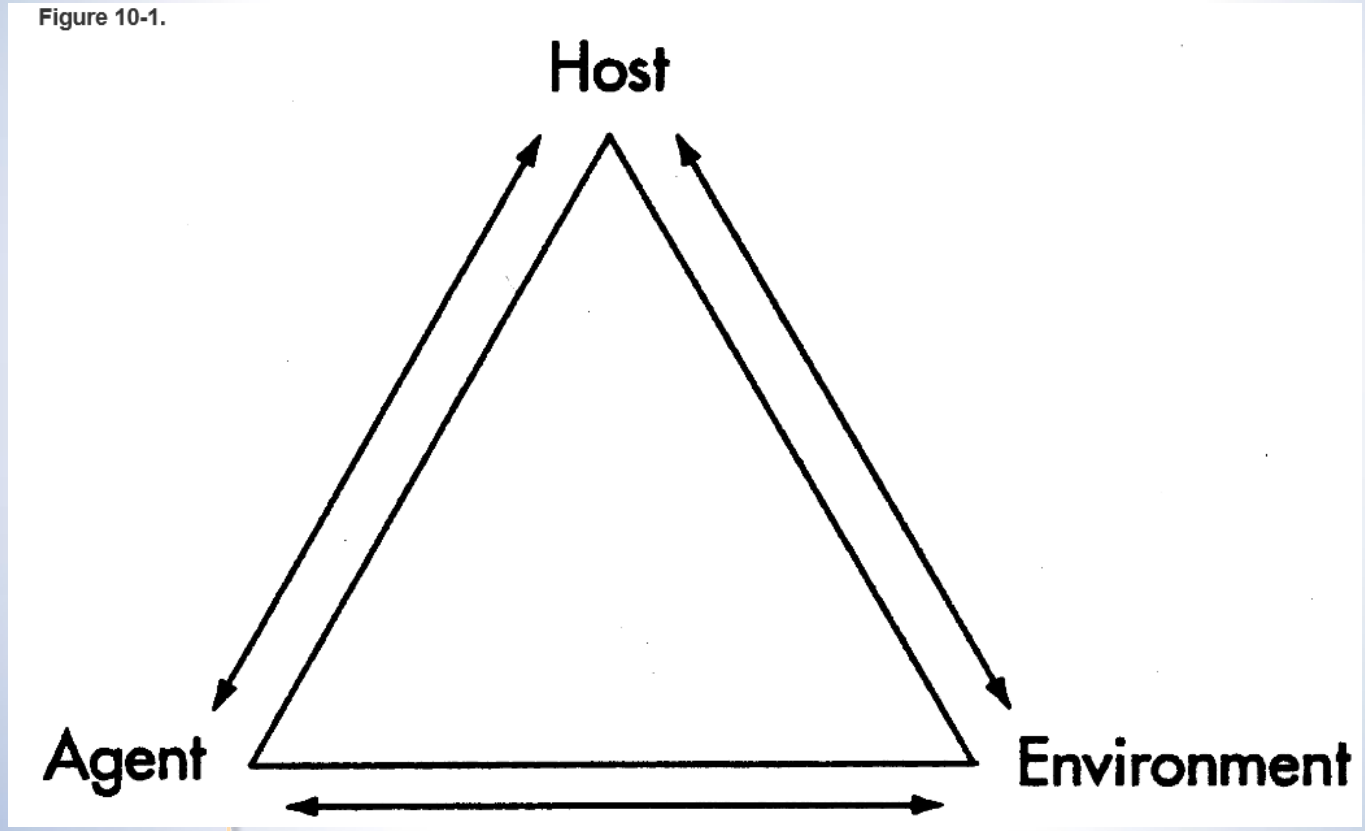
Surveillance and Epidemiology

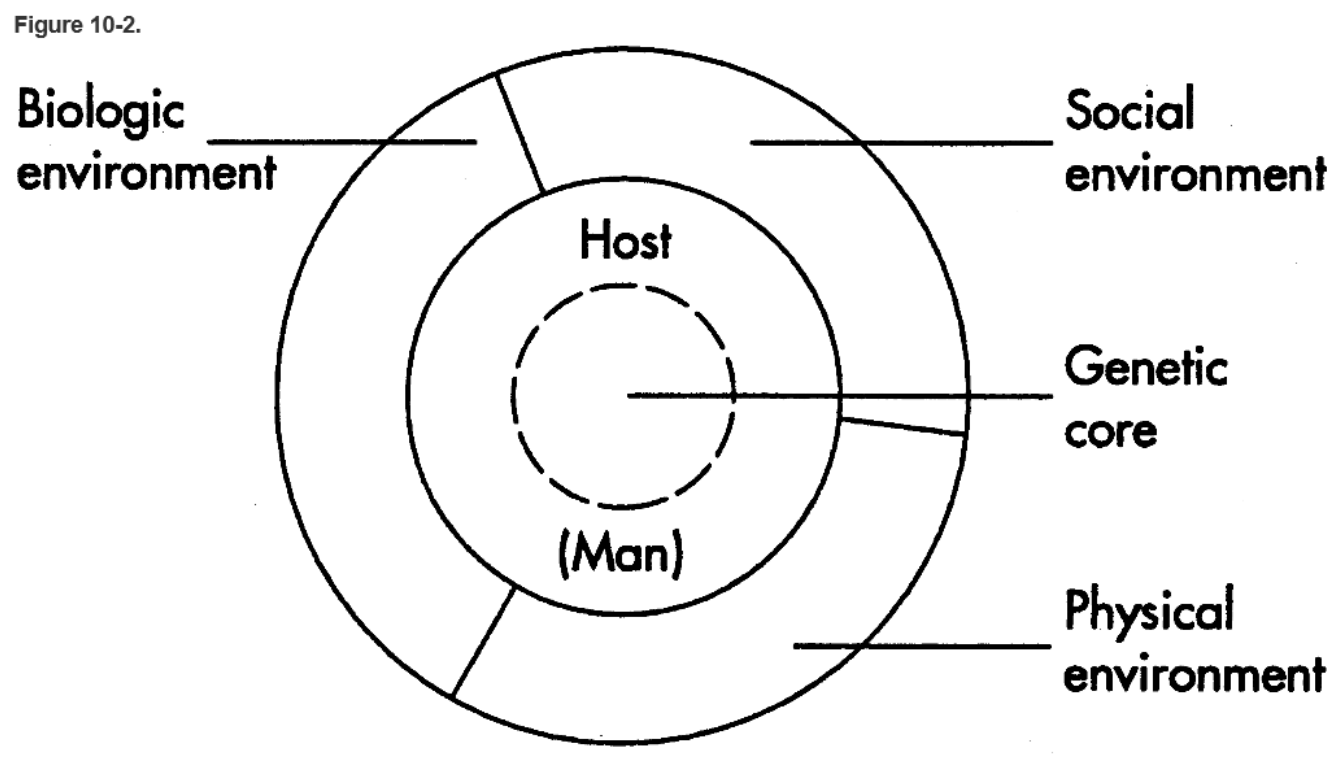
Key Epidemiology Concepts

- Understanding of the cause of a disease by knowing its distribution; determinants in terms of person, place, and time; and natural history
- Understanding the elements involved in the transmission of infection to develop strategies that target specific areas in the process
- Correct presentation of data to demonstrate outcomes and relationships in a manner that will likely encourage collaboration

Epidemiologic Triangle Model of Disease Causation

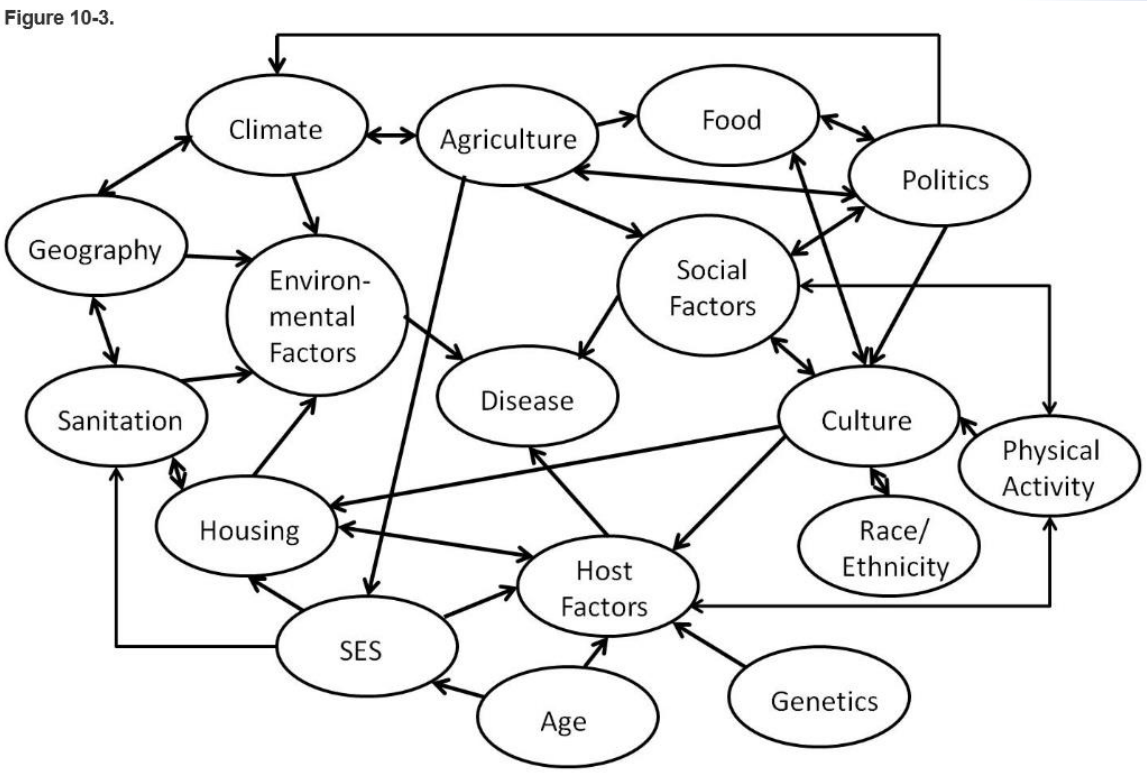


Wheel Model of Disease Causation



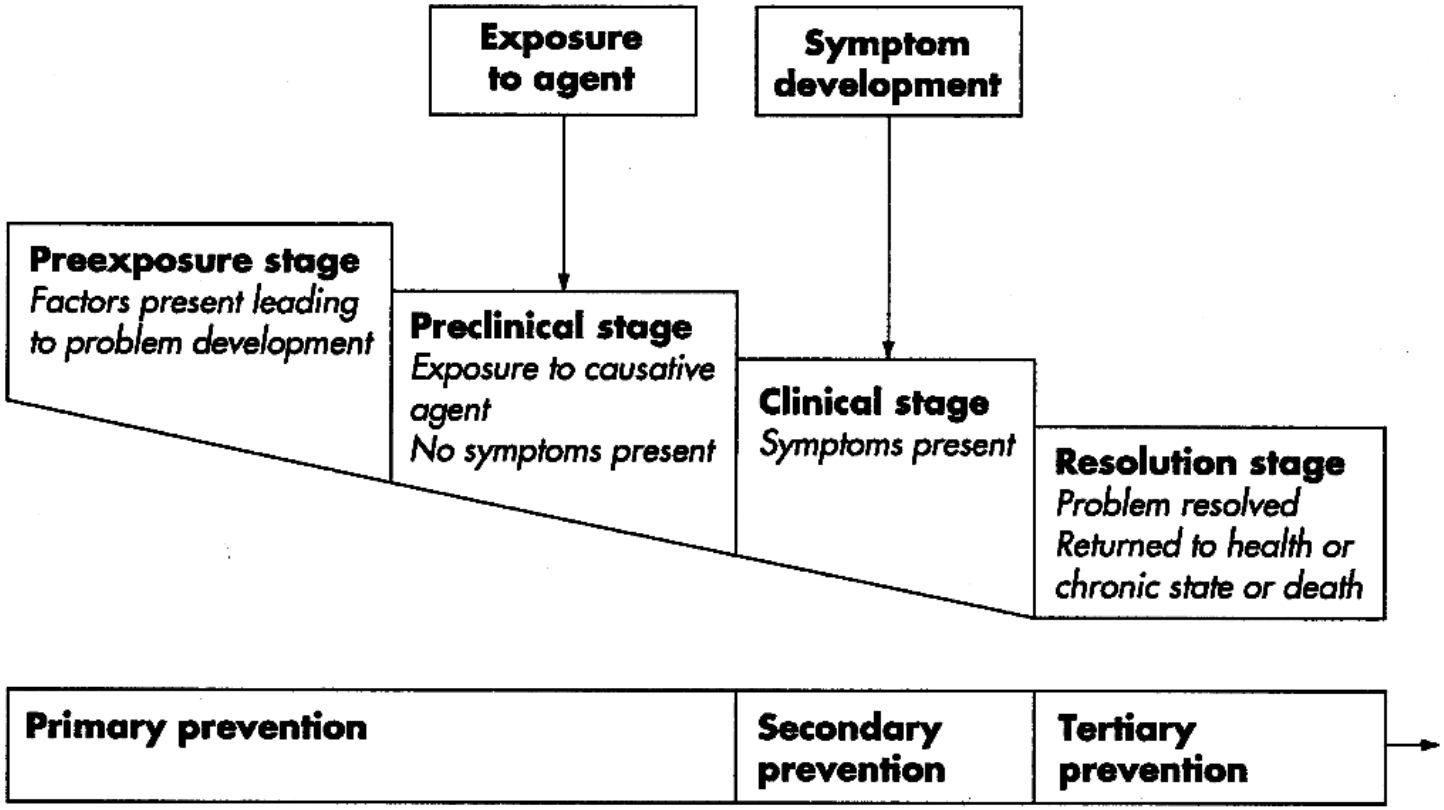
Web Model of Disease Causation

Figure 10-3.



Stages of Disease

Figure 10-4.



Epidemiology Key Terms

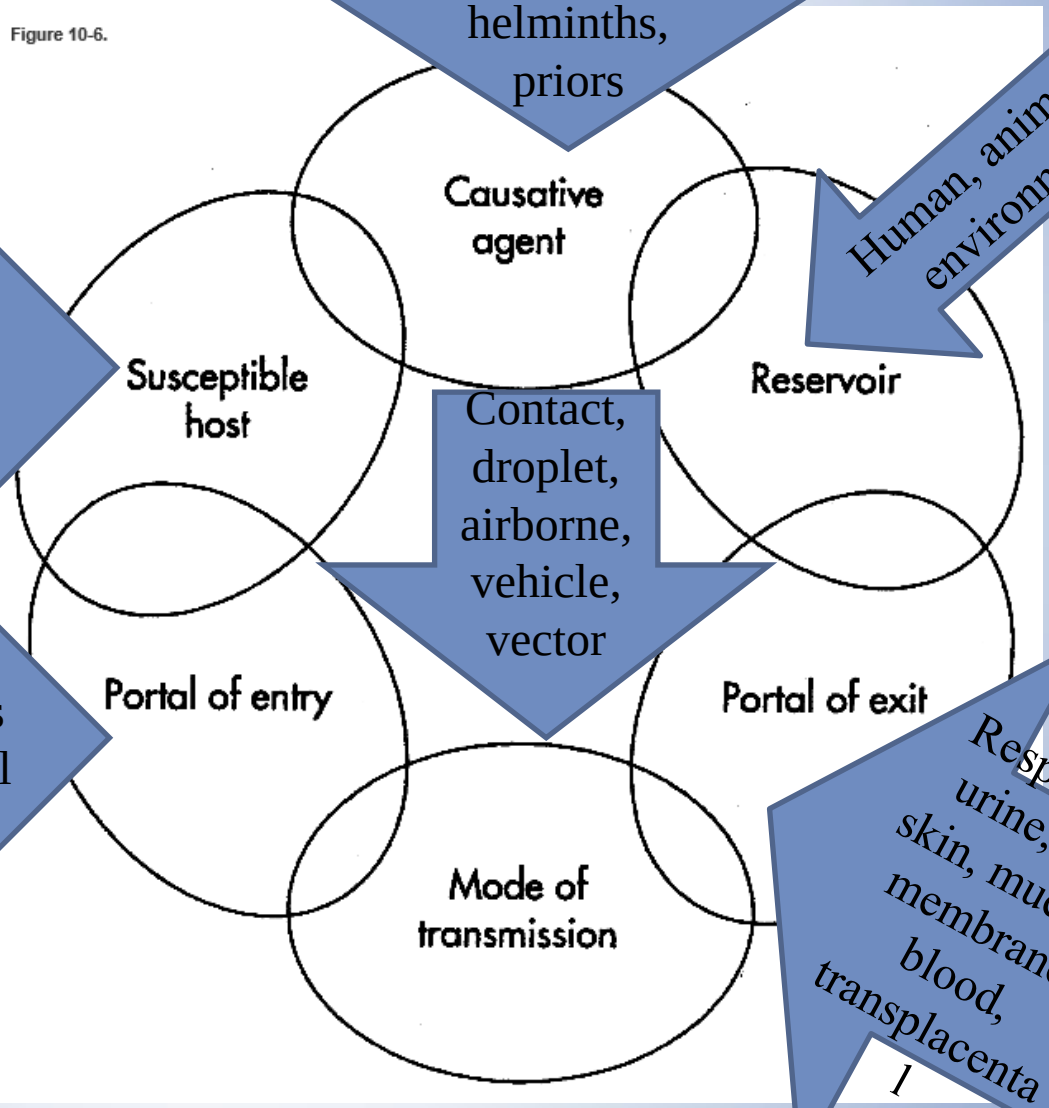
- Incidence: the number of new cases of a given disease in a given time period
- Prevalence: the number of existent cases of a given disease at a given time
- Endemic/Outbreak: the usual incidence of a given disease within a geographical area during a specified time period
- Epidemic: an excess over the expected incidence of disease within a given geographical area during a specified time period
- Pandemic: an epidemic spread over a wide geographical area, across countries or continents

Epidemiology Key Terms

- *Reservoir*: place in which an infectious agent can survive but may or may not multiply
- *Fomite*: an inanimate object on which organisms may exist for some period of time
- *Herd immunity*: the resistance of a group to invasion and to spread of an infectious agent, based on the immunity of a high proportion of individual members of the group
- *Risk*: the probability or likelihood of an event occurring
- *Risk factor*: a characteristic, behavior, or experience that increases the probability of developing a negative health status (e.g., infection).

Chain of Infection

Figure 10-6.



Bacteria, viruses, fungi, protozoa, helminths, priors

Human, animals, environment

Age, sex, ethnicity, socioeconomic status, lifestyle, heredity, nutrition status, occupation, immunization status, procedures, medications, pregnancy, trauma

Contact, droplet, airborne, vehicle, vector

Respiratory, urine, GI, skin, mucous membrane, parenteral, transplacental

Respirator, urine, GI, skin, mucous membrane, blood, transplacenta l

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AJIC
Recommended Practices for Surveillance

- A written plan is needed to outline goals, objectives, and elements of surveillance process.
- Thoroughness and intensity at same level
- Definitions and calculation methods need to be consistent

AJIC
Recommended Practices for Surveillance

- Resources are provided
- Annual review
- Outcomes or associated processes based on organization and patient population
- Process of collecting surveillance data should be managed by knowledgeable professions

Surveillance Definitions

Acute Care

- **Recommended practices for surveillance (2007)**

HomeCare and Hospice

- **APIC - HICPAC surveillance definitions for home healthcare and home hospice infections (2008)**

Surveillance Key Concepts

- Surveillance:
  - identify risk factors for infection and other adverse advents,
  - implement risk-reduction measures, and
  - monitor the effectiveness of interventions
- Surveillance identifies:
  - outbreaks,
  - emerging infectious diseases,
  - multidrug-resistant organisms, and
  - bioterrorist events
- Integrated infection prevention, performance improvement, patient safety, and public health activities

Purpose of Surveillance

- Determine baseline and endemic rates of occurrence of a disease or event
- Detect and investigate clusters or outbreaks
- Assess the effectiveness of prevention and control measures
- Monitor the occurrence of adverse outcomes to identify potential risk factors
- Provide information that can be used by an organization to target performance improvement activities
- Measure the efficacy of interventional and performance improvement efforts
- Observe practices, such as hand hygiene, central line insertion, and sterilizer performance monitoring, to promote compliance with recommendations and standards
- Detect and report notifiable diseases to the health department

Purpose of Surveillance

- Identify organisms and diseases of epidemiological importance to prevent their spread
- Ensure compliance with requirements of federal regulators
- Ensure compliance with state regulations and mandatory reporting requirements
- Meet requirements of accrediting agencies
- Provide information for the education of healthcare personnel
- Monitor injuries and identify risk factors for injuries of personnel
- Detect a bioterrorist event or an emerging infectious disease
- Provide data to conduct a facility risk assessment

Surveillance Terms

- *Attack rate:* an incidence proportion, rather than a true rate, that is used to measure the frequency of new cases of a disease or condition in a specific population during a limited period
- *Baseline*: the number or value used as the basis for comparison
- *Case*: an instance of a particular disease, injury, or other health condition that meets selected criteria
- *Case definition*: a set of uniformly applied criteria for determining whether a person should be identified as having a particular disease, injury, or other health condition
- *Cluster*: a group of cases that occurs closely related in time and place without regard to whether the number of cases is more than expected

Surveillance Terms

- *Denominator*: the lower portion of a fraction used to calculate a rate or ratio
- *Distribution*: frequency and pattern of an event in a population
- *Endemic*: usual presence of a disease or condition in a specific population or geographical area
- *Incidence rate*: a measure of the frequency with which an event occurs in a population over a defined time period. (e.g., number of new cases occurring during the defined time period divided by the population at risk)

Surveillance Terms

- *Outcome*: the result of care or performance activities
- *Numerator*: the upper portion of a fraction used to calculate a rate or ratio
- *Population*: the total number of individuals in a specified place or group
- *Prevalence rate*: the proportion of persons in a population who have a particular disease or condition at a specified point in time (point prevalence) or over a specified period (period prevalence)
- *Proportion*: a type of ratio in which the values in the numerator are included in (i.e., are a subset of) the denominator

Surveillance Terms

- *Process*: the series of steps or activities taken to achieve an outcome
- *Rate*: an expression of the frequency with which an event occurs in a defined population per unit of time (e.g., attack rate or incidence density rate)
- *Ratio*: the value obtained by dividing one quantity by another
- *Sensitivity*: the ability of a test, case definition, or surveillance system to identify true cases or persons who have the health condition of interest (i.e., the proportion of persons with a health condition that are correctly identified by a test or case definition as having the health condition)

Surveillance Terms

- *Specificity*: the ability of a test, case definition, or surveillance system to exclude persons who do not have the health condition of interest (i.e., the proportion of persons without a health condition that are correctly identified by a test or case definition as not having the health condition)
- *Validity*: the degree to which a measurement, test, study, or other data collection method actually measures or detects what it is intended to measure

Surveillance Methodologies

- Total (Whole) Surveillance
- Targeted Surveillance
- Combination

Surveillance Program Design

- Surveillance Methodology – typically targeted
- Assess and define the population – who has the greatest risk
- Choose the events to monitor:
  - Federal reporting requirements through NHSN:
    - CDI,
    - CLABSI,
    - CAUTI,
    - Inpatient SSI hysterectomy & colon procedures,
    - MRSA bloodstream infection,
    - Influenza vaccination

Surveillance Program Design

- OSHA requirements:
  - Bloodborne pathogen exposures
  - Employee exposure
- WI requirements:
  - Communicable diseases and other notifiable conditions
  - NHSN Carbapenem-Resistant Enterobacteriaceae (CRE)
  - Outbreaks, confirmed or suspected

Surveillance Program Design

- Surveillance criteria (NHSN, communicable disease statue)
- Data elements to be collected
  - Basic: name, sex, age, ID number, unit/location, physician/surgeon, service, type of infection DOA, DOO, DOD/T/Death
  - Determination of case definition: clinical signs or symptoms, lab or dx tests, test dates, organisms isolation, abx susceptibility
  - Risk Factors: underlined conditions or diseases, procedures and dates, date of insertion, duration of catheter, catheter type, body site
- Methods for data analysis (statistical measures)
- Method for data collection and management

Surveillance Program Sources

- Sources of data:
  - Medical records (paper and electronic)
  - Daily reports generated by the laboratory (e.g., microbiology, immunology, and serology results)
  - Daily list of admissions, including diagnosis
  - Monthly reports of patient-days and census data, by unit
  - Interviews with caregivers
  - List of patients on isolation precautions
  - List of prescribed antibiotics from the pharmacy
  - Test results from the radiology department

Surveillance Program Sources

- Sources of data continued:
  - Incident reports
  - Employee health reports of injuries, needlesticks, communicable diseases, and exposures
  - Procedure and activity logs from the respiratory therapy department, operating room, and medical care units
  - Reports from others who review medical records, such as performance improvement personnel
  - Reports from caregivers
  - Observations of care processes

Surveillance Report

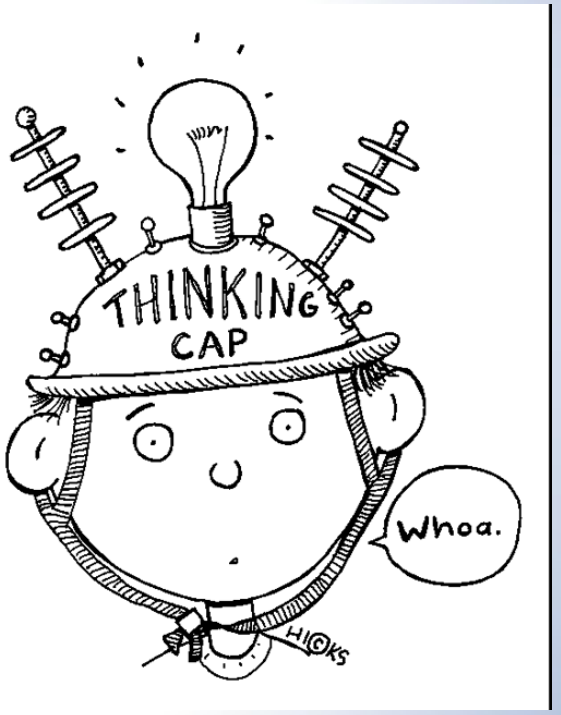
- Define the event, population, setting, and time period studied
- State the criteria used for defining a case
- Specify the number of cases or events identified and the number in the population studied
- Explain the methodology used to identify cases
- Identify the statistical methods and calculations used, when appropriate

Surveillance Report

- State the purpose for conducting surveillance (e.g., to identify risk factors for infection so that measures can be implemented to prevent infections from occurring)
- Interpret the findings in a manner that is understandable to those who read the report
- Describe any actions taken and recommendations made for prevention and control measures
- Identify the author and date of the report
- Identify the recipients of the report

How Do I Determine if I have an Infection?

- Review record
- Compare to definition
- Use NHSN resources
- Be consistent
- Document your work up
- Entry into NHSN



Tracking Database or Spreadsheet

- Should be easy to use
- Documents your work up and determination
- Easy to analyze results

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Determining Trends

- Did something unusual occur?
- Did something change from last year…last season?
- Was your attempts to decrease events effective?
- Who is at risk?
- Who continues to have infections?
- Do you have an outbreak on your hands?

Document Actions

- Document your review
- Document what you recognized in the analysis
- Document plan for future improvement:
  - Maintain
  - Decrease
  - Increase

Obstacles for Data Collection

- Provider burden
- Data collection vehicles and infrastructure
- Measure reliability issues
- Risk adjustment

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Validation of Components

Infection Control Assessment and Response (ICAR) Tools

- Infection Control Assessment Tool for Acute Care Hospitals
- Infection Control Assessment Tool for Outpatient Settings
- Infection Control Assessment Tool for Hemodialysis Facilities

Checklist When Back at Your Desk

- Surveillance Plan
- Exposure Control Plan
- Staff Training:
  - Standard precautions, PPE, Cough Etiquette, cleaning and disinfection
  - BBP, Safe Injection, work practice expectations
  - TB and Respiratory Protection

Checklist When Back at Your Desk

- Communicable Disease Notification Policy, Procedure, or Protocol
- Hand Hygiene Policy, Procedure, or Protocol
- Cleaning and Disinfection Policy, Procedure, or Protocol

Checklist When Back at Your Desk

- Outbreak Policy, Procedure, or Protocol
- Multi-Drug Resistant Organisms (MDRO) including determination, how documented, when isolation is indicated and discontinued
- Emergency Preparedness

Knowledge into Learning Activity

A hospitalist asks if the medical surgical unit has more CAUTI than other units.

- What additional information should be asked?
  - Why the concern

Knowledge into Learning Activity

What are your initial steps?

- Pull NHSN reports
  - TAP report
  - SUR report
  - CMS report

NHSN TAP Report

National Healthcare Safety Network
TAP Report for CAUTI Data for Acute Care and Critical Access Hospitals (2015 Baseline)
Locations Ranked by CAD Within a Facility
SIR Goal: HHS Goal = 0.75

A TAP Report is the first step in the CDC TAP Strategy. For more informatin on the TAP Strategy, please visit: http://www.cdc.gov/hai/prevent/tap.html
As of February 16, 2017 at 2:00 PM
Date Range: BS2_CAU_TAP summaryYr2016 to 2016

FACILITY			LOCATION									
Facility Org ID	Facility Name	Facility CAD	Location Rank	Location	CDC Location	Events	Urinary Catheter Days	DUR %	CAD	SIR	SIR Test	No. Pathogens (EC,YS,PA,KS,PM,ES)
10000	DHQP Memorial Hospital	10.78	1	ICU	IN:ACUTE:CC:M	4	453	8	3.51	.		6 (3, 0, 0, 0, 0, 1)
			2	STEP1	IN:ACUTE:STEP	2	1054	12	1.5	.		2 (1, 0, 0, 0, 0, 0)
			3	ICU2	IN:ACUTE:CC:M	2	830	8	1.43	.		2 (0, 0, 0, 0, 0, 1)
			4	ICU3	IN:ACUTE:CC:MS	2	1008	12	1.38	.		3 (1, 0, 0, 0, 0, 2)
			5	1E	IN:ACUTE:WARD:M	3	950	68	1.24	1.3		3 (1, 0, 0, 2, 0, 0)
			6	2E	IN:ACUTE:WARD:MS	2	1325	13	0.98	1.5		3 (2, 0, 0, 1, 0, 0)
			7	1W	IN:ACUTE:WARD:PP	3	3090	75	0.86	1.1		4 (1, 0, 0, 0, 1, 1)
			8	ICU4	IN:ACUTE:CC:MS	3	3380	75	0.66	1		3 (1, 0, 1, 1, 0, 0)
			9	5E	IN:ACUTE:WARD:M	1	720	9	0.51	.		2 (0, 0, 0, 0, 0, 1)

1. This report includes CAUTI data for 2015 and forward.
2. If location-level CADs are the same in a given facility, their ranks are tied.
3. (EC,YS,PA,KS,PM,ES) = No. of E. Coli, Yeast (both candida and non-candida species), P. aeruginosa, K. pneumoniae/K. oxytoca, Proteus Mirabilis, Enterococcus species
4. SIR is set to '.' when predicted number of events is <1.0.
5. LOCATION CAD = (OBSERVED_LOCATION - PREDICTED_LOCATION* SELECTED SIR Goal)
6. SIR TEST = 'SIG' means SIR > SIR Goal significantly

https://www.lsqin.org/wp-content/uploads/2015/01/CAUTI-TAP-Report.pdf

NHSN SUR Report

National Healthcare Safety Network

SUR for Central Line Device Use for Acute Care Hospitals (2015 baseline) - By OrgID

As of: June 8, 2017 at 2:43 PM

Date Range: BS2_CLAB_RATESALL summaryYM 2016M01 to 2016M06

if (((location = "MED CC")))

orgID=10315 CCN=N/A medType=M

orgID	numCLDays	numPredDDays	SUR	SUR_pval	SUR95CI
10315	797	443.221	1.798	0.0000	1.677, 1.926

1. This report includes central line utilization data from acute care hospitals for 2015 and forward.
2. The SUR is only calculated if number of predicted device days (numPredDDays) is >= 1. Lower bound of 95% Confidence Interval only calculated when number of observed device days > 0.
3. The predicted device utilization days is calculated based on national aggregate NHSN data from 2015. It is risk adjusted for CDC location, hospital beds, medical school affiliation type, and facility type.

https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/run-interpret-sur-reports.pdf

Knowledge into Learning Activity

Target your positive numbers

- CAD
  - Risk adjusted for the organization and unit
  - Easy to share how many less infections are needed
  - Are infections occurring within 5 days of placement?
- SIR
  - Risk adjusted for the organization and unit
  - A little harder to explain as it is a ratio not a rate
- SUR
  - Risk adjusted for the organization and unit
  - Easy to share how many less device days are needed

Knowledge into Learning Activity

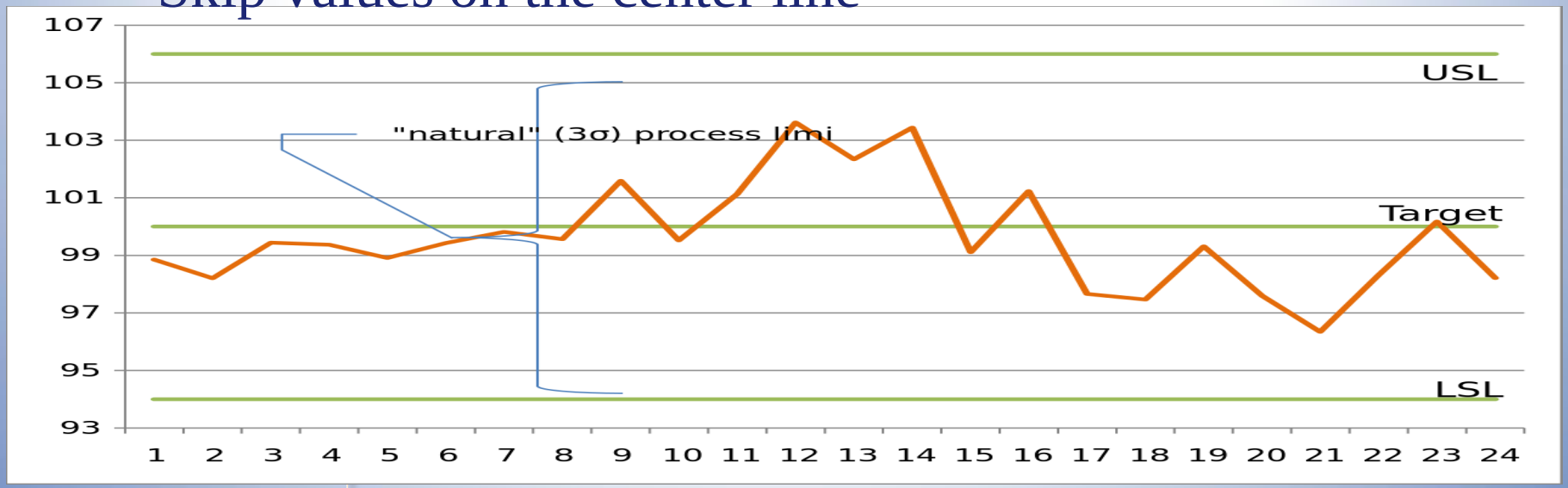
What if the unit does have a higher CAUTI rate

- Not risk adjusted
- Run chart
  - Monitors variation in data/process over time
  - Use with continuous data
  - Use with count data
    - When to use
      - Few data points
      - Rapidly detect signals of improvement
      - Readily accepted
      - Detects non-random signals of change

Run Chart Rules

Shift

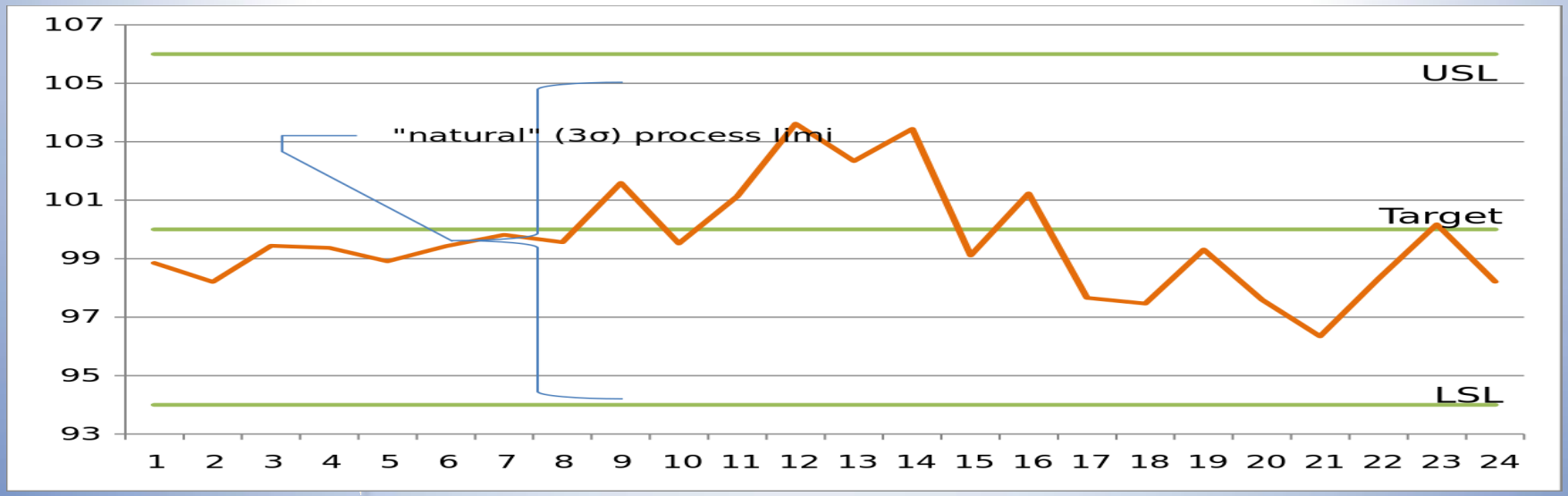
- 6 or more consecutive all above or below center line
  - Don’t count values that fall on the line
  - Values on the center line do not make a shift
  - Values on the center line do not break a shift
  - Skip values on the center line



Run Chart Rules

Trend

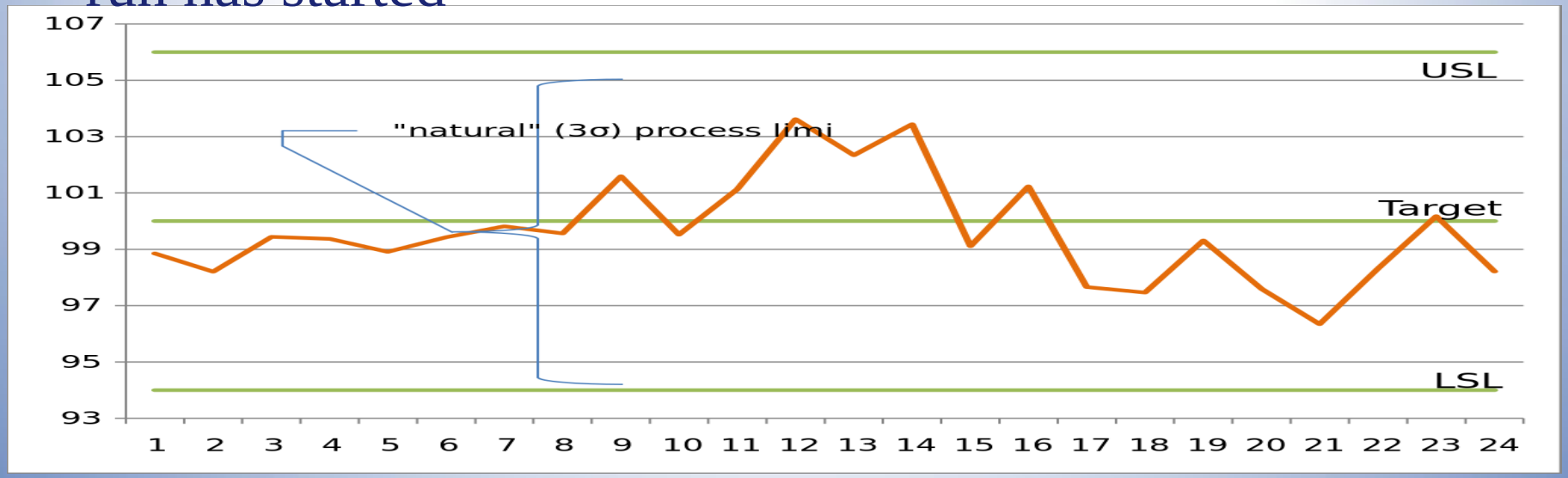
- 5 or more consecutive points going all up or down
  - If 2 or more points are the same – count only first point
  - Like values do not make or break a trend



Run Chart Rules

Number of Runs

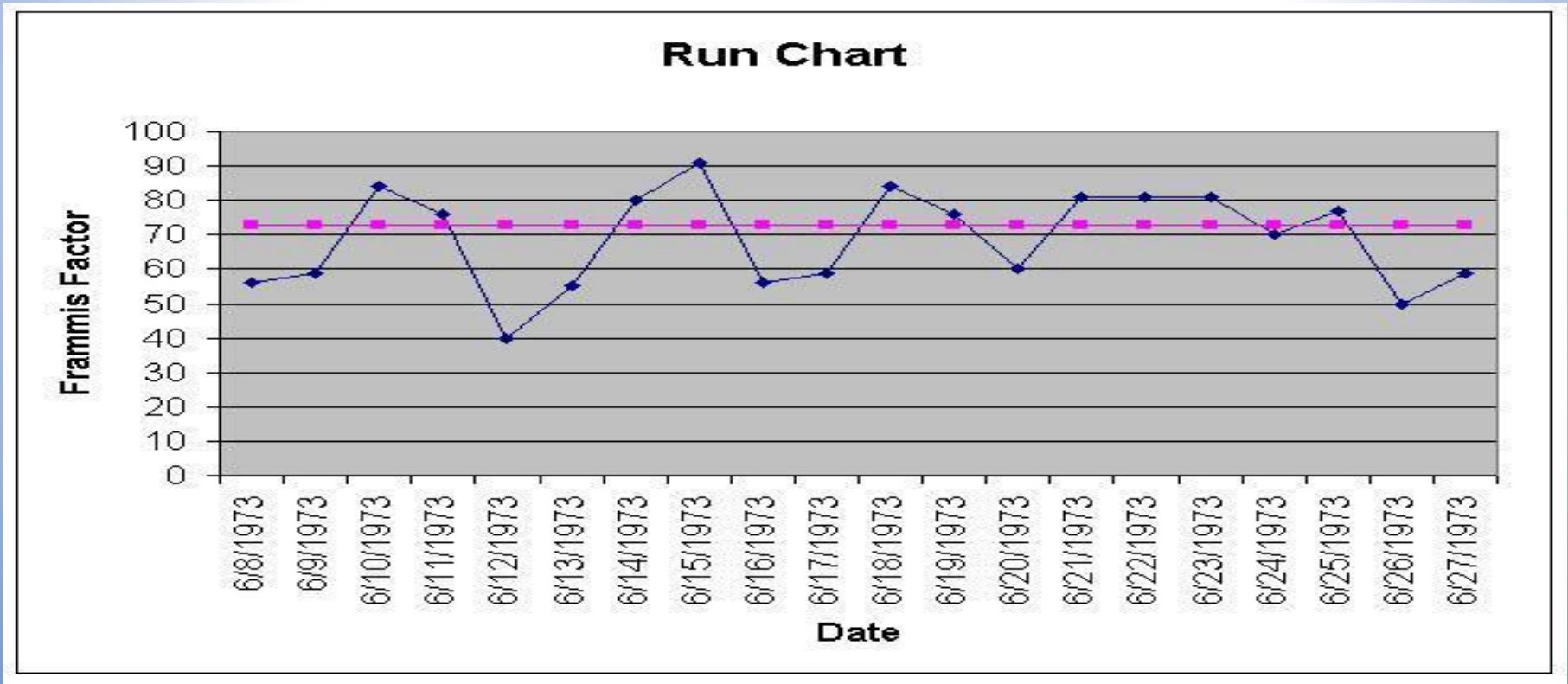
- Run – a series of points in a row on one side of the center line
- Too few or many runs signal nonrandom pattern of change – need to use a table based on # of data points
- Data must cross the center line to identify a new run has started



Run Chart Rules

Astronomical

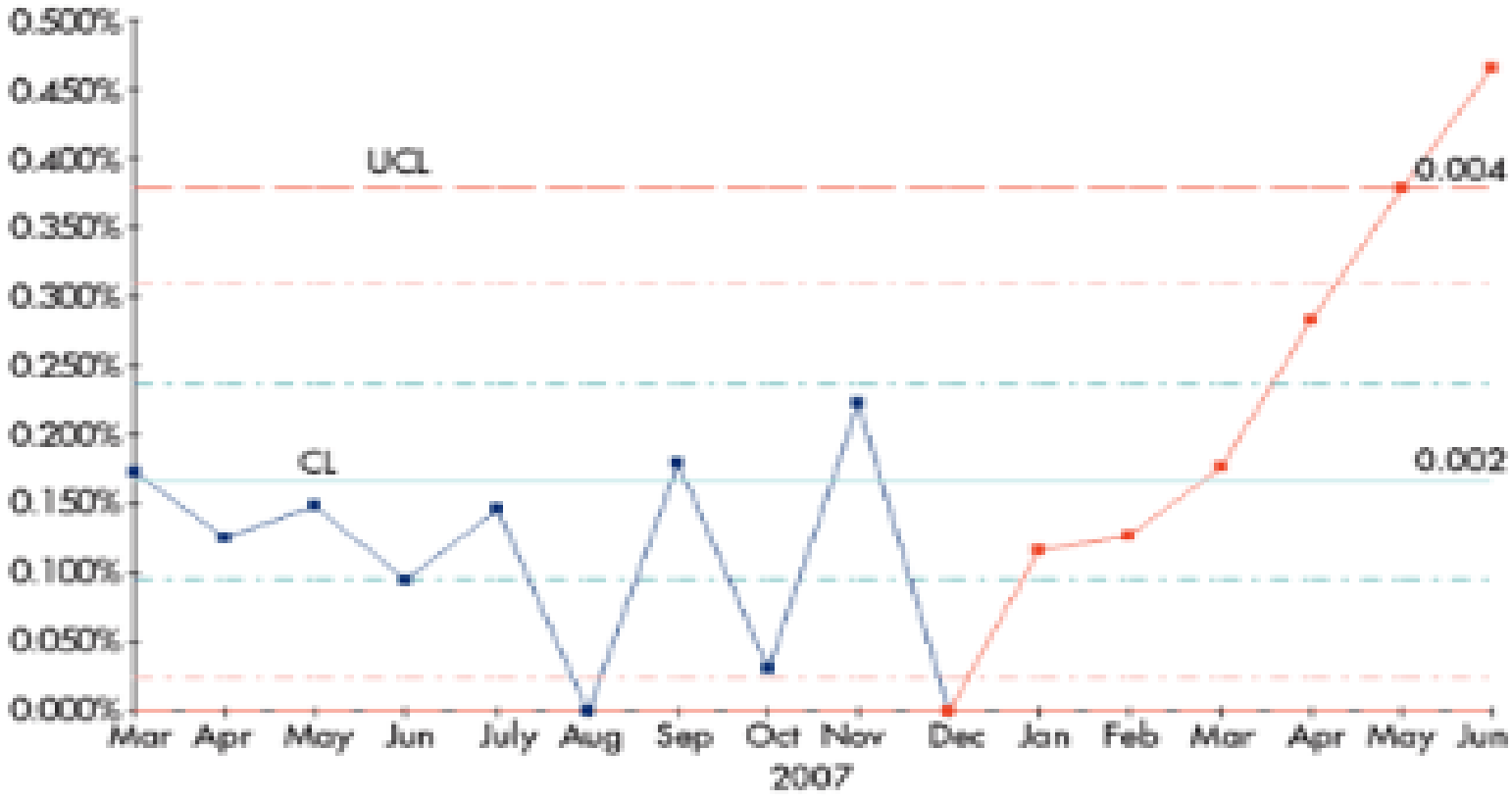
- Obviously different from other points



Control Charts – upper and lower control limits

- More precise than run chart – Special Cause Rules
  - Shift with 8 consecutive points or more above or below the mean
  - Trend with 6 consecutive points or more going up or down
  - Astronomical with any point outside the UCL or LCL

Figure 1: Infection Rate



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Knowledge into Learning Activity

Audit – Assess what is going on?

- Direct observations
- Chart review or extraction
- Questionnaire, survey or discussion
- Investigation forms

Knowledge into Learning Activity

How are you going to prevent

- Improvement Guides
  - Insertion
  - maintenance
- Common gaps in literature
  - Culture collection method
  - Culture without symptoms
- PDSA cycle

Questions

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