Effective Presentation of Infection Control Data

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What are we going to do today?

- Outline the process of transforming data into information and knowledge
- List the components of a well-designed data display
- Describe factors to consider in the process of designing a meaningful report
- Discuss the issues related to the use of comparative or benchmarking information

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What is surveillance?

Systematic method of collecting, consolidating, and analyzing data concerning the distribution and determinants of a given disease or event, followed by dissemination of that information to those who can change the results

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Recommended Practices for Surveillance

- Assess the population
- Select the outcome or process to survey
- Apply surveillance definitions
- Collect surveillance data
- Calculate rates and analyze surveillance findings
- Apply risk stratification methods
- **Report and use surveillance information**

The Data Model

Data → Information → Knowledge → Wisdom
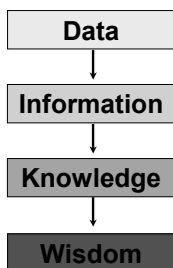
The goal of data presentation is to create wisdom by converting data into information, information into knowledge, and knowledge into wisdom.

Why Analyze, Display and Report Data?

- Tracking and Trending
  - Trends/changes over time
  - Seasonal occurrences
  - Outbreaks
  - Sentinel events
- Benchmarking/Comparison
  - Compare to others
  - Detect areas for improvement
  - Use to improve performance

The Toolbox

* Case Finding / Marker Tools

* Collection and Storage Tools

* Analysis Tools

* Presentation Tools

Case Finding / Marker

* Tasks
  * Finding potential nosocomial infections
* Tools
  * Manual review of multiple data sources using ICP knowledge
 * Data mining using artificial intelligence/logic (MedMined, Theradoc, Cereplex)

Data Sources

* Laboratory
* Operating Room
* Employee Health
* Respiratory Care
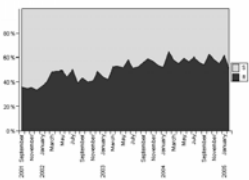* Admitting
* Emergency Room

Data Mining

Most of the ICP's time is spent reviewing laboratory and patient data, generating reports, etc. Time spent on these tasks takes away from the teaching and interventions that prevent infections.

Aspergillus Control Chart

52-Week (04/03/2004 to 03/26/2005)
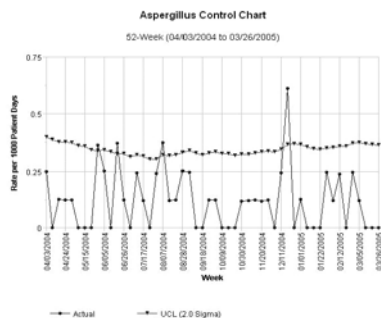
Staphylococcus aureus isolates and methicillin resistance by month by unique patient (duplicate specimens removed)*

Collection and Storage

* Tasks
  * Data entry
  * Data warehousing
  * Data relationships
* Tools
  * IC surveillance software (e.g., AICE, Epi Info, EpiQuest, Softmed)
  * Database (Access, Oracle)
  * Spreadsheet (Excel)

Analysis

* Tasks
  * Rate calculations
  * Statistical calculations
  * Trend Analysis
* Tools
  * Spreadsheets (Excel / Lotus)
  * Statistical Software (SPSS, SAS)
  * IC Surveillance (AICE, Epi Info)
  * Database (Access)

Summarizing Data

* Comparisons among categories
  * Bar charts, pie charts, pareto charts
* Frequency of events
  * Rates, ratios, proportions
* Variability analysis (numerical)
  * Mean, median, mode
  * Range, standard deviation
* Variability analysis (graphical)
  * Line graphs, histograms, control charts

Presentation

* Tasks
  * Generating reports
  * Creating tables
  * Creating graphs and charts
* Tools
  * Business Graphics (Powerpoint)
  * Spreadsheet (Excel)
  * IC Surveillance Software (AICE, Epi Info)

From Data to Information

Line List – A Data Table

First Name	MR#	Age	Admit Date	Cult Date	Cult Site	Organism	ORG. 2	H/A	NI Site
R	3183499	60	5/30/1998	6/10/1998	URINE	SEM		Y	UTIC
CECIL	3183183	55	5/21/1998	6/3/1998	BLOOD	MRSA		Y	BLDS
HARTWELL	3184101	68	6/11/1998	6/11/1998	WOUND	MRSA	PRV	Y	SRWD
ROSE	3179535	79	5/15/1998	6/2/1998	SPUTUM	MRSA		Y	LRES
WILLIE	3013810	68	5/29/1998	6/10/1998	URINE	ENT	CNS	Y	UTI
A	3111263	82	6/8/1998	6/10/1998	URINE	PRM		Y	UTIC
JACQUELINE	3122513	78	6/3/1998	6/11/1998	SPUTUM	MRSA	PSA	Y	LRES
WILLIE	3124570	79	6/5/1998	6/8/1998	URINE	KLP	ENT	Y	UTIC

Pivot Table – A Data Analysis Table

sex	(All) ▼													
unit	(All) ▼													

Count of infection type inf mor ▼													
organism ▼	1	2	3	4	5	6	7	8	9	10	11	12	Grand Total
ACA									1				1
CALB								1					1
ECOLI			1	1	1							1	6
ENTB SP	1		1										2
ENTC			1					1		1			3
KLEBPN			1	1								1	3
MRSA	1		3		1	5	2				2	1	16
PRO SP			1										1
PROSP		1											1
PSAER							1	1	1				7
SAUR	1	1		2		1	1			1			7
SERMAR		1						1	1	3	5		11
STENMALT				2			1						3
VRENFM						2	1						3
Grand Total	2	4	7	7	5	4	6	5	4	6	6	9	65

Chart Data

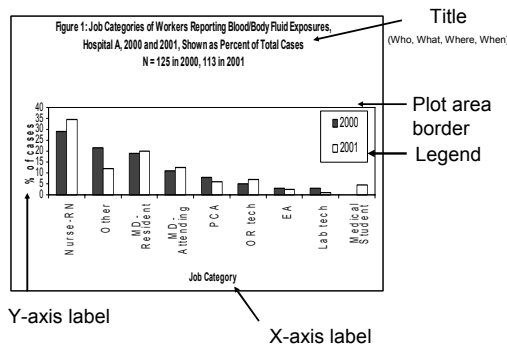|	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
MRSA	1		3		1	1	5	2			2	1	16
Pt. Days	172	177	170	174	171	170	166	170	161	165	172	188	2056
Rate	5.8	0.0	17.6	0.0	5.8	5.9	30.1	11.8	0.0	0.0	11.6	5.3	7.8

Annotated Run Chart

MRSA Rate/1000 Pt Days
Hospital X

MRSA Outbreak in Nursing Homes
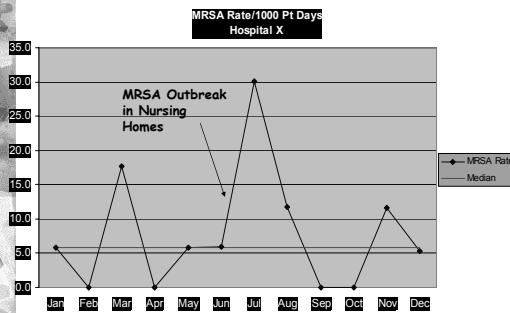
Anatomy of a Graphic Display of Data

* Chart title
* Y-axis and labels
* X-axis and labels
* Data series
* Data points
* Legend
* Plot area

Anatomy of a Graphic Display of Data

Figure 1: Job Categories of Workers Reporting Blood/Body Fluid Exposures, Hospital A, 2000 and 2001, Shown as Percent of Total Cases
N = 125 in 2000, 113 in 2001

Title (Who, What, Where, When)

Plot area border
Legend

Y-axis label

X-axis label

Guide to Selecting a Graph or Chart to Display Data

Type of Graph or Chart	When to Use
Line Graph	Trends in numbers or rates over time
Histogram	Frequency distribution of a continuous variable. Number of cases during an epidemic or over time
Simple Bar Chart	Compare size or frequency of different categories of a single variable
Grouped Bar Chart	Compare size or frequency of different categories of 2-4 series of data
Stacked Bar Chart	Compare totals and illustrate component parts of the total among different groups
Pie Chart	Show components of a whole
Scatter Diagram	Plot association between two variables

** Adapted from Dicker R, et al. *Principles of Epidemiology: An Introduction to Applied Epidemiology and Biostatistics,* USDHHS, Atlanta, Georgia, 1992.

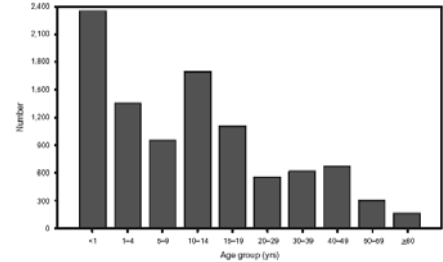## Bar Charts

* Visual display using one coordinate
* <u>Display summary data, e.g., rates for categories of a variable</u>
* Allows comparisons of magnitude between categories of data
* Can display vertically or horizontally

Bar Chart - Example

PERTUSSIS. Reported cases,* by age group — United States, 2002

*Of 9,771 cases, 25 cases were reported with unknown age.
In 2002, 21% of reported cases were in infants aged <6 months (who were too young to receive 3 DTaP doses), and 52% of cases were in persons aged ≥10 years (no pertussis vaccine is licensed for use in persons aged ≥7 years).

Histogram

* Displays the <u>frequency distribution for categories of a variable</u> (individual data points grouped into classes)
* Can identify normal versus skewed distributions
* Example - epidemic curve for an outbreak

Histogram - Example
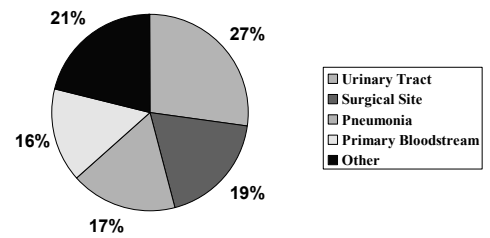

Epidemic curve of a person-to-person transmitted outbreak
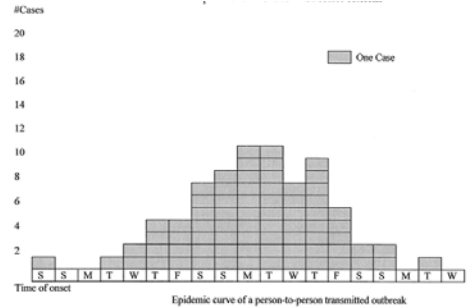
Pie Charts

* Display proportion or each category of a variable
* Identify relative size of proportions

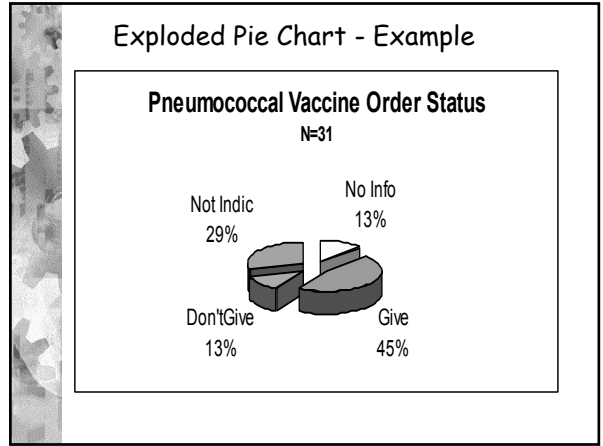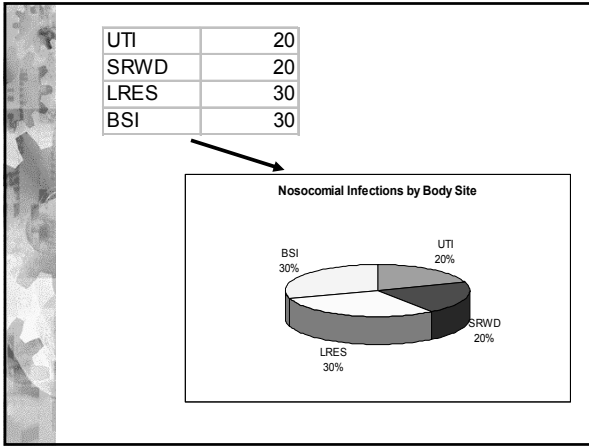### Distribution of Nosocomial Infections, U.S., NNIS Jan 93 - Dec 00

21% 27% 16% 17% 19%

- Urinary Tract
- Surgical Site
- Pneumonia
- Primary Bloodstream
- Other

CDC, NNIS Semiannual Report, Dec 2000

UTI	20
SRWD	20
LRES	30
BSI	30

Nosocomial Infections by Body Site

BSI 30%
UTI 20%
SRWD 20%
LRES 30%

Exploded Pie Chart - Example

Pneumococcal Vaccine Order Status
N=31

Not Indic 29%
No Info 13%
Don'tGive 13%
Give 45%

Line Graph
Run Chart and Control Chart

* Plots the movement of something over a given period of time
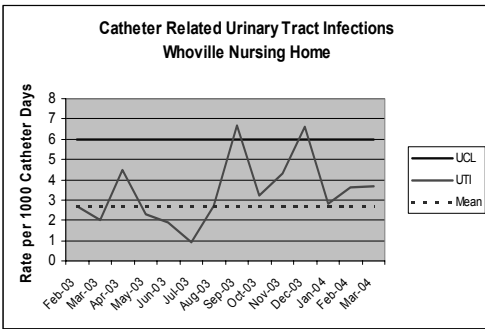* Used with any type of data
* Run Chart vs Control Chart

Outbreak Detection

VRE Line Listing by Onset Date

Facility/ Unit Room	MRN	Patient Name	Admission Number	Adm Date	Discharge Date	Organism
MRL Global Hospital 1 West 1	30237054	JAW_FN HWY_LN	30237054_0102	2006/01/07		VRE
MRL Global Hospital 2 East	30221529	EDN_FN PIN_LN	30221529_0111	2006/01/11		VRE
MRL Global Hospital 4 West 4	30175522	OTL_FN HAL_LN	30175522_0113	2006/01/18		VRE
MRL Global Hospital 1 West 1	30310403	ROG_FN PAT_LN	30310403_0215	2006/01/28		VRE
MRL Global Hospital 2 East 1	30270694	JAC_FN HWY_LN	30270694_0221	2006/02/01		VRE
MRL Global Hospital 4 West 1	30144557	HOW_FN VIOF_LN	30144557_0429	2006/02/09		VRE
MRL Global Hospital 2 East	30242574	FRA_FN HAL_LN	30242574_0302	2006/03/05		VRE

Infections Associated With VRE

Courtesy of MRL

AVERAGE WAIT TIME (IN MINUTES) TO See a Physician in the ED

41

DAY OF THE WEEK

BOTULISM, FOODBORNE. Reported cases, by year — United States, 1982–2002

Outbreak caused by sautéed onions, IL

Outbreak caused by fermented fish/seafood products, AK

Outbreak caused by baked potatoes, TX

Outbreak caused by chili sauce, TX

Foodborne botulism is a rare but potentially fatal disease. Every case of botulism must be treated as a public health emergency, and the contaminated food vehicle and all exposed persons must be identified.

Control Chart

Catheter Related Urinary Tract Infections
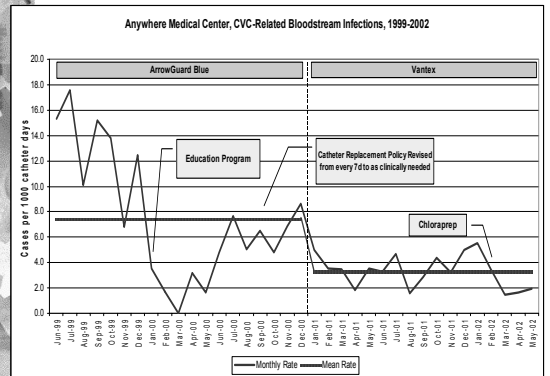**Whoville Nursing Home**

Putting It All Together

* Dashboards
* Instrument Panels
* Balanced Scorecards
* Report Cards

Dashboard

Infection Control Dashboard - St. Elsewhere Hospital						
Q1FY04						
	CVICU	SICU	MICU	3E	3W	OB
NOSOCOMIAL INFECTIONS						
IVD Related Bloodstream Infections*						na
Ventilator Associated Pneumonia*				na	na	na
Foley Catheter Related UTI*						
PROCESS MEASURES						
Appropriate hand hygiene **						
IVD Dressing Documentation ***						

	* - above NNIS 75th percentile
	* - between NNIS 50th and 75th percentile
	* - at or below NNIS 50th percentile

Anywhere Medical Center, CVC-Related Bloodstream Infections, 1999-2002

Courtesy Robert Garcia, MT(ASCP), CIC

Patient Care Dashboard at Hospital X

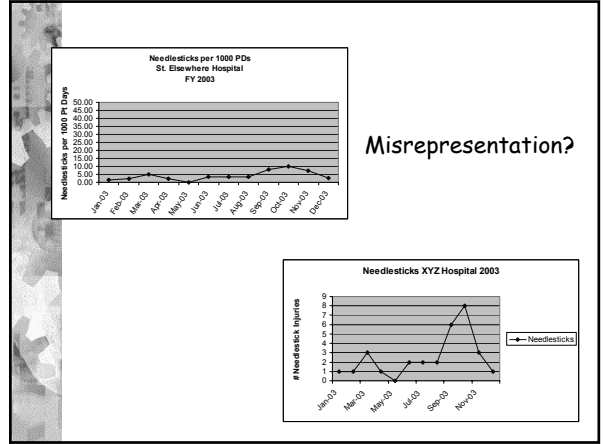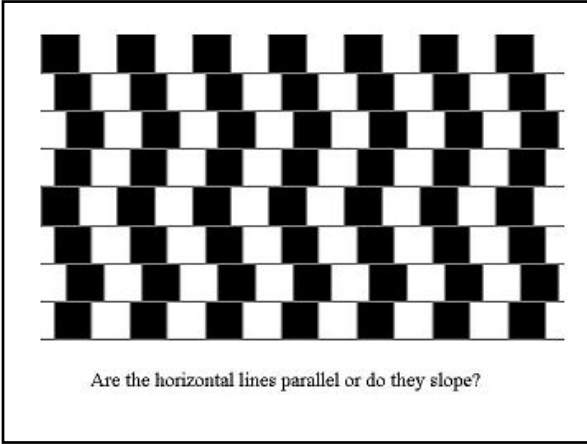% success compared to target
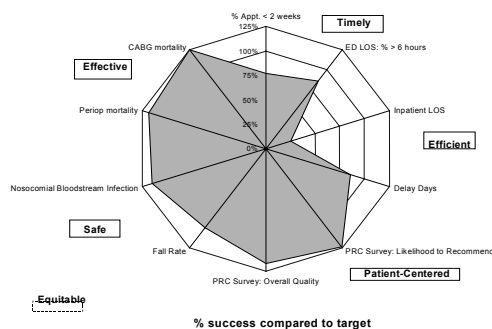
From Data to Presentation

* Collect and organize your data!
* Begin with a sketch of your finished display
* Select the data to present
* Begin with a basic display, then format it
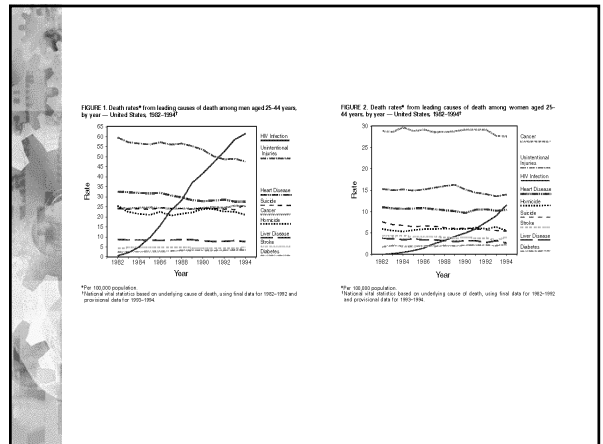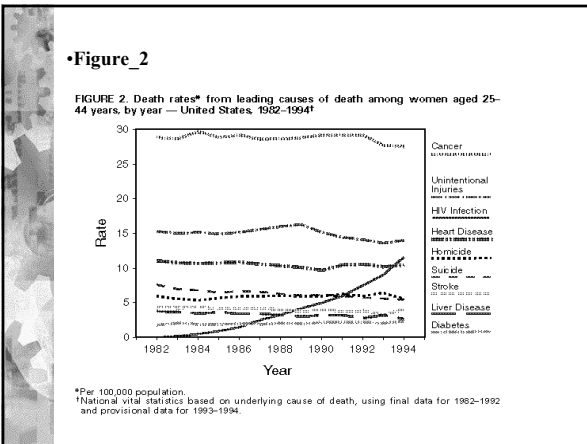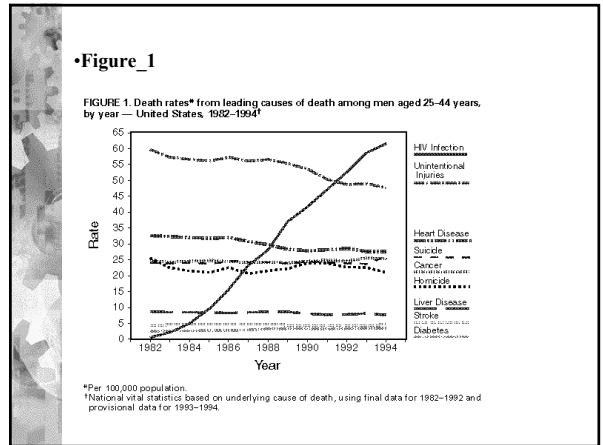
Are the horizontal lines parallel or do they slope?

Misrepresentation?

Data Graphics Principles

* Above all else, show the data
* Maximize the data-ink ratio, within reason
* Erase non-data-ink, within reason
* Erase redundant data ink, within reason
* Don't misrepresent the data
* Revise and edit

The Visual Display of Quantitative Information

•Figure_1

FIGURE 1. Death rates* from leading causes of death among men aged 25–44 years, by year — United States, 1982–1994†

*Per 100,000 population.
†National vital statistics based on underlying cause of death, using final data for 1982–1992 and provisional data for 1993–1994.

•Figure_2

FIGURE 2. Death rates* from leading causes of death among women aged 25–44 years, by year — United States, 1982–1994†

*Per 100,000 population.
†National vital statistics based on underlying cause of death, using final data for 1982–1992 and provisional data for 1993–1994.

Visuals in Presentations

* Enhance
* Aid in comprehension
* Simple – less is more
* Use color, typeface and clipart carefully
* Continually ask "How will this reinforce my message?"

Who is your audience?

* Administration
* Physicians
* Clinical Department Directors
* Clinical Staff
* Non-Clinical Department Directors
* Non-Clinical Staff
* Nursing

Data Display Summary

* Be sure of what you want audience to understand from your display!
* Attract audience attention
* If data are not compelling, don't use them
* Use appropriate display type
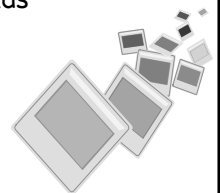* One key message per visual display

Research Paper Analogy

* Background / rationale (why)
* Methods
  * Population (who)
  * Setting (where)
  * Time period (when)
  * Event reporting on (what)
    * Case finding (how)
    * Criteria for inclusion

Research Paper Analogy (cont'd)

* Findings
  * Numerator / denominator
  * Visual displays
* Discussion
* Limitations
* Recommendations
* Dissemination

Graphic Presentation Output Options

* Handouts
* Presentation books – "flip 'n tell"
* Black & white overheads
* Color overheads
* 35mm slides
* Screen shows

Benchmarking

Process of comparing oneself to others performing similar activities, so as to continuously improve

----- Lenz et. al.

Benchmarking Requirements

* Standard criteria to define cases
* Criteria applied consistently
* Surveillance methodology consistent
* Rates and ratios calculated the same
* Large enough denominator
* Standardized risk adjustment

Process of Using Data to Improve Care

* Decide what you want the project to accomplish
* Gather information
* Set up management processes
* Obtain and analyze data
* Decide what information to convey to audience
* Determine how to present data to audience
* Test materials with audience
* Select best way to package info for audience
* Distribute info to audience
* Create ways for audience to use info
* Evaluate progress

Source: www.talkingquality.gov

Communication Guidelines

* Most affected first
* Implications understood
* Respect for audience
* Involve the affected parties in translation from data to intervention
* Commitment to communication skills

Sandman PM. Emerging communication responsibilities of epidemioloogists. *J Clin Epidemiol.* 1991;44(1 SUPPL):41S 5S.

Plan, plan, plan!

Goal of Presentation of Data

To synthesize and summarize data in a way that is easily understood by the intended audience so that they are empowered to take action

Resources

* Arias K. Surveillance in APIC Text of Infection Control and Epidemiology, 2005.
* Beebe SA and Beebe SJ: Public speaking: an audience centered approach. 1997
* Kosslyn SM. Elements of graph design. 1994
* Lenz S, et. al. Benchmarking: finding ways to improve. Jt Comm J Qual Improv 20:250-259, 1994
* Tufte ER. Visual explanations. 1997
* Tufte ER. The visual display of quantitative data. 1996

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