The Compelling Display of Data to Achieve Desired Decision Making

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The University of Texas Health Science Center at Houston
Professor of Occupational Health
The University of Texas School of Public Health
Why Training on Data Presentation?

• An interesting dilemma:
  – Almost all programs thrive on data
  – Virtually every important decision is based on data to some extent
  – Formal training in the area of compelling data presentations is rare for many professionals
  – The ability to compellingly display data is the key to desired decision making
Why Training on Data Presentation (cont.)?

• The public health profession is particularly awash in bad examples of data presentations!

• We’ve all endured them at some point in our careers!

• *Commentary*: This may be the reason for repeated encounters with people do not understand what public health programs do.
Achieving Data Display Excellence

• The presentation of complex ideas and concepts in ways that are
  – Clear
  – Precise
  – Efficient

• How do we go about achieving this?
Go to The Experts On Information Display

- Tukey, JW, *Exploratory Data Analysis*, Reading, MA 1977


Recommendations
(we’ll see examples of all of these)

• Don’t blindly rely on the automatic graphic formatting provided by Excel or Powerpoint!

• Encourage the eye to compare different data

• Representations of numbers should be directly proportional to their numerical quantities

• Use clear, detailed, and thorough labeling
Recommendations (cont.)

• Display the variation of data, not a variation of design

• Maximize the data to ink ratio – put most of the ink to work telling about the data!

• When possible, use horizontal graphics: 50% wider than tall is usually best
“Visual reasoning occurs more effectively when relevant information is shown adjacent in the space within our eye-span”

“This is especially true for statistical data where the fundamental analytical act is to make comparisons”

The key point: “compared to what?”
Three UTHSC-H “Make Over” Examples

• Data we accumulated and displayed on:
  – Nuisance Fire Alarms
  – Workers compensation experience modifiers
  – Corridor clearance

• But first, 2 quick notes:
  – The forum to be used:
    • The “big screen” versus the “small screen”?
    • In what setting are most important decisions made?

  – Like fashion, there are likely no right answers – individual tastes apply, but some universal rules will become apparent
Results of the Great UTHSC-H Nuisance Fire Alarm Challenge

Number of Alarms

- Contractor
- Smoke/Fire
- Spontaneous
- Maintenance
Results of the Great UTHSC-H Nuisance Fire Alarm Challenge

<table>
<thead>
<tr>
<th>Month</th>
<th>Contractor</th>
<th>Smoke/Fire</th>
<th>Spontaneous</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Oct</td>
<td>2</td>
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<td>Nov</td>
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<td>Dec</td>
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<td>1</td>
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<td>Jan</td>
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<td>Feb</td>
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<td>Mar</td>
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<td>May</td>
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<td>Jun</td>
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<td>Jul</td>
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<td>0</td>
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<tr>
<td>Aug</td>
<td>9</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Legend:
- Contractor
- Smoke/Fire
- Spontaneous
- Maintenance
Results of the Great UTHSC-H Nuisance Fire Alarm Challenge

[Bar chart depicting the number of alarms per month for different categories: Contractor, Smoke/Fire, Spontaneous, and Maintenance.]
Results of the Great UTHSC-H Nuisance Fire Alarm Challenge

Number of Alarms

- Contractor
- Smoke/Fire
- Spontaneous
- Maintenance

Graph showing the number of alarms by month from September to August.
Results of the Great UTHSC-H Nuisance Fire Alarm Challenge

Number of Alarms

Contractor
Smoke/Fire
Spontaneous
Maintenance

Sept Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug

0 1 2 3 4 5 6 7 8 9 10

Number of Alarms

- Orange: Contractor
- Red: Smoke/Fire
- Yellow: Spontaneous
- Pink: Maintenance
Results of the Great UTHSC-H Nuisance Fire Alarm Challenge

<table>
<thead>
<tr>
<th>Month</th>
<th>Contractor</th>
<th>Smoke/Fire</th>
<th>Spontaneous</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Oct</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Nov</td>
<td>2</td>
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<tr>
<td>Jul</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aug</td>
<td>9</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Results of the Great UTHSC-H Nuisance Fire Alarm Challenge

Number of Alarms

- Maintenance
- Spontaneous
- Smoke/Fire
- Contractor
Results of the Great UTHSC-H Nuisance Fire Alarm Challenge (FY04)

Number of Alarms

- Caused by UTHSCH Facilities work
- Caused by detector malfunction or dust accumulation
- Caused by actual smoke or fire
- Caused by outside contractor work

Fiscal Year 04
Results of the Great UTHSC-H Nuisance Fire Alarm Challenge

![Graph showing the number of alarms per month for different categories: Contractor, Smoke/Fire, Spontaneous, Maintenance. The graph displays fluctuations throughout the months of Sept to Aug.]
Employee Worker’s Comp Experience Modifier
compared to other UT health components, FY 98-FY 04

Rate of "1" industry average, representing $1 premium per $100
WCI Premium Adjustment for UTS Health Components
(discount premium rating as compared to a baseline of 1)

- UT Health Center Tyler (0.40)
- UT Medical Branch Galveston (0.38)
- UT HSC San Antonio (0.27)
- UT Southwestern Dallas (0.24)
- UT HSC Houston (0.17)
- UT MD Anderson Cancer Center (0.14)
MSB Corridor Blockage in Cumulative Occluded Linear Feet, by Month and Floor
(building floor indicated at origin of each line)
Important Caveats

• Although the techniques displayed here are powerful, there are some downsides to this approach
  – Time involved to create assemble data and create non-standard graphs may not mesh with work demands
  – Relentless tinkering and artistic judgment

• Suggested sources for regular observations to develop an intuitive feel for the process
  – Suggested consistent source of good examples:
    • Wall Street Journal
  – Suggested consistent source of not-so-good examples:
    • USA Today “char-toons”
The ability to display data compellingly is the key to desired decision making.

Always anticipate “compared to what?”

Maximize the data-to-ink ratio – e.g. eliminate the unnecessary.

Think about what it is you’re trying to say.

Show to others unfamiliar with the topic without speaking – does this tell the story we’re trying to tell?
Your Questions at This Point?

Now Let’s Look at Some Other Examples
COLLABORATIVE LABORATORY INSPECTION PROGRAM (CLIP)

• During October 2005, 80 Principle Investigators for a total of 316 laboratory rooms were inspected
• A total of 30 CLIP inspections were performed

**PI Inspections:**

<table>
<thead>
<tr>
<th></th>
<th>Total PI’s</th>
<th># Without Lab Violations</th>
<th># With Lab Violations</th>
<th>% Without Lab Violations</th>
<th>% With Lab Violations</th>
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<tr>
<td>May 2005</td>
<td>94</td>
<td>53</td>
<td>41</td>
<td>56.38</td>
<td>43.62</td>
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<tr>
<td>June 2005</td>
<td>78</td>
<td>40</td>
<td>38</td>
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<td>July 2005</td>
<td>84</td>
<td>54</td>
<td>30</td>
<td>64.29</td>
<td>35.71</td>
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<tr>
<td>August 2005</td>
<td>74</td>
<td>54</td>
<td>20</td>
<td>72.97</td>
<td>27.03</td>
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<tr>
<td>September 2005</td>
<td>69</td>
<td>39</td>
<td>30</td>
<td>56.52</td>
<td>43.48</td>
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<td>October 2005</td>
<td>80</td>
<td>50</td>
<td>30</td>
<td>62.50</td>
<td>37.50</td>
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</table>
## Comprehensive Laboratory Inspection Program (CLIP) Activities and Outcomes, 2005

<table>
<thead>
<tr>
<th>Month in Year 2005</th>
<th>Number of Principle Investigators Inspected</th>
<th>Inspections Without Violations</th>
<th>Inspections With Violations</th>
</tr>
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<tbody>
<tr>
<td>May</td>
<td>94</td>
<td>53 (56%)</td>
<td>41 (44%)</td>
</tr>
<tr>
<td>June</td>
<td>78</td>
<td>40 (51%)</td>
<td>38 (49%)</td>
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<tr>
<td>July</td>
<td>84</td>
<td>54 (64%)</td>
<td>30 (36%)</td>
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<tr>
<td>August</td>
<td>74</td>
<td>54 (73%)</td>
<td>20 (27%)</td>
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<tr>
<td>September</td>
<td>69</td>
<td>39 (56%)</td>
<td>30 (44%)</td>
</tr>
<tr>
<td>October</td>
<td>80</td>
<td>50 (62%)</td>
<td>30 (38%)</td>
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</tbody>
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2005 Collaborative Laboratory Inspection Program (CLIP)
Inspection Activities and Compliance Findings

No. of Principal Investigator Inspections

<table>
<thead>
<tr>
<th>Month</th>
<th>Violations</th>
<th>No Violations</th>
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<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Oct</td>
<td>40</td>
<td>30</td>
</tr>
</tbody>
</table>

Months within Calendar Year 2005

Number without violations

Number with violations
Figure 3. Receipt of Radioactive Material

<table>
<thead>
<tr>
<th>Year</th>
<th>Non-Medical</th>
<th>Medical</th>
<th>Total</th>
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<tbody>
<tr>
<td>FY00</td>
<td>5000</td>
<td>2000</td>
<td>7000</td>
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<td>7000</td>
</tr>
<tr>
<td>FY04</td>
<td>1000</td>
<td>6000</td>
<td>7000</td>
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</table>
Fig. 3. Receipts of Radioactive Materials

Number of medical use radioactive material receipts

Number of non-medical use radioactive material receipts

Fiscal Year

FY 00 FY 01 FY 02 FY 03 FY 04 FY 05 FY 06

Number of receipts

0 1,000 2,000 3,000 4,000 5,000 6,000
Fig. 3. Receipts of Radioactive Materials

Number of medical use radioactive material receipts

Number of non-medical use radioactive material receipts

Fiscal Year

FY 00
FY 01
FY 02
FY 03
FY 04
FY 05
FY 06

Number of receipts

0
1,000
2,000
3,000
4,000
5,000
6,000
Results of University EH&S Lab Inspection Program, 2003 to 2005

Number of labs existing but not inspected

Number of labs inspected and one or more violation detected

Number of labs inspected and no violations detected

Note: 33 labs added to campus in 2005, increasing total from 269 to 302.
Average Cost of Workers Compensation Claims By Cause
Period FY01 - FY06
2005 Workers' Compensation
by Injury Type

Month: Jan, Feb, March, April, May, June, July, Aug, Sept, Oct, Nov, Dec

Number of Cases:
- Burn/Scald
- Caught In
- Cut, Puncture, Scrape
- Fall, Slip, Trip
- MVA
- Strain
- Strike Against
- Struck By
- Rub/Abraded
- Misc.
2005 Total Number of Monthly Workers Compensation Claims inclusive of the three most frequent identifiable classes of injuries

- Total
- Fall
- Strain
- Cut, Puncture

Graph showing the number of events per month from January to December 2005.
Growth in U of L Research Enterprise and Concurrent Growth in Committee and EH&S Workload, 2001 to 2005

Annual Research Expenditures in Millions of Dollars

Research Committees Workload

EH&S Biosafety Program Workload

Other EH&S Biosafety Associated Activities

- New IBC Protocols
- IBC Amendments
- IACUC Protocols
- Lab inspections
- Lab close outs
- Special Animal Safety Protocols
- ATCC Attestations
- MTA's
- DOD Certifications

- ATCC Attestations
- MTA's
- DOD Certifications
Reported Sharps Injuries by Type for Academic Year 2006  (total n = 22)

Number of reported events

Month of academic year 2006

Number caused by non-needle sharps
Number caused by hollow-bore needles

Start of Academic Year
<table>
<thead>
<tr>
<th>Year</th>
<th>Fire Extinguisher Systems</th>
<th>Fire Extinguishers</th>
<th>Fire Related Incidents</th>
<th>Asbestos Projects</th>
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<td>1986</td>
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<td>0</td>
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<td>1998</td>
<td>208</td>
<td>25</td>
<td>15</td>
<td>68</td>
</tr>
<tr>
<td>2003</td>
<td>437</td>
<td>46</td>
<td>-18</td>
<td>191</td>
</tr>
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</table>
Growth in Occupational Safety Responsibilities 1986 to 2003

- **Building Fire Systems to be Serviced**
  - Number: 0, 50, 100, 150, 200, 250

- **Required Portable Fire Extinguishers**
  - Number: 0, 1,000, 2,000, 3,000

- **Asbestos Projects**
  - Number: 0, 20, 40, 60

- **Fire Related incidents**
  - Number: 0, 500, 1,000, 1,500
Figure 1: Laboratory Waste verses Total Waste Generated

- Cost of Wastes Generated from Laboratory Operations
- Cost of Waste Generated from Administrative Departments
- Cost of Waste Generated from Renovation Projects
- Total Cost of Waste Generated by the University of Delaware
Figure 2: Annual Hazardous Waste Disposal Cost by Type of Institutional Activity

- Total cost
- Cost of waste from lab operations
- Cost of waste from administrative departments
- Cost of waste from renovation projects

Fiscal Year

Dollars:
- $0
- $50,000
- $100,000
- $150,000
- $200,000
- $250,000
- $300,000

Years:
- 2001
- 2002
- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
Chix® Quat-Safe™ Foodservice Towels

A Solution Engineered to Address a Crucial Food Safety Issue

Visit our website for a link to a special investigative report: www.chicopeeproducts.com

The depletion of quaternary sanitizer holding solutions is a widespread, serious problem in the foodservice industry. Allowing a solution to fall below the FDA standard of 200 PPM not only increases a foodservice operator’s chances of being cited during a health inspection, but also leaves their patrons at risk. Using Quat-Safe® towels ensures that sanitizer solutions are maintained at a safe level protecting both the foodservice operator from citation and the public’s health. Further, regulation in the form of FDA Food Code 3-304.14 B2 specifically states:

Wiping Cloths, Use Limitations - Cloths used for wiping food spills shall be wet and cleaned as specified under 4-402.11(E), stored in a chemical sanitizer at a concentration specified in 4-401.1/4, and used for wiping spills from food-contact and non-food-contact surfaces of equipment. This requires a solution that can be prepared and maintained at a concentration level to satisfy not only the FDA standard, but also any additional state or local regulations that may apply.

A recent study shows that traditional cotton towels immediately reduced quaternary sanitizer solutions by 13% followed by a total reduction of 52% over four hours. Solutions with Quat-Safe® towels were consistently above 350 PPM.

Quat-Safe™ vs. Standard Cotton Towels in 4-Chain Quat Solution

![Graph showing comparison between Quat-Safe™ and Standard Cotton Towels](image)

Regular cotton foodservice towels are negatively charged and therefore act as a “pump” that extracts the positively charged quaternary ammonium chloride ions from the holding solution. When rinsed, quaternary ammonium chloride ions, which are not firmly attached to the towel, are released with the water and bio-load and therefore discarded. Quick fixes such as changing sanitizer every couple of hours or using 4-chain quaternary sanitizers only increase expense; towels that are not Quat-Safe™ deplete sanitizers in minutes.

A regular nonwoven, terry, or linen towel is introduced into the sanitizer holding solution.

![Diagram showing towel and sanitizer interaction](image)

The result is a solution that is below the FDA guideline for a holding solution.

After more than 30 years experience in the foodservice and general purpose cleaning industry, Chicopee® remains a name synonymous with quality you can trust. Our hallmark is the total control of our product from fiber to finished goods.

For more information about our cost-effective wiping solutions, contact us at 888.835.2442 or visit us on the web at www.chicopeeproducts.com. Samples and information are available for educational purposes.

Quat-Safe™ is available for purchase through many major distribution networks. Call your local representative for information.

Thank you for making Food Safety a top priority!
The depletion of quaternary sanitizer holding solutions is a widespread, serious problem in the foodservice industry. Allowing a solution to fall below the FDA standard of 200 PPM not only increases a foodservice operator's chances of being cited during a health inspection, but also leaves their patrons at risk. Using Quat-Safe™ towels ensures that sanitizer solutions are maintained at a safe level protecting both the foodservice operator from citation and the public's health. Further, regulation in the form of FDA Food Code 3-304.14 B2 specifically states:

Wiping Cloths, Use Limitations - Cloths used for wiping food spills shall be wet and cleaned as specified under 4-802.11(D), stored in a chemical sanitizer at a concentration specified in 4-501.114, and used for wiping spills from food-contact and nonfood-contact surfaces of equipment. This requires a solution that can be prepared and maintained at a concentration level to satisfy not only the FDA standard, but also any additional state or local regulations that may apply.

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Quat-Safe™ vs. Standard Cotton Towels in 4-Chain Quat Solution

![Graph showing PPM Quaternary Ammonium Chloride over time for Quat-Safe™ and Cotton Towels.](image)

Regular cotton foodservice towels are negatively charged and therefore act as a "pump" that extracts the positively charged quaternary ammonium chloride ions from the holding solution. When rinsed, quaternary ammonium chloride ions, which are not firmly attached to the towel, are released with the water and bio-load and therefore discarded. Quick fixes such as changing sanitizer every couple of hours or using 4-chain quaternary sanitizers only increase expense; towels that are not Quat-Safe™ deplete sanitizers in minutes.

A regular nonwoven, terry, or linen towel is introduced into...
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A regular nonwoven, terry, or linen towel is introduced into...
Quat-Safe and Cotton
Food Service Towel Quanternary Ammonium Chloride Solution Concentration Compared Over Time*

*Towels removed and rinsed at each interval
People who find you on Facebook

- High School people you hated
- College people you hated
- Work colleagues you hate
- Actual friends

GraphJam
PRESTIGE vs TIME

YOUR INTENDED CAREER PATH

WHY YOU DRINK

YOUR ACTUAL CAREER PATH

BIRTH

DEATH

GraphJam
WHERE DO ALL MY SOCKS GO?

Number of Socks

When dryer is started

When dryer is finished

GraphJam
World’s Most Accurate Pie Chart

Pie I have eaten

Pie I have not yet eaten