Computer Decision Support for Antimicrobial Prescribing: Form Follows Function

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Panasonic
RESTROOMS

"And it was so typically brilliant of you to have invited an epidemiologist"

Outline

- Definition of “computer decision support”
- Extension of antimicrobial computer decision support programs into a) rural settings in the intermountain West and b) other tertiary referral hospitals in Salt Lake City
- What are the advantages to the use of computers to influence and improve antimicrobial prescribing?
- What are the limitations and barriers?

Why now?

Proposition: computer decision support for antmicrobial prescribing is on the cusp of widespread use

- Last June, a conference was held at Deer Valley, Utah to bring together experts in diverse fields to discuss both theoretical and practical aspects of the application of computer systems to infectious disease management

What does “computer decision support for antimicrobial prescribing” mean?

- Broad definition
  – Application of computer systems to advise or enhance management of infectious diseases
- Narrow definition
  – A computerized knowledge system that uses multiple patient data items to generate case-specific antimicrobial recommendations in real-time at the point of care

Moving up the computer food chain

- “Stand-alone” systems in which patient data are manually entered
- Automated alert systems
- Reminders and rules linked to computer order entry
- Comprehensive knowledge based systems integrated with electronic patient data

You do not need to have physician order entry to implement computer decision support programs

Targets for computer decision support in relation to the 12 step program

- Infection prevention
  - Vaccination reminders (step 1)
  - Catheter extended-use alerts (step 2)
- Infection diagnosis and the decision to initiate antimicrobials
  - Are positive cultures indicative of true infection or just contamination/colonization? (steps 7-8)

Antimicrobial decision-points (cont)

- Antimicrobial selection and orders
  - Does the empiric antimicrobial selection reflect local antimicrobial resistance data (step 6)
  - Was antimicrobial therapy appropriately narrowed when definitive culture results come back and the antimicrobials adequately covering the true pathogen(s) (step 3)
  - Is the dose and duration appropriate? (step 10)
  - Is the patient being adequately monitored for toxicity and clinical response?

Extension of antimicrobial decision support into rural communities: the RADAR (Rural Antibiotic Decision-support and Resistance) project

Funded by CMS

Partnership between Idaho and Utah PROs, University of Utah, Theradoc, and CDC

Key Personnel

- PRO-West and CMS
  - K Stevenson
  - P Houck
  - J Barbera
  - L Hannah
- HealthInsight
  - K Bateman
  - J Rischer
- Theradoc
  - S Pestotnik
  - J Olson
- CDC
  - J. Gerberding
  - C. Murphy
- University of Utah
  - M Samore
  - W Tettelbach
  - M Rubin
  - J Burke
  - M Sande

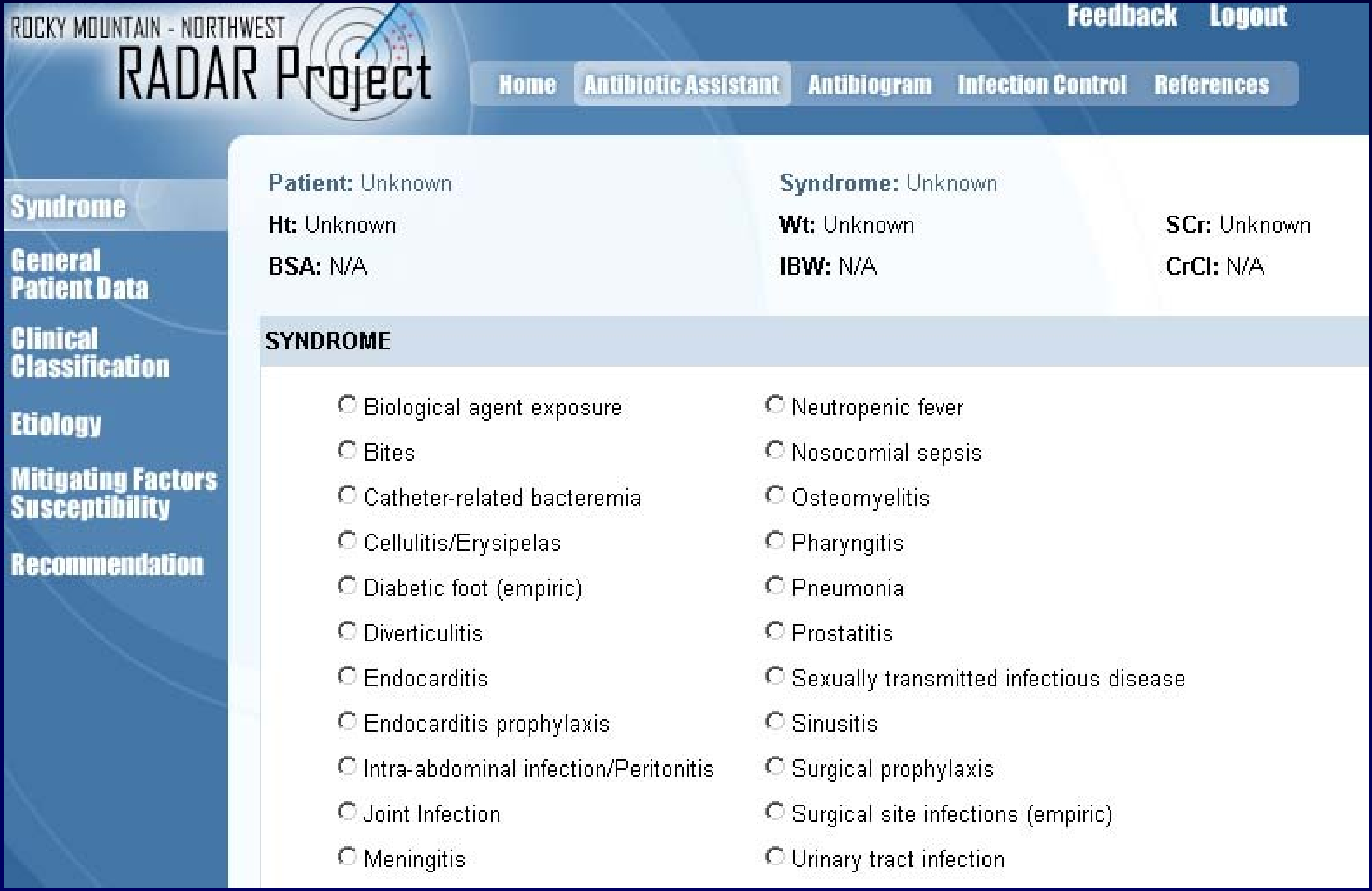
Initial aims

- Assess hospital characteristics, infection control infrastructure, microbiology laboratory practice, antibiotic resistance profiles, antibiotic utilization, quality improvement programs, and computer infrastructure in the inter-mountain West (Idaho, Utah, Nevada, and Washington)
- Develop a Web-based computerized tool that provides support for infection control and antibiotic decision-making

Decision-support components

- Organism and drug name lexicon
- Drug-bug engine
- Local formulary and antibiogram
- Empiric antibiotic selection rules
- Treatment duration rules
- Dose engine
- Rules for presentation of mitigating factors
- Evaluation of contraindications
- Intrinsic and cross resistance rules
- Drug interactions
- Equivalent and alternative agents
- Logic statements and caveats
- Structured feedback form

Screen shot of first page of Web-based decision support tool



Evaluation phase: antimicrobial management team

- Initial kick off: a presentation to the medical staff of the rural hospital about antmicrobial resistance
- For inpatients started on parenteral antimicrobials, the pharmacist evaluates what is prescribed against what is recommended by the Web-based decision support tool
- Pre- and post-assessment of antimicrobial prescribing orders

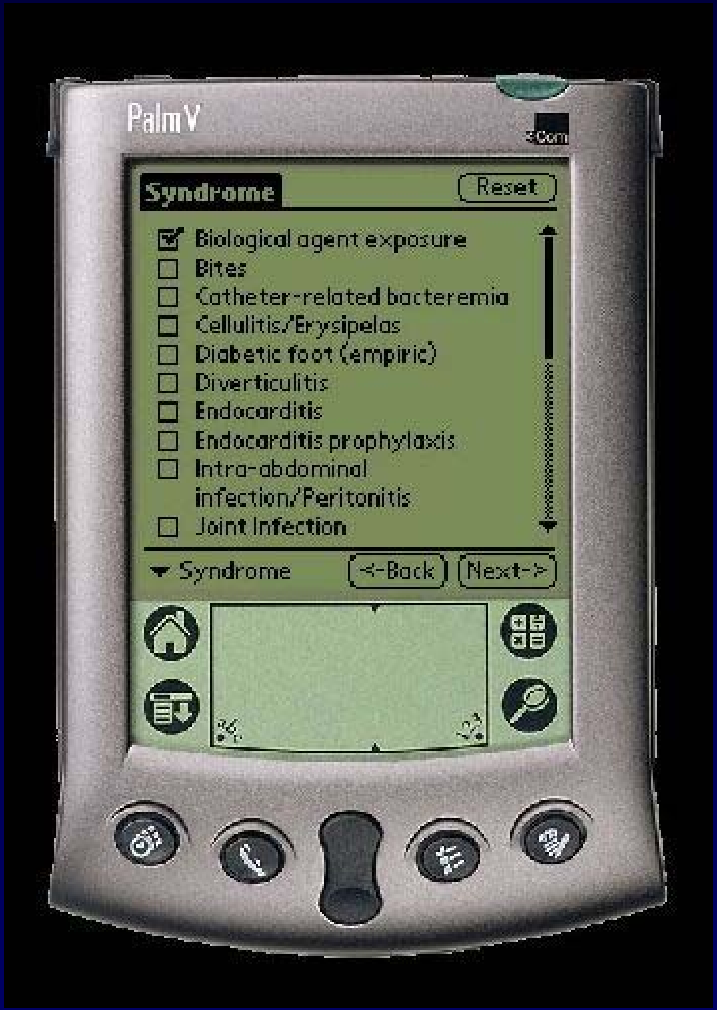
Another project directed toward rural communities: IMPART (Inter-Mountain Project on Antimicrobial Resistance and Therapy)

- CDC funded
- Partnership includes Utah and Idaho quality improvement organizations, state health departments, University of Utah
- One component involves a community randomized trial of a physician plus community/patient intervention versus a community/patient education alone
- For this component, the primary endpoint is antimicrobial usage, assessed using a variety of data sources

Algorithms and decision support tools provided to physicians

- Target diagnoses: rhinosinusitis, otitis media, pharyngitis, bronchitis
- Two different paper versions of the algorithms
- Downloadable palm pilot decision support tools
- Web site: www.impartproject.org

Palm pilot version of decision support tool



Extension of decision-support programs into the Pediatric Hospital setting

- Primary Children’s Hospital, Salt Lake City, UT
- Charles J. Mullett, M.D.,Ph.D, R. Scott Evans, M.S.,Ph.D., John C. Christenson, M.D., J.Michael Dean, M.D., M.B.A. **Development and Impact of a Computerized Pediatric Antiinfective Decision Support Program.** Pediatrics. October, 2001

Extension of the LDS decision support program into a pediatric hospital

- Same underlying information system (HELP)
- Rules and dose recommendations reconfigured for children and neonates
- Outcomes monitored included overall anti-infective use, anti-infective orders, therapy-susceptibility mis-matches, errors in dosing, pharmacist interventions, adverse drug events, and costs

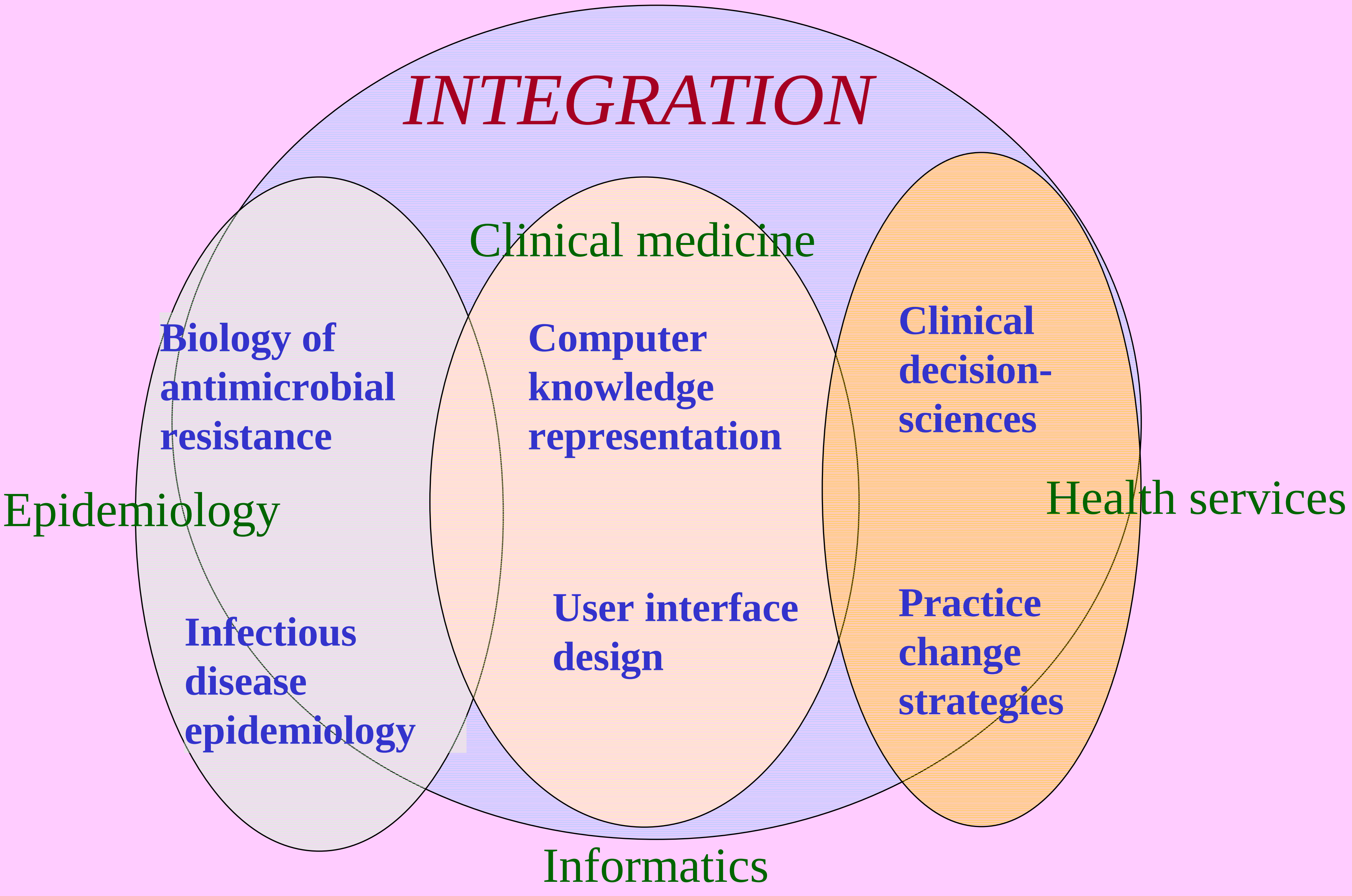
Results

- Six-month control and six-month intervention period
- Rate of pharmacy interventions for erroneous drug doses declined by 59% ($p<0.01$).
- Antiinfective subtherapeutic patient days decreased by 36% ($p<0.001$),
- Excessive-dose days declined by 28%

Computer decision-support for antimicrobial prescribing: opportunities

- Population level objectives *(inter-dependence, the feature that distinguishes infectious diseases from other clinical domains)*
- Use local, population level susceptibility data
- Individual optimization of agent(s), dose, duration (problem: where are the cultures?)
- Translation of computer logic for surveillance purposes
- Test hypotheses (such as the strategy to maximize antimicrobial “mixing”)

A graphical model of the components of antimicrobial decision support systems



Questions and Unknowns

- What is the desired level of compliance (50%? 75%? 95%?)
- Reducing practice variation may not be an appropriate goal (should diversity be explicitly increased?)
- Which type of device fits into workflow best? (e.g., in ambulatory clinics, laptops vs tablets vs handhelds)
- Is the optimal strategy for reducing resistance always known? (e.g., when should combination therapy be used for Pseudomonas aeruginosa?)

Computer decision support and antimicrobial resistance

- Computer programs are not a panacea but are highly promising as intervention tools particularly when designed by clinicians
- There is no evidence that computer-based guidance for antimicrobial prescribing is a uniquely superior way to reduce resistance.
- Effective antimicrobial stewardship may depend less on the modality and more on the application of sound principles of quality improvement, patient safety, judicious antimicrobial use

"This is so cool! I'm flying this thing completely on my Palm pilot!"

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A paperless environment is not the ultimate goal

- “Paper enables a certain kind of thinking. Picture, for instance, the top of your desk…..When a group at Apple Computer studied piling behavior several years ago, they found that even the most disorderly piles usually make perfect sense to the piler….Piles represent the process of active, ongoing thinking”*

*Gladwell M, The New Yorker, 3/25/02

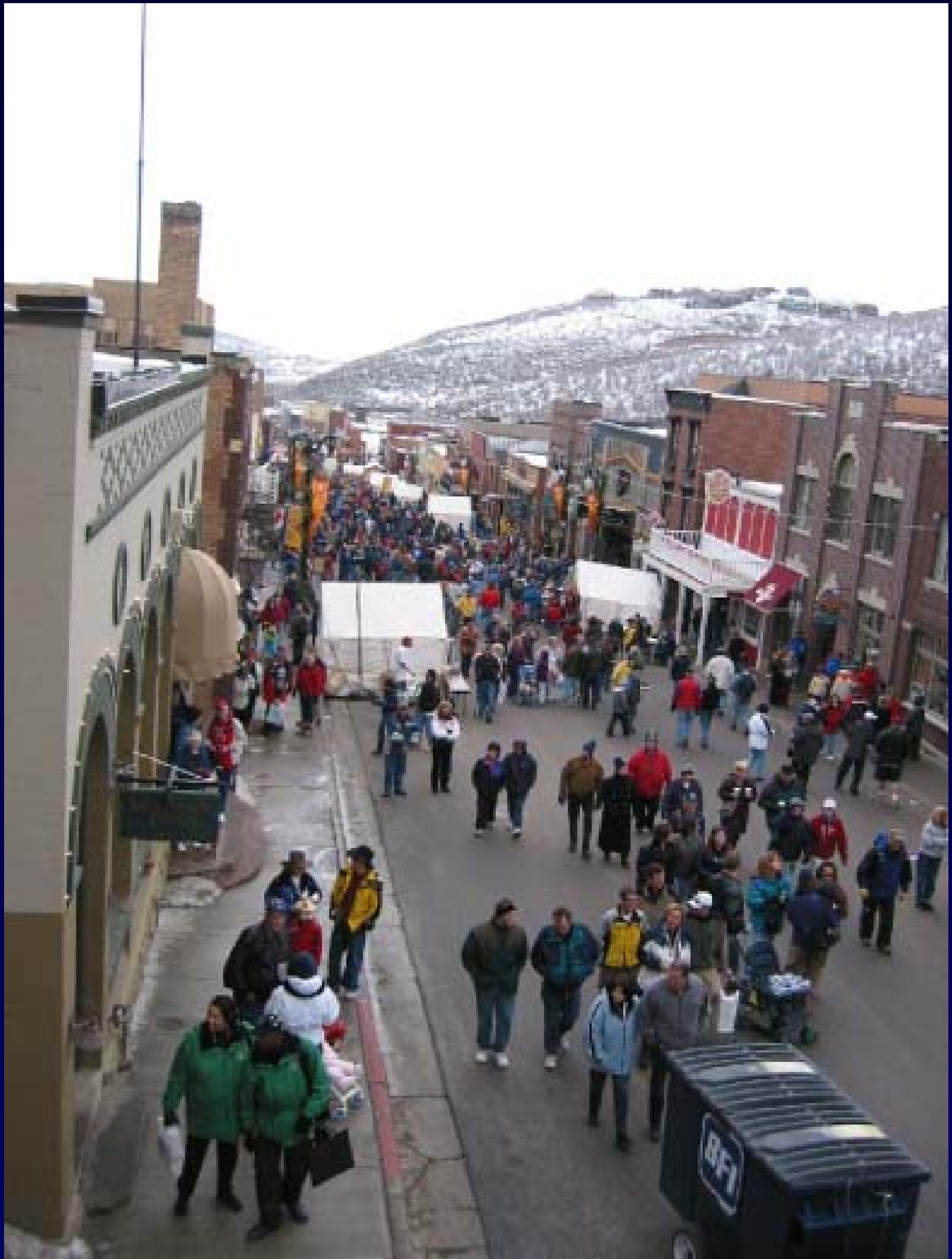
Conclusions I

- Computers are great tools for assisting clinicians in decision-making but it is not simply a matter of “build it and they will come”—there is wide variation in clinician acceptance and usage
- Now that a variety of computer programs for antimicrobial prescribing are “within reach”, rigorously conducted implementation and evaluation studies are vitally needed

Conclusions II

- Antimicrobial resistance is the most challenging endpoint to assess: single institution studies will be inadequate
- To see “programs in action”, attend the 4 hour SHEA workshop April 6th in Salt Lake City:

  “Use of computers to enhance surveillance and management of infections and antimicrobial resistance: building blocks and example programs”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