A Systems Approach for Vision Health

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- University of Michigan
- Duke University
- PBA (past board member)
- CDC (consultant)

- Conflicts of Interests
  - Genentech
  - Pfizer / Merck / GSK
  - Novartis
  - Quorum
  - Health services research funding

Systems Approach for Vision Health

- Focus on the future
- Learning system based on surveillance
- Possible future changes

Eye Care for the Future

Hugh Taylor, Wiesenfeld Lecture, IOVS, 2002

- Poor vision is bad for you
- Poor vision is much more common than we think
- Lots of simple things to be done for poor vision
  - Refractive error
  - Cataract
  - Diabetes
  - Glaucoma
  - AMD
- Vision 2020 and national action plans (e.g., Healthy People 2020)

LECTURE

Eye Care for the Future
The Weisenfeld Lecture

Hugh R. Taylor

I am particularly proud to give the Mildred Weisenfeld Lecture because she was truly a great lady. Mrs. Weisenfeld died in 1997 at the age of 76.[1,2] She had lost her vision as a teenager to retinitis pigmentosa, but when she was only 25, she established the National Council to Combat Blindness, which soon became known as Fight for Sight. Its first research grants were provided in 1947 and, over the years, many of the young researchers became the leaders in ophthalmology in the United States and overseas. In 1949, Mildred Weisenfeld started working with others to have blindness added to the mandate of the National Institute of Neurologic Diseases and she continued pressing until the National Eye Institute was finally established.

Fight for Sight is a very important supporter of eye research, particularly focusing on young researchers and fellowship applications. ARVO took over the peer review of these applications in the mid 1980s, and this has continued under the leadership of Art Silverstein. In 1988, Fight for Sight became the research division of Prevent Blindness America.

I was very proud to receive the first Fight for Sight citation for achievement in clinical research at ARVO in 1980 as a very young researcher. I take this opportunity to recognize the great contribution of my colleagues and mentors, with whom I shared this award: Art Silverstein, Chan Dawson, and Bob Prendergast. I had the distinct privilege of winning this award a second time in 1987, this time in collaboration with our President, Sheila West, Beatrice Munoz, and other colleagues. It was during this time that I also had the pleasure of meeting Mrs. Weisenfeld.

Mrs. Weisenfeld enlisted many famous people to support her work, ranging from Bob Hope to Liza Minelli, and she continued to work full time until her death. Her enormous contribution was recognized by ARVO and the American Academy of Ophthalmology and also by President Harry S. Truman. Mildred Weisenfeld was passionate about the importance of ophthalmic research and the need to make a difference in people's lives.

Population-Based Data

I have chosen to talk about eye care for the future, but before you can look at the future, you have to know where you are. The work that I present here draws on the experience of many studies, but particularly on the work that we have done in Melbourne. We are based at the Royal Victorian Eye and Ear Hospital, which is as much an "ivory tower" as you will find anywhere. However, we were concerned to find the status of eye care and eye disease in our community, and to do this we had to get out to where the people are, rather than wait and examine only those who came to see us at the clinic.

As with the other major population-based studies such as the Beaver Dam Eye Study, the Blue Mountains Eye Study, the Rotterdam Eye Study, the Salisbury Eye Study, and so forth, we first defined a particular area and then went door to door to do a private census to identify every resident older than 40 years.[3] We set up a local examination site with all our equipment in a suitable local house or office. We collected detailed background information and medical histories from participants. We used standardized measurements of acuity, refraction, and so forth and standardized eye examinations with photographs of the lens, retina, and discs that were all later graded. For those who could not come to our examination site, we conducted examinations at home. We wanted to make sure that nobody who was in the sample escaped our net if we could help it.

Our initial work was done over several years and involved nine randomly selected sites in the Melbourne metropolitan area that gave us an urban sample of 3271.[4] We then randomly sampled nursing homes in the areas around the field sites to get a sample of 403 people in aged care and nursing homes.[5] Finally, we examined a rural sample of 1473.[6] We then had a representative sample and could reconstruct the distribution of eye disease across the whole community. We had examined a total of 5147 people aged more than 40 years; the oldest participant was 103. Overall, we had a very good participation rate of 86%. Having gathered these data, it was just a "simple matter" of feeding them into the computer, turning the handle three times, and out comes all the information. Basically, there are only three things you need to know.

1. Poor Vision Is Bad for You

The first thing to recognize is that poor vision is bad for you, and now data are available to quantify this. Data from the Salisbury Eye Study and the Blue Mountains Eye Study show that even a moderate level of visual impairment—that is, less than 6/12 (20/40)—has a significant impact on the ability of people to enjoy healthy aging (Table 1). Difficulties in daily living, social functioning, and religious participation, all are altered twofold by just this very modest reduction in acuity.[7] The use of community services increases 12% for each line of vision lost (Wang JJ, Mitchell P, Smith W, Cumming RG. ARVO Abstract 3077, 1998).

Not only is there an impact on social isolation, but this level of moderate visual impairment has a significant impact on morbidity. The Beaver Dam Eye Study and others have shown an increased risk of falls and hip fractures[8,9] and an increase in depression.[10] Probably of greatest importance is the doubling in mortality attributable to this moderate visual loss, even after adjusting for the other factors that affect morbidity that can be measured in a population-based study.[11–15]

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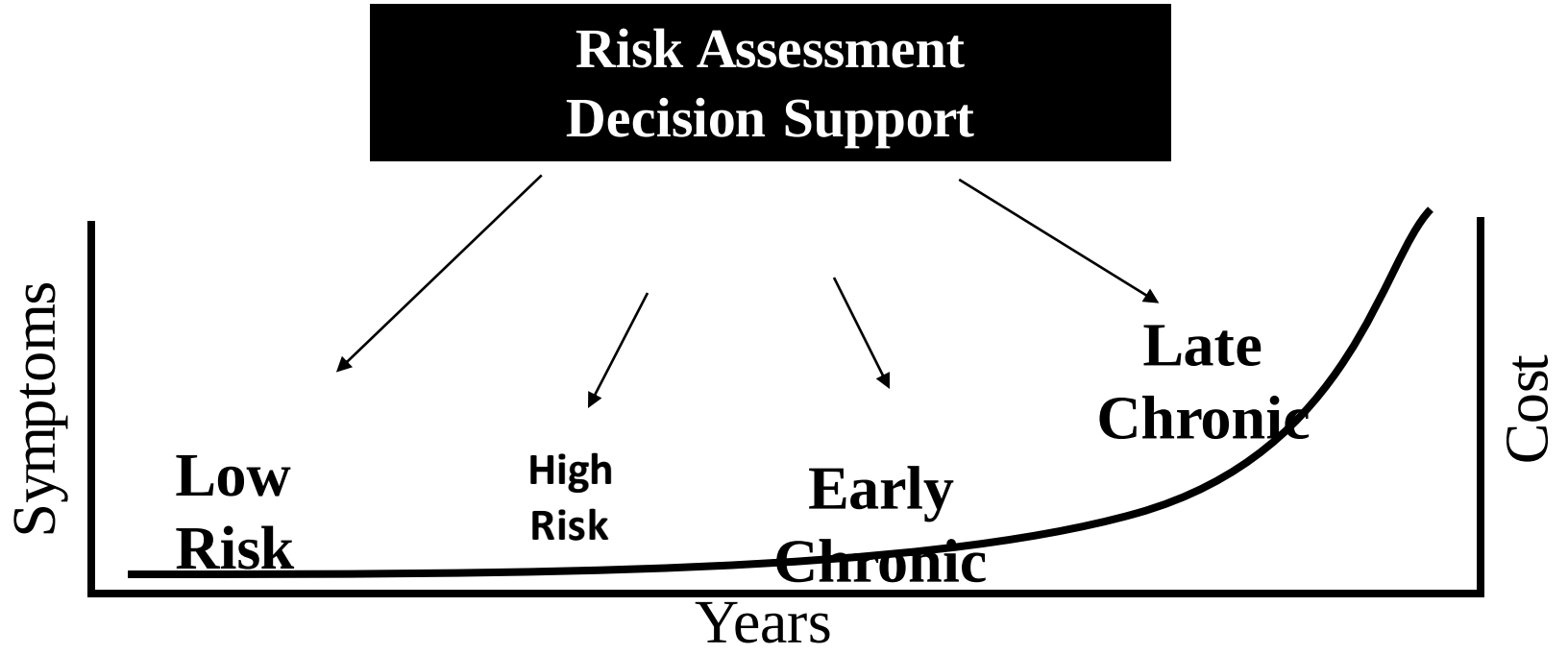
New Paradigm - Prospective Health

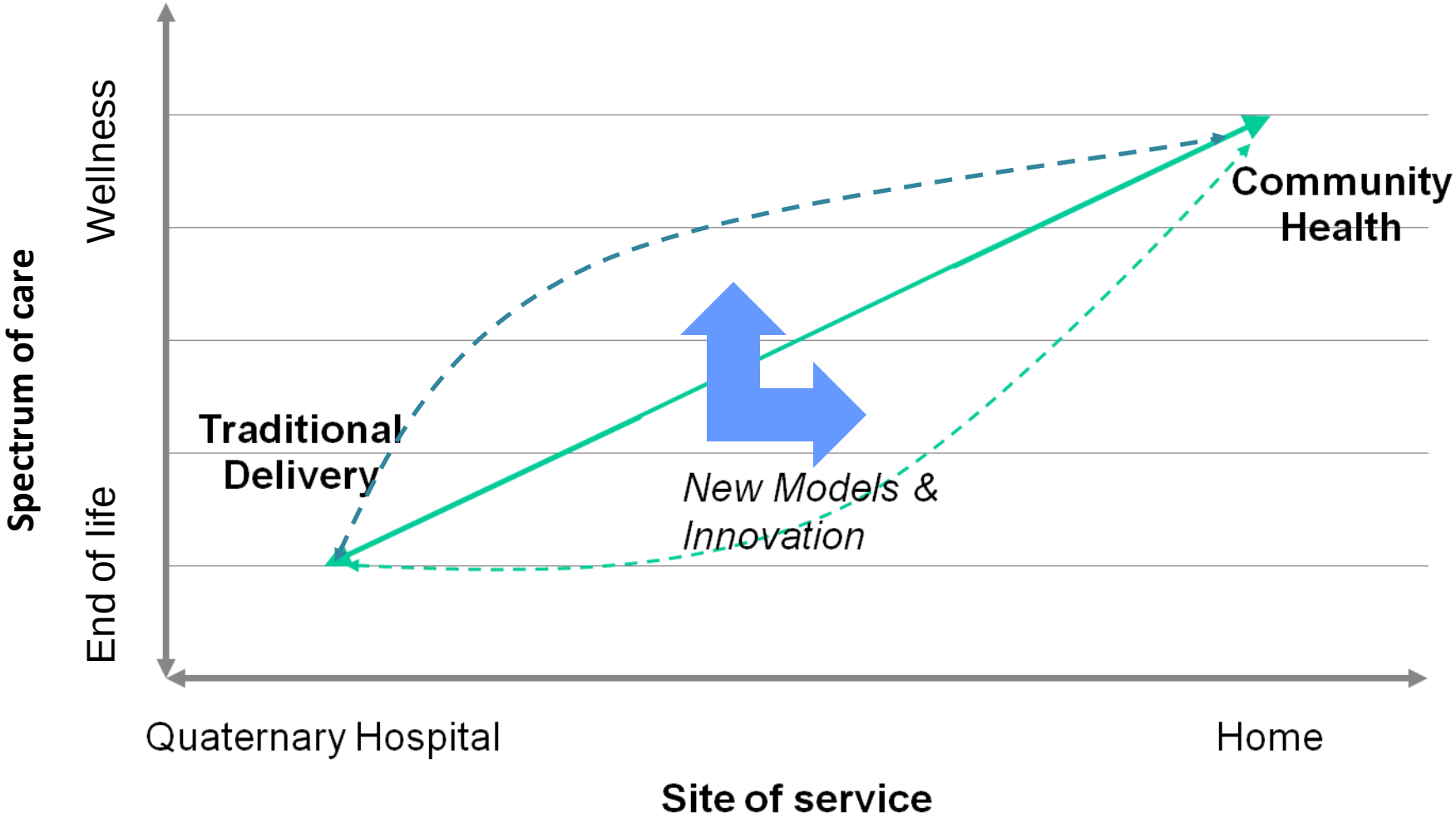


Personalized Health Plan

Personal Lifestyle Plan	*Risk Modification*	*Disease Management*
Wellness education and Internet & Health Provider guided planning for all; genomics / personalized education	**Wellness education and Internet & Health Provider guided planning for all; genomics guided**	**Individual-focused; integrated provider systems. Focus on quality of life and palliation at appropriate late stages**

(Courtesy of R Snyderman, MD)

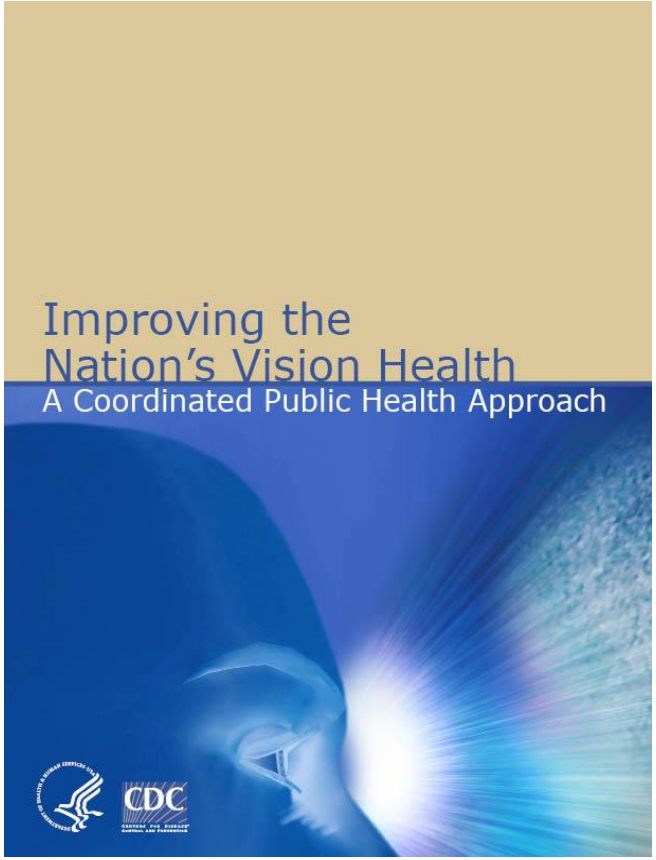
Population Health for Systems



Source: Paul Lee

Systems Approach and Surveillance

- Monitor / Prioritize / Evaluate
  - Vision loss
  - Use of eye care
  - Eye injury and protection
- Integrate data with programs to meet Healthy People 2020
  - Reduce disparities



Systems Approach for Vision Health

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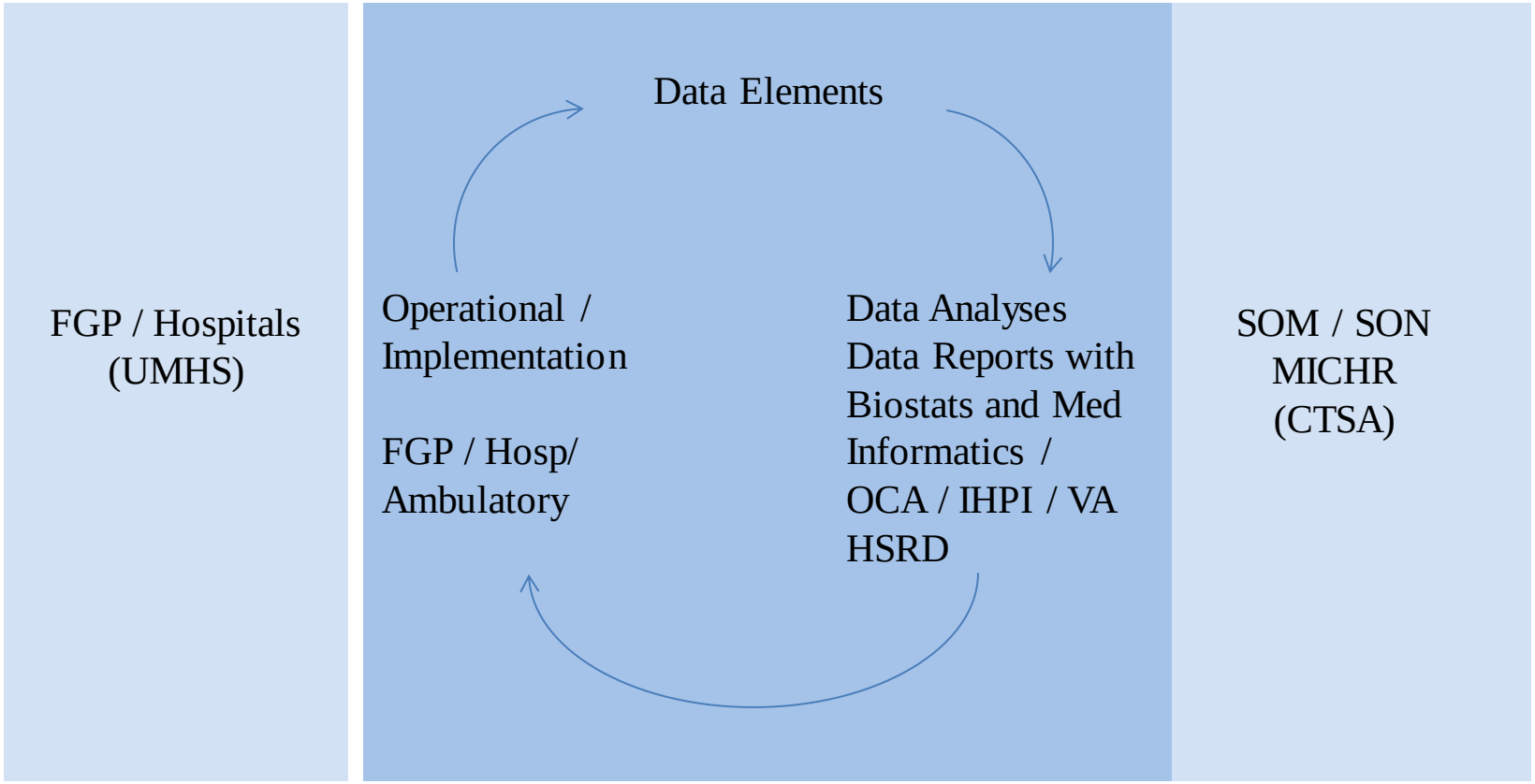
Fundamentals of a Systems Approach: Learning Health Care System



- **Critical role of faculty leadership in collaborative, integrated teamwork**
- **Can establish priorities and governance**
- **Define outcomes and metrics that matter**
- **Virtuous cycle of academic and operational improvement**
- **Implementation in specific areas**

Healthy People 2020 Objectives

- Increase the proportion of adults who have a comprehensive eye examination, including dilation, within the past 2 years
- Increase the use of personal protective eyewear in recreational activities and hazardous situations around the home
- Increase vision rehabilitation

Healthy People 2020 Objectives

- Reduce visual impairment in US population
  - Uncorrected refractive error (12 and older)
  - Diabetic retinopathy
  - Glaucoma (45 and older)
  - Cataract (65 and older)
  - Age-related macular degeneration (AMD) (45 and older)

Functions (Minimum) of Vision Surveillance System to Achieve Objectives

- Establish standard definitions of endpoints for Healthy People 2020 objectives
- Reliably collect data on Healthy People 2020 objectives
- Integrate with "effectors" who can implement programs to increase utilization of appropriate services and reduce visual impairment
- Feedback loop of endpoint measurement of progress towards meeting objectives

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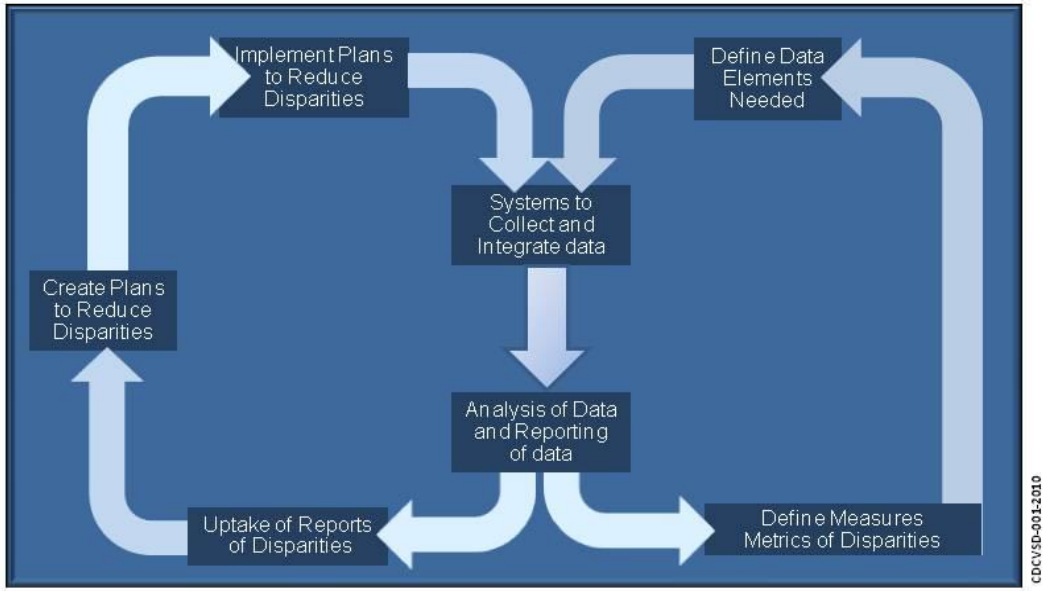
Surveillance Panel Observations

1. **Link data collection and analysis with ongoing public health interventions to improve eye health disparities**



Panel Observations

2. **Effectively assess vision loss**
    A. **Performance-based measures**
        - **Threshold approach**
        - **Central visual acuity**
        - **Contrast sensitivity**
    B. **Self-reported measures**
        - **Need to harmonize measures**

Technology Interface

- Fundus / Imaging cameras
  - Telephone camera
  - Cheaper systems

- Assessment of acuity
  - Online
  - I-pad

Automated Detection of DR

Abramoff MD, Neimeijer M, Russell SR. Expert Rev Med Dev 2010

Performance

- "… performance of the algorithms measured in ROC only slightly lags behind the sensitivity and specificity of the experts."
- "… the system can always match the sensitivity of the human expert – but at a lower specificity."
- " the cost per patient for automated detection to be … [US $ 0.25]

Future Efforts

- "… further measurable improvements in detection performance have become difficult to achieve."
- "… validation on well-defined populations of patients with diabetes … are more urgent than further algorithm development."

Panel Observations

3. **Effectively assess utilization of care**
    A. **Currently measured in < ½ states**
    B. **Multiple methods available**
        surveys / claims data / EHR's
    C. **Topics of interest**
        use intervals / barriers / rehab use

Use of Claims Databases

Jonathan Javitt – pioneer in Medicare database analyses

Outcomes of Eye Care From Medicare Data

Clinical research in ophthalmology has increasingly shifted from isolated case reports and retrospective analyses of case series to randomized prospective trials and cross-sectional population-based studies of eye disease, enabling investigators to draw broadly applicable inferences about treatment, disease prevalence, and risk factors. Because clinical trials and population-based studies consume considerable scarce research resources in terms of research funds, personnel, and space, they are appropriately employed only to answer questions of major interest that cannot be answered through other means. In proper circumstances, the implementation of recommendations resulting from multicenter trials can generate positive economic and clinical outcomes.[1,2]

See also p 1085.

Study of the outcomes and effectiveness of medical care (so-called outcomes research) based on insurance databases and similar secondary sources shows promise for studying issues not practically addressed by clinical trials and population-based studies. At comparatively lower cost and research resource consumption, outcomes research can provide an overview of specific treatment modalities throughout the country and point to variations in treatment and in the outcomes of that treatment. This may provide the study hypothesis for a subsequent trial or may yield clinically applicable conclusions on its own. We recently presented data on the rate of rehospitalization for retinal detachment following cataract extraction and in this issue present data on rehospitalization for endophthalmitis.[3] These studies are based on the Medicare records of all 338 141 Medicare beneficiaries aged 65 years and older who were hospitalized for cataract extraction in 1984. The rate of rehospitalization (1.55%) for retinal detachment during the 4 years following intracapsular surgery was more than one and one half times the risk associated with extracapsular cataract extraction (0.9%). This is hardly a surprising finding and is consistent with the teaching of most ophthalmology residency programs.

Several surprising findings emerged from this study, however, that point out the unique strengths of outcomes research. First, the likelihood of rehospitalization for retinal detachment in all groups of patients studied was quite low and substantially less than most rates reported in the ophthalmologic literature from retrospective case series. Second, the rate of rehospitalization for retinal detachment following phacoemulsification (1.12%) was also higher than that following extracapsular extraction. Third, patients who underwent anterior vitrectomy for vitreous loss at the time of cataract extraction were four and one half times more likely to be rehospitalized for retinal detachment than those who underwent all types of cataract extraction with no concurrent vitrectomy (5.0% vs 1.12%). Last, younger patients undergoing cataract extraction were at greatest risk of subsequent retinal detachment, regardless of surgical modality.

Perhaps the most important strength of outcomes research is its inherent ability to detect differences in the rate of rare events. Serious complications of ophthalmologic care are rare events. Achieving 90% power ($\beta = .1$) to detect the above difference between intracapsular and extracapsular surgery requires that 15 000 patients be followed up in each group, a daunting task for any institution.[4]

The discrepancy between outcomes of care in the Medicare data set and those reported in the ophthalmologic literature suggests that the patients or surgery studied in the two sources may differ. The 338 141 Medicare beneficiaries are likely to be representative of all elderly US patients and to have been operated on by a representative sample of ophthalmologists. While an inpatient data file was used, 1984 was a year in which 50% of cataract surgery in the United States was performed on an inpatient basis.

In contrast, the largest literature report consisted of 5870 patients from a single center. Since all 5870 charts were reviewed manually, this is certainly a monumental achievement. Nevertheless, retrospective case series generally reflect the experience in a single institution, frequently an academic referral center, in which patients are likely to have ophthalmologic comorbidities and other underlying factors that predispose them to higher complication rates. Additionally, case series are frequently published to record the experience of the first cohorts of patients to undergo a particular intervention. Thus, the outcome of these patients may differ from that of patients exposed to a more mature technology.

Patients identified in the Medicare database by definition are representative of the national experience for persons aged 65 years and older. In most cases, they receive treatment that represents the current standard of care (in 1984, nearly two thirds of patients underwent extracapsular extraction and one third of patients un-

Downloaded from www.archophthalmol.com at Duke University, on June 16, 2011

Issues with Current Analyses

- Accuracy of coding
  - Procedures - high
  - Diagnoses (3 / 4 /5 digits) - variable
- Completeness of coding for all conditions in patient
- Uncoded / unbilled services
- No laterality
- Generally no severity / stage of condition (but DM and AMD have stages, and OAG soon)
- Aggregates across all providers for patient data

Impact of ICD-10 Coding System

Starting October 1, 2013

- ICD-10-CM for diagnoses
  - Up to 155,000 combinations
  - Goes to 7 alphanumeric characters (6 eye) with decimal after 3rd
  - Laterality (inc bilateral)
  - Combines conditions and common symptoms
  - Future expansion possible
  - Expanded post-operative complications
  - Distinction intra and post-operative complications
- ICD-10-PCS for procedures (2012)
  - 7 alphanumeric characters, no decimals
  - 71,918 codes total
    - 61,896 in med / surg
  - Greater detail about devices
  - Restricts NOS / NEC
  - Character 2 = body system
  - Character 3 = root operation
  - Characters 4 through 7
    - Body part / Approach
    - Device / Qualifier

Sampling of Registries

Non-Ophthalmic

- US Bureau of Pension for Union Army Civil War disability pensions (1890)
  - Sloan F, et al, Archives, 2008
- Uses
  - Prevention
  - Treatment
  - After care
  - At risk
  - Population status / disease
- Duke Databank for Cardiovascular Disease, 1969 (Eugene Stead)

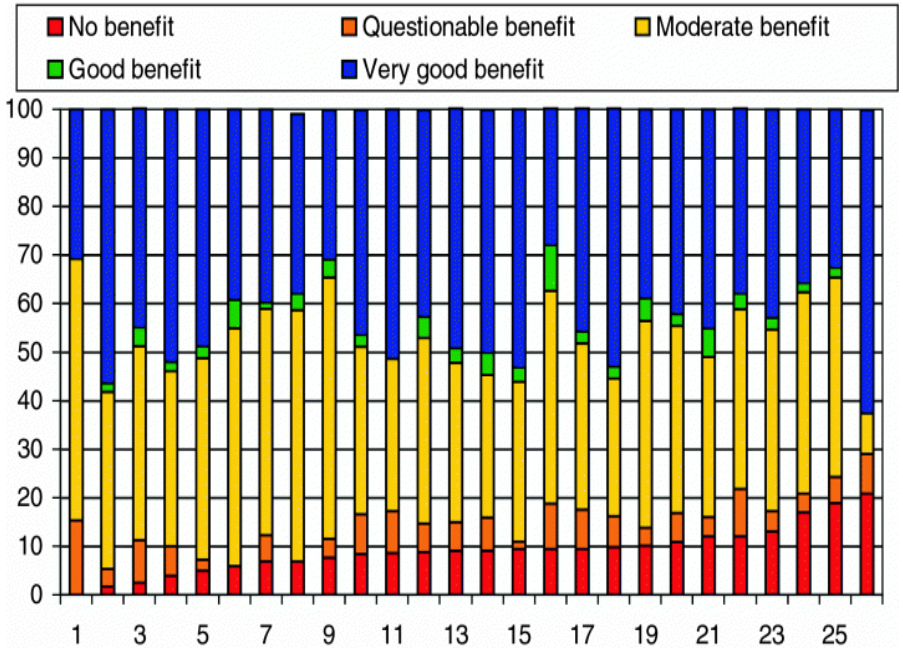
Eye Care

- Blindness Registries
  - Country
  - State
- Retinoblastoma (Netherlands)
  - Data as far back as 1862; start 1945
- Ocular side effects of drugs
- Cataract Surgery
- Corneal grafts
- Eye injury / trauma
- Dry eye
- Glaucoma

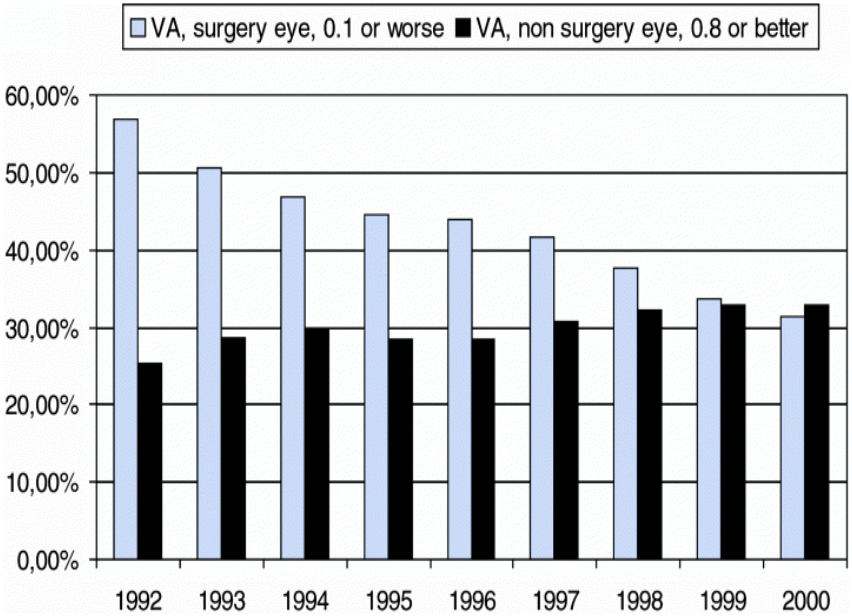
Swedish Cataract Registry Work

Stenevi, Lundstrom, Thorburn, Acta Ophthalmol Scand 1995 / Lundstrom et al, Acta Ophthalmol Scand 2002 / Kugelbuerg & Lundstrom J Cat Refr Surg 2008

Quality of Life measures using CATQUEST



Pre-operative VA



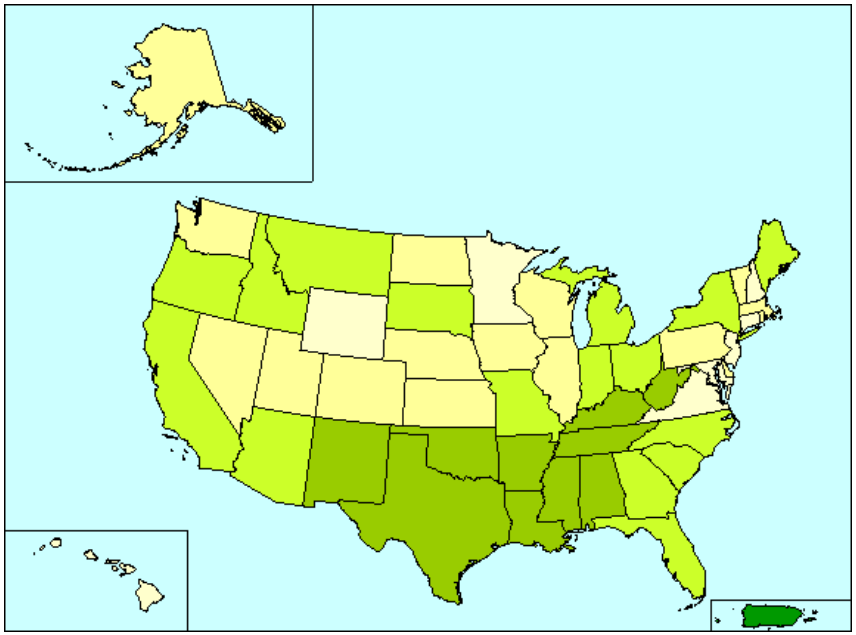
Panel Observations

4. Include defined populations to assess disparities in vision loss and utilization of care

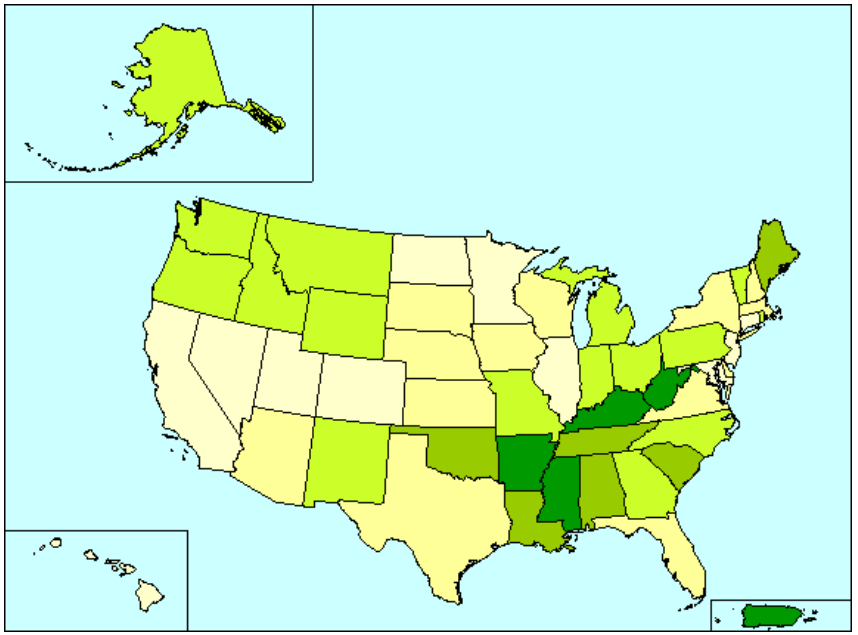
- **A. Geographic**
- **B. Gender**
- **C. Race/ Ethnicity**
- **D. Socioeconomic status**

Geographic Variation Mapping: Economics and Health

Poverty – US 2007

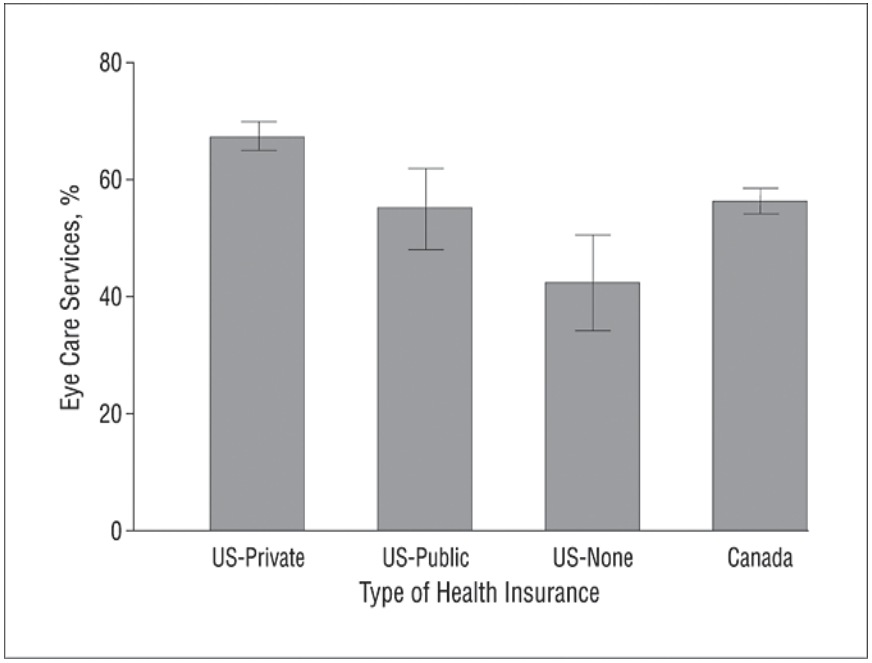


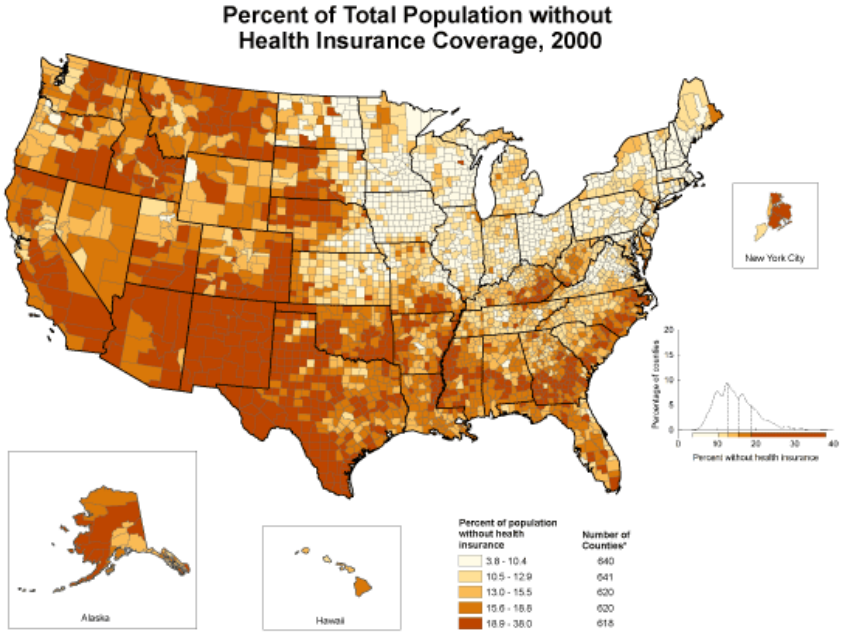
Disability – US 2007



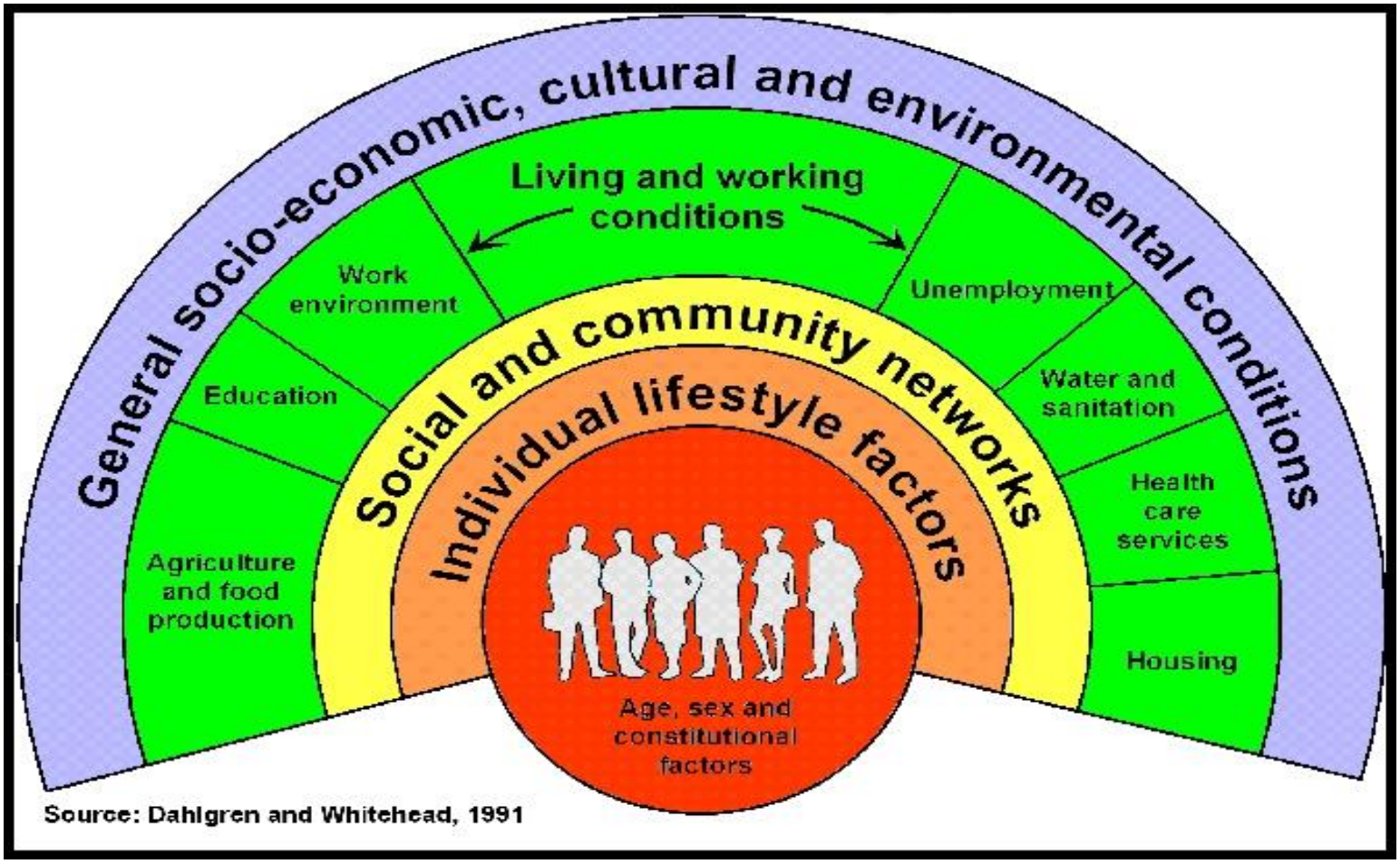
Insurance and Use of Eye Care

Zhang X, et al, Arch 2008





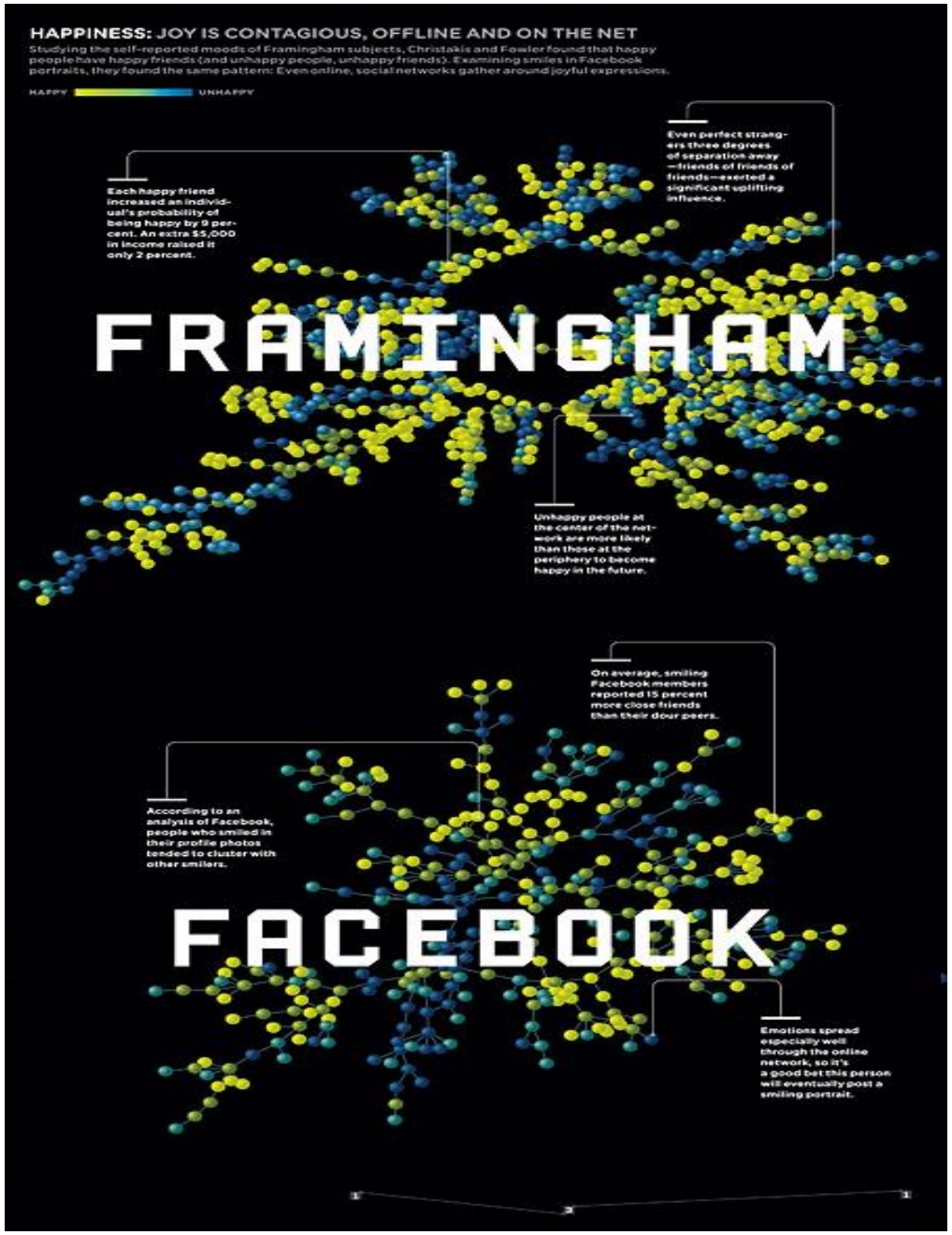
Social Determinants of Health



Panel Observations

5. Include and sustain ophthalmic / vision measurement and question components within national surveys

A. **BRFSS – vision module in 23 states (since 2005; discontinued in 2011)**
B. **NHANES – vision discontinued in 2009**
C. **NHIS vision supplement in 2002 and 2008**



Social Networks to Change Attitudes

- WIRED, Issue 17.10, Sept 2009
- People cluster around happy people / joyful expressions
- Smoking cessation
- Weight loss
- Healthy behaviors

Panel Observations

6. Vision surveillance system needs to be forged among federal agencies and other stakeholders to monitor nation's eye health and eye care utilization for trends in disparities

A. **Harmonize self-reported items**

B. **Promote implementation of system**

C. **Offer input to private entities**

Engaging Care System to Meet Healthy People 2020 Objectives

- Essential link in continuous improvement / learning systems approach
- Enterprise approach with coordination of care system stakeholders
  - Support surveillance system
  - Coordinate implementation programs / approaches

Prevent Blindness America®

Our Vision Is Vision®