



Big Data: Opportunities and Challenges in Healthcare

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Big data growth

- U.S. healthcare system reached 150 exabytes in 2011
- Growing at an annual rate of 40%
- At this rate, healthcare will soon reach the zettabyte and yottabyte scales
- Kaiser Permanente is estimated to have between 26 and 44 petabytes of data from electronic health records alone

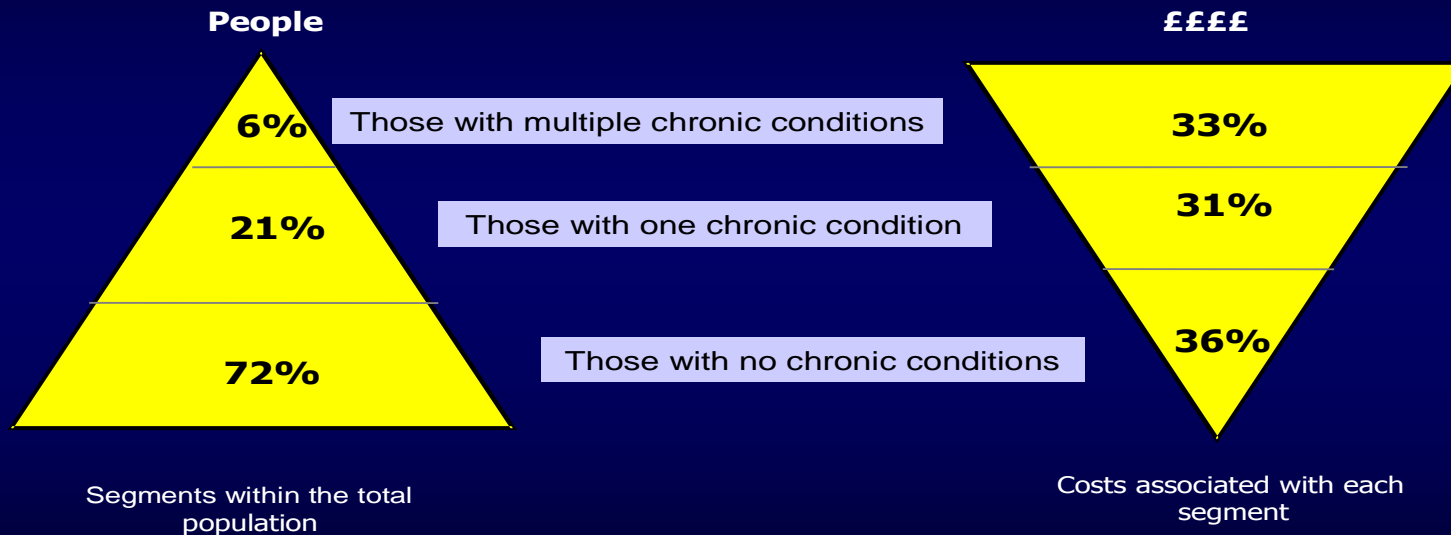


We live and work in challenging times

- Health care reform is on the agenda
- Burden of chronic illness
- More with less
- Rapid pace
- Relentless change
- Increased accountability

Naylor & Naylor 2012 ; Song & Lee 2013; Davidson, Daly & Hill 2013

Chronic Illness Drives Medical Care Costs



Source: Kaiser Permanente Northern California commercial member ship, DxCG methodology, 2001.

Source: Towards Managed Care - Information Exchange Event. Dr HF Macintyre
17th September 2004, Effingham Park Hotel, Copthorne Accessed at <http://www.natpact.nhs.uk/cms/363.php>.

EXHIBIT ES-1. OVERALL RANKING

COUNTRY RANKINGS

Top 2*

Middle

Bottom 2*



	AUS	CAN	FRA	GER	NETH	NZ	NOR	SWE	SWIZ	UK	US
OVERALL RANKING (2013)	4	10	9	5	5	7	7	3	2	1	11
Quality Care	2	9	8	7	5	4	11	10	3	1	5
Effective Care	4	7	9	6	5	2	11	10	8	1	3
Safe Care	3	10	2	6	7	9	11	5	4	1	7
Coordinated Care	4	8	9	10	5	2	7	11	3	1	6
Patient-Centered Care	5	8	10	7	3	6	11	9	2	1	4
Access	8	9	11	2	4	7	6	4	2	1	9
Cost-Related Problem	9	5	10	4	8	6	3	1	7	1	11
Timeliness of Care	6	11	10	4	2	7	8	9	1	3	5
Efficiency	4	10	8	9	7	3	4	2	6	1	11
Equity	5	9	7	4	8	10	6	1	2	2	11
Healthy Lives	4	8	1	7	5	9	6	2	3	10	11
Health Expenditures/Capita, 2011**	\$3,800	\$4,522	\$4,118	\$4,495	\$5,099	\$3,182	\$5,669	\$3,925	\$5,643	\$3,405	\$8,508

Notes: * Includes ties. ** Expenditures shown in \$US PPP (purchasing power parity); Australian \$ data are from 2010.

Source: Calculated by The Commonwealth Fund based on 2011 International Health Policy Survey of Sicker Adults; 2012 International Health Policy Survey of Primary Care Physicians; 2013 International Health Policy Survey; Commonwealth Fund *National Scorecard 2011*; World Health Organization; and Organization for Economic Cooperation and Development, *OECD Health Data, 2013* (Paris: OECD, Nov. 2013).



Health care: data rich

But information poor

(David Currow 2011)

Healthcare and big data

- Healthcare generates huge amounts of data
- Hard copy non standardized data elements
- Electronic storage heralds many opportunities
- Implementation and process issues
- Sociology and politics of health



Date	Time	Notes
10/1/10	10:00	Patient admitted to the hospital. Initial assessment: T 38.5, P 100, R 20, BP 120/80. Patient is alert and oriented. History of illness: 2-day history of fever, cough, and shortness of breath. Physical exam: Lungs clear, heart normal, no edema. Lab work: WBC 12,000, CRP 10. Treatment: Started on amoxicillin and ibuprofen. Patient is on oxygen at 2L. Plan: Monitor vital signs, repeat chest exam, and lab work in 24 hours.
10/1/10	14:00	Update: Patient's condition is stable. T 38.0, P 90, R 18, BP 110/70. Patient is eating and drinking well. No new symptoms. Plan: Continue current treatment and monitor.
10/1/10	18:00	Update: Patient is still stable. T 37.5, P 85, R 16, BP 100/60. Patient is sleeping well. No new symptoms. Plan: Continue current treatment and monitor.
10/2/10	08:00	Update: Patient is discharged. T 37.0, P 80, R 14, BP 90/50. Patient is feeling well and is able to perform daily activities. Plan: Discharge home with instructions and follow-up in 7 days.



What is big data in healthcare?

- *“Big data in healthcare refers to electronic health data sets so large and complex that they are difficult (or impossible) to manage with traditional software and/or hardware; nor can they be easily managed with traditional or common data management tools and methods” (Frost & Sullivan)*



What is big data in healthcare?

- Electronic health records
- Health insurance claims
- Biometric data
- Data input by individuals
- Multiple data to enabling patterning



Heart, Lung and Circulation (2014) 23, 320–324

1443-9506/04/\$36.00

<http://dx.doi.org/10.1016/j.hlc.2013.10.056>

Socioeconomic Status and Heart Failure in Sydney



CrossMark

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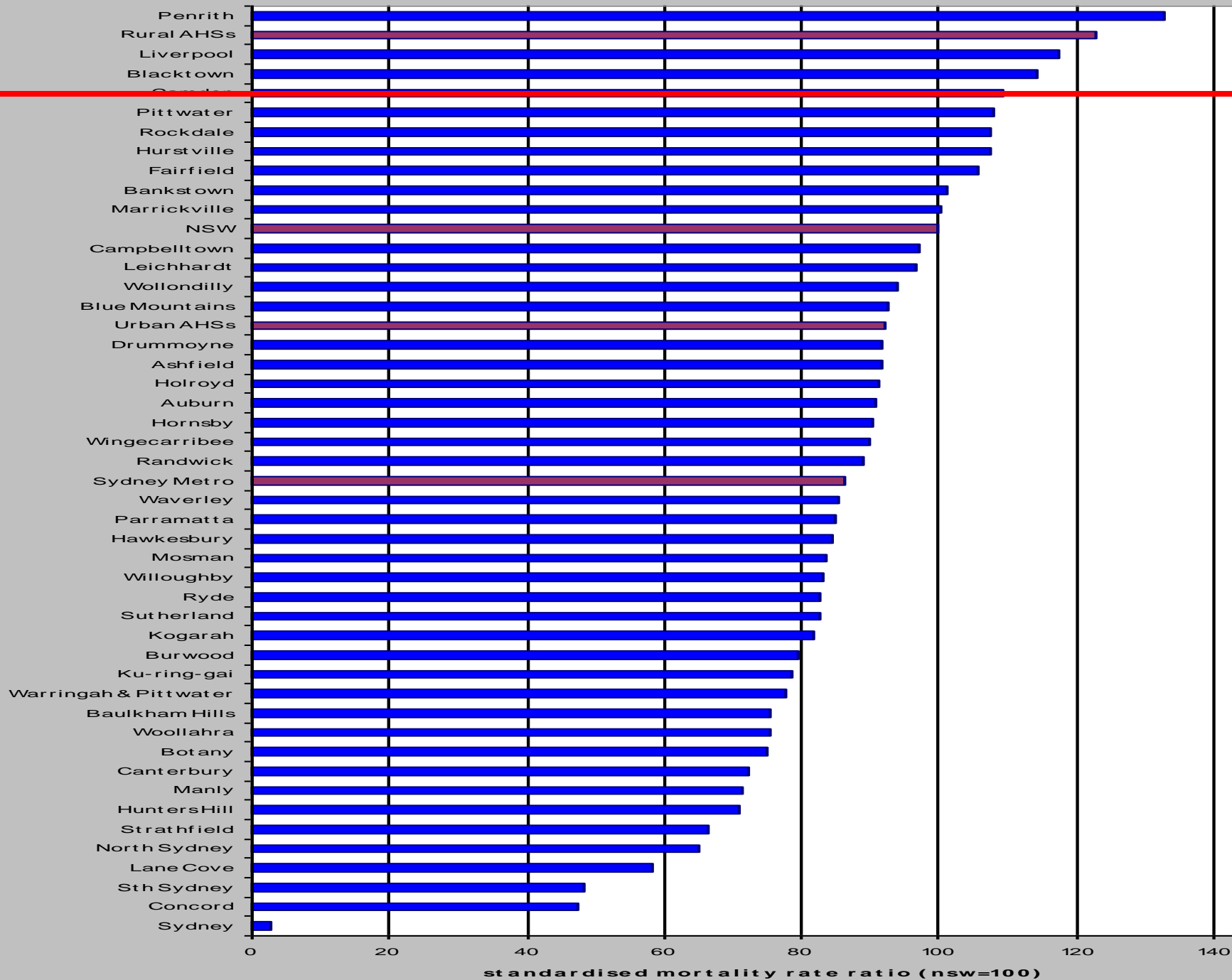
^cUniversity of Western Sydney, Australia

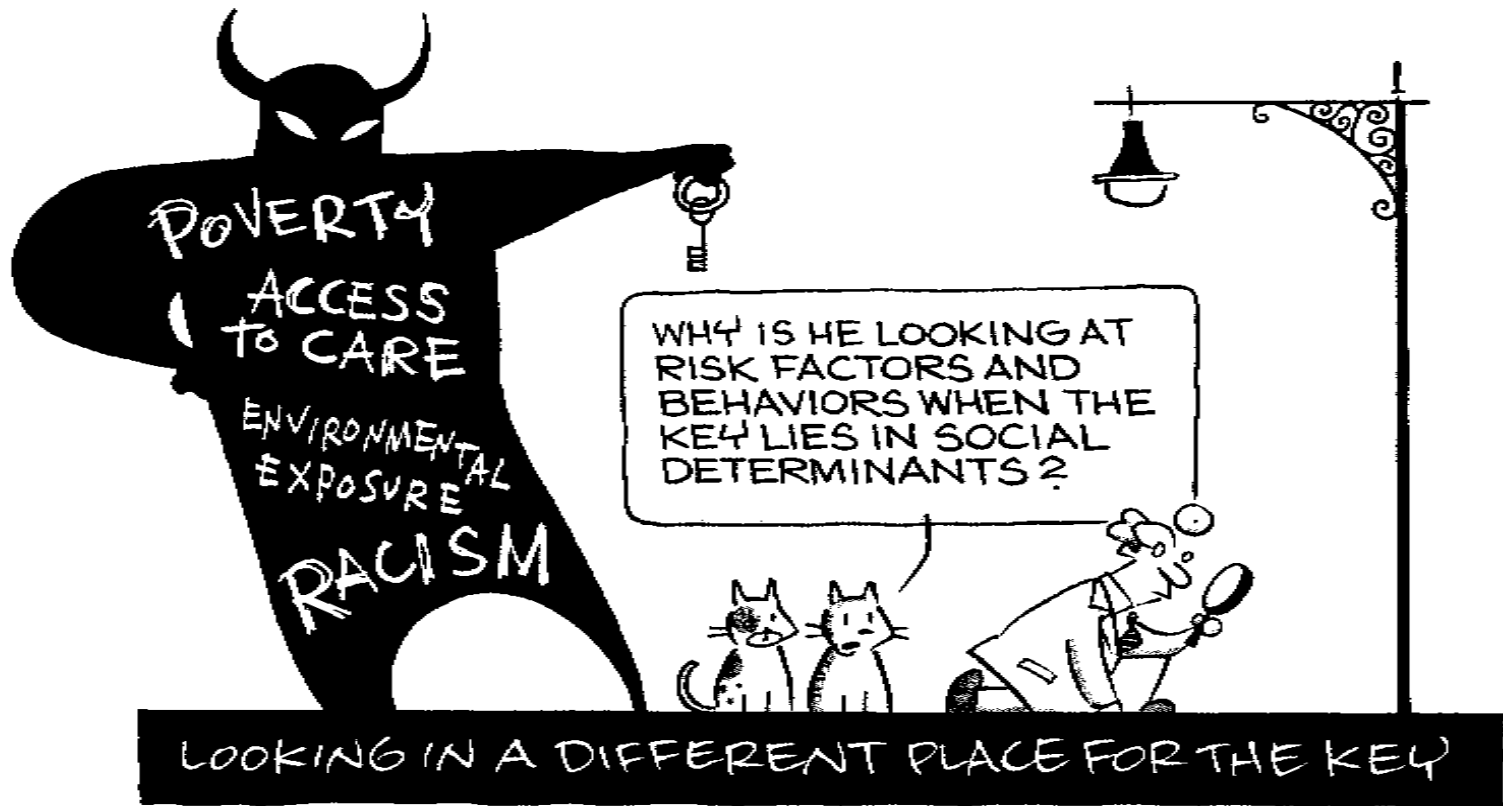
^dUniversity of Wollongong, Australia

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What this means for health practice?

- Public access shifts power and decision making
- Allow healthcare professionals to:
 - make decisions based on thousands (or millions) of cases
 - assess needs for subpopulations,
 - intervene early for at-risk groups
- Better quality, cheaper healthcare



Areas of opportunity

- Clinical operations
- Research and development
- Public health
- Evidence-based medicine
- Genomics
- Fraud prevention
- Patient profile analysis



Challenges

- Ethical and policy issues
- Challenging entrenched paradigms
- Data “cleaning”
- Collection and analysis process
- Public access
- Storage
- Accessibility



Lessons from consumer IT

- Internet as a source of data
- Information coding and grouping
- Allowed companies to develop technologies to meet consumer need
- Volume, velocity, variety and veracity
- Partnerships between technical and domain expertise



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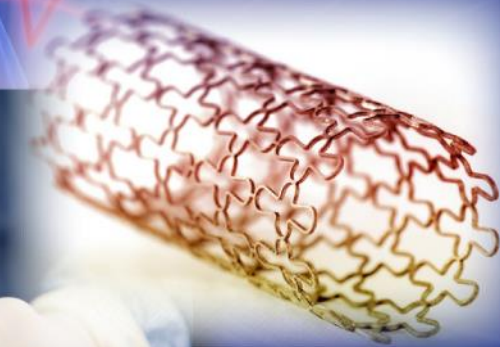
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Next steps for healthcare

- Paradigm shifts
- Industry commitment
- Overcome silos and ownership
- Ensure data is “structured”
- Industry wide applications
- Knowledge, awareness and capability
- Pattern recognition instead of position testing





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