Partners in Academic Medicine







# **Doctor in the Cockpit**



#### Diffusion of aviation innovations in hospitals

Dirk F. de Korne, PhD MSc Deputy Director, Health Innovation Assistant Professor, Health Services Management & Organisation

Singapore Healthcare Management Congress, 19 August 2013

PATIENTS. AT THE HE RT OF ALL WE DO.

Members of the SingHealth Group















Singapore National Eve Centre





Patients. At the Heart of All We Do.

How safe are hospitals? (James 2000)



#### (Amalberti et al. Ann Intern Med 2005:756-64)





#### What do we know about patient safety?

> In U.S. hospitals **44,000 - 98,000 annual deaths** due to preventable iatrogenic harm (IOM, 1999)

> 20-30% of hospitalized patients experience harm (Classen et al. 2011)

> 30% of U.S. health care expenditures are unnecessary or wasted (IOM 2010; ibid. 2012)

> In Dutch hospitals annually 1,735 - 1,960 annual deaths due to preventable iatrogenic harm

... and about 30,000 patients got serious iatrogenic harm (2.3%).

(De Bruijne et al., 2007)



LIFEI C5

WORLD A15

THE STRAITS TIMES

MONDAY, JULY 8, 2013



#### JET CRASH 'NOT MECHANICAL FAILURE'

A Boeing 777 aircraft that crash-landed at San Francisco airport killing two people did not have mechanical problems, an airline official said.

The head of the South Korean airline Asiana, Mr Yoon Young Doo, did not rule out human error but said the pilots were veterans.

The plane came down short of the runway, ripping off its tail, after apparently hitting a sea wall. MOTO MERKE FRANCE PRESSE

PM Lee urges the young to make Singapore better

#### Teacher held after video shows 'abuse' of boy, 3

#### By WALTER SIM and LIM YI HAN-

MEET MS. PSI

HOME B5

A CHILDCARE teacher was arrested yesterday after shocking footage emerged of her apparentby dragging a three-year-old



#### Accidents by Primary Cause\*

Hull Loss - Worldwide Commercial Jet Fleet - 1994 through 2003





#### Main causes adverse event hospitals (De Bruine et al.)

Human factors (knowledge, behaviour, skills):

Organisational factors:

**Technical factors:** 

4%

14%

56%

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## Tenerife, 27 March 1977







#### Accidental causal chain ("Swiss cheese model", Reason 1990)



# System dynamics model for safety conditions ("feedback loops", Bouloiz et al 2013)





#### What has aviation learned since Tenerife?

- Decrease of hierarchie co-efficient in the cockpit and importance of team work
- Recognize personal limitations
- Disclosure of (near) incidents
- Standardization and checklists

>>> System & Culture Change





### Diffusion of innovations (Rogers 1995)

- Innovation = 'an idea, practice or objective perceived as new by an individual, a group, or an organisation'
- Diffusion = 'the process in which an innovation is communicated, through certain channels over time, among the members of a social system'









## Medical innovations diffuse slowly (Balas & Boren 2000)

• From research trial to clinical practice: 17 years

| Габ | le | П. | Landmark | Clinical | Trials and | i Current | Rate of | Use | for Selected | i Procedures |
|-----|----|----|----------|----------|------------|-----------|---------|-----|--------------|--------------|
|-----|----|----|----------|----------|------------|-----------|---------|-----|--------------|--------------|

|           | Clinical Procedure       | Landmark Trial       | Current Rate of Use |
|-----------|--------------------------|----------------------|---------------------|
|           | Flu vaccination          | 1968 [7]             | 55% [8]             |
|           | Thrombolytic therapy     | 1971 [9]             | 20% [10]            |
|           | Pneumococcal vaccination | <sup>1977</sup> [11] | 35.6% [8]           |
| $\square$ | Diabetic eye exam        | 1981 [4]             | 38.4% [6]           |
|           | Beta blockers after MI   | 1982 [12]            | 61.9% [6]           |
|           | Mammography              | 1982 [13]            | 70.4% [6]           |
|           | Cholesterol screening    | 1984 [14]            | 65% [15]            |
|           | Fecal occult blood test  | 1986 [16]            | 17% [17]            |
|           | Diabetic foot care       | 1993 [18]            | 20% [19]            |



# Spread and sustainability of innovations in health services organisations (Greenhalgh et al. 2005)





#### Framework for analysis (Greenhalgh et al. 2005, adapted)

|                          | System A (Airline)  | System B (Hospital)   | Feasibility of Changing<br>Practice, Procedures, and Context<br>of Hospital to Match Airline                                  |
|--------------------------|---|---|---|
| The innovation           | Salient features currently used<br>in System A?   | Salient features of innovation<br>proposed for use in System B?                                       | Could and should System B adopt the same innovation as is used by System A?   |
| The resources            | What resources were used in producing the outcomes (e.g., staff time, money, equipment, space)?                   | What resources in System B?   | Does System B have the resources to<br>emulate the practice of System A?  |
| The people               | What are the salient characteristics<br>of the key actors in terms of<br>expertise, experience, commitment?       | What are the characteristics of the key actors in System B?   | Insofar as there is a mismatch, would it be<br>desirable or feasible to recruit different<br>staff, invest in training, etc.? |
| Institutional factors    | How much were the outcomes<br>dependent on organizational/<br>departmental structure,<br>organizational cultures? | To what extent does the<br>organizational structure and<br>culture of System B<br>determine practice? | Differences? Feasible or desirable<br>to change the institutional structures and<br>cultures in B?                            |
| Environmental<br>factors | How much were the outcomes<br>dependent on particular<br>environmental factors<br>(e.g., political, legislative)? | To what extent is the external<br>environment of System B<br>comparable to System A?                  | Differences? Change the external<br>environment of System B?  |
| Measures                 | What baseline, process, outcome,<br>and other measures were used<br>to evaluate success?                          | Does (or could) System B use the same measures?   | Desirable or feasible for System B to<br>change the way it measures and records<br>practice?                                  |
| Procedures               | What was exactly done in System A that led to the outcomes reported?  | Does (or could) System B do<br>exactly the same?  | Differences? Should System B change what it does?   |
| Outcomes                 | What were the key outcomes, for whom, at what cost, and what are they attributable to?                            | What were the key outcomes in<br>System B? Achieve for same<br>actors as System A?                    | To what are the differences attributable?<br>Desirable outcomes that System B is not<br>achieving?                            |

### Learning from quality experiences in other sectors

| Quality<br>dimension(s)                                  | Quality issue                            | Type(s) of industry<br>with comparable<br>experience | Model                       |
|--|--|--|-----------------------------|
| Efficient<br>Accessible<br>Patient centered<br>Safe      | Process orientation                      | Manufacturing,<br>Aviation                           | Process<br>Reengineering    |
| Safe   | Safe design of operating areas           | Offshore, Aviation                                   | Marking                     |
| Safe   | Awareness of risks and unsafe conditions | Aviation   | Crew Resource<br>Management |
| Efficient<br>Effective<br>Accessible<br>Patient centered | Costs of non compliance                  | Manufacturing  | Quality Costing             |
| Efficient<br>Effective<br>Accessible<br>Patient centered | Process orientation                      | Manufacturing,<br>Automobile Industry                | Value Chain                 |
| Efficient<br>Effective                                   | Performance assessment                   | Printing   | Benchmarking                |



#### **Diffusing Aviation Innovations in Hospitals**



de Korne et al. JCJ 2010:339-47



### Application philosophy KLM planning

reservation seat on plane reservation of consult or reservation of surgery





#### Rotterdam Eye Hospital, Netherlands







#### Fear Reduction





Patients. At the Heart of All We Do.

#### **Rotterdam Eye Hospital - Figures**

- 145,000 outpatient visits (510 p/day)
- 14,000 surgeries (50 p/day)
- 4 OR's + 2 Daysurgery OR's
- 9 beds
- 93 % daycase
- 50 % outside of Rotterdam
- 26,000 emergency visits (70 p/day)(7/24)
- 25 outpatient rooms
- 400 employees
- 30 ophthalmologists + 20 residents
- care, teaching & research





#### World Association of Eye Hospitals



Members of the European Association of Eyehospitals Members of the American Association of Eye & Ear hospitals Members of the Asean Association of Eye Hospitals



#### Learning from peers in your own sector

- > choose organizations your doctors esteem
- > exchange of staff members
- > make the nurse your consultant
- > stimulate implementation in professional organization
- > benchmark results



#### Singapore National Eye Centre





#### Singapore National Eye Centre - Figures

- 280,000 outpatient visits
- 36,000 surgeries
- 9 OR's
- 0 beds
- 98% daycase
- 30 outpatient rooms
- 560 employees
- 64 ophthalmologists + 20 residents
- care, teaching & research: SERI
- national centre, part of SingHealth



#### Safety Improvement: Risk Analysis & Management







Singapore National Eye Centre









#### Effects of a 'Time Out' before surgery



#### de Korne et al. JCJ 2010:339-47





















# Seduction








## Pilot and physician







## Flight crew and nursing team





# Eye Care Air





Singapore National Eye Centre

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#### The Jet Sex Airline Stewardesses and the Making of an American Icon Victoria Vantoch 304 pages | 6 x 9 | 30 illus. Cloth Apr 2013 | ISBN 978-0-8122-4481-6 | \$34.95t | £23.00 | Add to cart

"The modern-day flight attendant is more like a safety professional, almost a different profession from that what it was in the 1950s and 1960s when American stewardesses were celebrated icons of American womanhood"

unnarried, interrigent, charming, and nurturing, she inspired young girls everywhere to set their signis





#### THE STRAITS TIMES TUESD





Mis Ong was inspired by the way nurses cared for her son Lukas when he had to undergo surgery as a baby, and decided to become one. ST PHOTO: EDWARD TEO mas yes

Air stewardess gives up flying to care for sick



SIA stewardess Ms Ong Teng Teng (37) was inspired by the way nurses cared for her son Lukas when he had to undergo surgery as a baby

"When I was flying, I was happy for myself (..) now I am satisfied when I can nurse a patient back to health."



## Flight Data Recorder



































het oogziekenhuis rotterdam eye nospitai





HER WORDT GEINVESTEERD IN UW TOEKOMST DIT PROJECT IS MEDE GEFINANCIERD MET STEUN VAN HET EUROPEES FONDS VOOR REGIONALE ONTWIKKELING VAN DE EUROPESE COMMISSIE







(c) 2011 Vertigo Games BV - www.vertigo-games.com





#### Team training improves safety culture

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|                   |                           | Before (2007)<br>N= 213 |      | After (2009)<br>N=196 |      |      |
|-------------------|---------------------------|-------------------------|------|-----------------------|------|------|
|                   |                           |                         |      |                       |      |      |
|                   |                           | M                       | SD   | M                     | SD   | — P  |
| Risk              | Physical risk patient     | 1.65                    | 1.31 | 2.15                  | 1.47 | .004 |
|                   | Risk time loss            | 1.31                    | 1.20 | 2.48                  | .99  | .001 |
| Unce rtainty      | Pre dictability           | 3.10                    | .74  | 3.29                  | .53  | .021 |
|                   | Complexity                | 3.15                    | 1.48 | 2.99                  | .89  | NS   |
| Error Management  | Mastery                   | 3.68                    | .58  | 3.63                  | .57  | NS   |
|                   | Correction                | 3.75                    | .63  | 3.68                  | .62  | NS   |
|                   | Analysis                  | 3.61                    | .74  | 3.60                  | .76  | NS   |
|                   | Learning                  | 3.67                    | .58  | 3.60                  | .58  | NS   |
|                   | Social orientation        | 3.67                    | .71  | 3.68                  | .63  | NS   |
|                   | Communication             | 3.60                    | .78  | 3.59                  | .72  | NS   |
|                   | Helping                   | 3.75                    | .73  | 3.80                  | .64  | NS   |
|                   | Awareness                 | 2.63                    | .54  | 2.62                  | .53  | NS   |
|                   | Anticipation              | 3.13                    | .68  | 3.02                  | .62  | NS   |
|                   | Acceptance                | 2.57                    | .71  | 2.53                  | .62  | NS   |
|                   | Responsible risk taking   | 2.18                    | .75  | 2.27                  | .73  | NS   |
|                   | Aversion                  | 2.57                    | .47  | 2.65                  | .44  | NS   |
|                   | Stress through errors     | 2.66                    | .67  | 2.65                  | .64  | NS   |
|                   | Cover                     | 1.87                    | .60  | 1.93                  | .62  | NS   |
|                   | Rigid focus on prevention | 3.18                    | .80  | 3.29                  | .71  | NS   |
| Safety Leadership | Support                   | 2.50                    | .86  | 2.95                  | .95  | .001 |
|                   | Action                    | 2.43                    | .71  | 2.89                  | 1.08 | .000 |
|                   | Expectations              | 4.03                    | .91  | 1.95                  | .60  | .000 |
|                   | T op m anagement          | 2.83                    | .75  | 3.06                  | .67  | .024 |
|                   |                           |                         |      |                       |      |      |

Note: Mean (M) scores (scales 1-5), Standard Deviations (SD). NS=not significant. One way ANOVA analysis.



#### WALK THE TALK: LEADERS' ENACTED PRIORITY OF SAFETY, INCIDENT REPORTING, AND ERROR MANAGEMENT

Cathy Van Dyck, Nicoletta G. Dimitrova, Dirk F. de Korne and Frans Hiddema

#### ABSTRACT

Purpose – The main goal of the current research was to investigate whether and how leaders in health care organizations can stimulate incident reporting and error management by "walking the safety talk" (enacted priority of safety).

Design/methodology/approach – Open interviews (N=26) and a crosssectional questionnaire (N=183) were conducted at the Rotterdam Eye Hospital (REH) in The Netherlands.

Findings – As hypothesized, leaders' enacted priority of safety was positively related to incident reporting and error management, and the relation between leaders' enacted priority of safety and error management was mediated by incident reporting. The interviews yielded rich data on (near) incidents, the leaders' role in (non)reporting, and error management, grounding quantitative findings in concrete case descriptions.

Leading in Health Care Organizations: Improving Safety, Satisfaction and Financial Performance Advances in Health Care Management, Volume 14, 95–117 Copyright © 2013 by Emerald Group Publishing Limited All rights of reproduction in any form reserved ISSN: 1474-8231/doi:10.1108/S1474-8231(2013)0000014009 95

#### Advances in Health Care Management 2013;14:95-117.



#### Association Between Implementation of a Medical Team Training Program and Surgical Mortality

| Julia Neily, RN, MS, MPH     |  |  |  |
|------------------------------|--|--|--|
| Peter D. Mills, PhD, MS      |  |  |  |
| Yinong Young-Xu, ScD, MA, MS |  |  |  |
| Brian T. Carney, MD          |  |  |  |
| Priscilla West, MPH          |  |  |  |
| David H. Berger, MD, MHCM    |  |  |  |
| Lisa M. Mazzia, MD           |  |  |  |
| Douglas E. Paull, MD         |  |  |  |
| James P. Bagian, MD, PE      |  |  |  |

DVERSE EVENTS RELATED TO surgery continue to occur despite the best efforts of clinicians.1 Teamwork and effective communication are known determinates of surgical safety.2-6 Previous efforts at demonstrating the efficacy of patient safety initiatives have been limited because of the inability to study a control group.7 For example, the use of the World Health Organization Safe Surgery checklist has been evaluated, but its overall efficacy remains uncertain because no control group was studied to clearly demonstrate this instrument's effectiveness.6

The Veterans Health Administration (VHA) is the largest national integrated health care system in the United States, with 153 hospitals, 130 of which provide surgical services. The VHA implemented a national team training program and studied the program's effect on patient outcomes. The VHA began piloting team training that

For editorial comment p 1721.

**Context** There is insufficient information about the effectiveness of medical team training on surgical outcomes. The Veterans Health Administration (VHA) implemented a formalized medical team training program for operating room personnel on a national level.

**Objective** To determine whether an association existed between the VHA Medical Team Training program and surgical outcomes.

**Design, Setting, and Participants** A retrospective health services study with a contemporaneous control group was conducted. Outcome data were obtained from the VHA Surgical Quality Improvement Program (VASQIP) and from structured interviews in fiscal years 2006 to 2008. The analysis included 182 409 sampled procedures from 108 VHA facilities that provided care to veterans. The VHA's nationwide training program required briefings and debriefings in the operating room and included checklists as an integral part of this process. The training included 2 months of preparation, a 1-day conference, and 1 year of quarterly coaching interviews

**Main Outcome Measure** The rate of change in the mortality rate 1 year after facilities enrolled in the training program compared with the year before and with nontraining sites.

**Results** The 74 facilities in the training program experienced an 18% reduction in annual mortality (rate ratio [RR], 0.82; 95% confidence interval [CI], 0.76-0.91; P=.01) compared with a 7% decrease among the 34 facilities that had not yet undergone training (RR, 0.93; 95% CI, 0.80-1.06; P=.59). The risk-adjusted mortality rates at baseline were 17 per 1000 procedures per year for the trained facilities and 15 per 1000 procedures per year for the trained facilities and 15 per 1000 procedures per year for both groups. Propensity matching of the trained and nontrained groups demonstrated that the decline in the risk-adjusted surgical mortality rate was about 50% greater in the training group (RR,1.49; 95% CI, 1.10-2.07; P=.01) than in the nontraining group. A dose-response relationship for additional quarters of the training program was also demonstrated: for every quarter of the training program, a reduction of 0.5 deaths per 1000 procedures occurred (95% CI, 0.2-1.0; P=.001).

**Conclusion** Participation in the VHA Medical Team Training program was associated with lower surgical mortality.

JAMA. 2010;304(15):1693-1700

www.jama.com

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Table 3. Improvements Repo Interviews

# **Figure.** Quarters of Risk-Adjusted Surgical Mortality Rate

#### Reported Improveme

Communication among operatin

Staff awareness

Overall efficiency

Equipment use during surgery

Reduced length of procedures

Improved first-case start times

Other types of efficiency improve

<sup>a</sup>For example, reduced delays for su time hours.





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#### **Crew Resource Management**





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### Safe system design

#### Launch of tower top section in action











#### Safe system design









# Are the surgical instruments positioned correctly?



de Korne et al. BMJ Qual Saf 2012:746-52



## Risk management is related to context







#### System approach: pilot vs. doctor selection





### Pre-screening on non-technical skills





| Checklist Professional Profile |                      |  |  |  |
|--------------------------------|----------------------|--|--|--|
| - Resilience                   | - Dominance          |  |  |  |
| - Stress tolerance             | - Assertiveness      |  |  |  |
| - Impulse control              | - Openness           |  |  |  |
| - Ambition                     | - Need for variation |  |  |  |
| - Accurary                     | - Teamwork           |  |  |  |
| - Perseverance                 | - Altruism           |  |  |  |
| - Autonomy                     | - Empathy            |  |  |  |
| - Persuasiveness               |                      |  |  |  |





## Computerized Pilot Aptitude Screening System

### COMPASS

- Control & coordination Slalom
- Orientation
- Multi-task management
- **Mathematics**
- Short term memory



#### Preliminary scores: n=97 physicians vs. n=715 pilots





# Preliminary CPP results (N\_physicians=98; N\_KLMpilots=715; N\_Emiratespilots=2,133)



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## Preliminary CPP results (N\_surgeons=98; N\_KLMpilots=715; N\_Emiratespilots=2,133)

#### Autonomy





### System approach: patient in the lead









### 11-item post-retinal surgery discharge checklist

| DOMAIN                   | ITEM                                |
|--------------------------|-------------------------------------|
| Physical safety          | 1. Posture advice                   |
| Filysical salety         | 2. Eye protection                   |
|                          | 3. Activities of daily living (ADL) |
| Medication safety        | 4. Prescription checked             |
|                          | 5. Eye drops administering          |
|                          | 6. Medication reconciliation        |
| Post-op hospital contact | 7. Emergency                        |
|                          | 8. Complaints                       |
|                          | 9. Follow-up visit                  |
| Patient peer community   | 10. Helpdesk                        |
| a alone poor community   | 11. Retina patient forum            |













# Non checked post-surgical information items



Vankan et al. submitted





## System approach: standardisation and spread



Intensive collaboration of ophthalmic departments in Dutch hospitals in order to improve the quality of ophthalmic care by sharing knowledge





## Integrated Eye Care Network: 12 hospitals, > 70 ophthalmologists



12 hospitals

> 70 ophthalmologists

> 200 opticians & optometrists

- > 100 general practitioners
- 3 rehabilitation institutes



#### Currently moving to...

# The I-bus







Singapore National Eye Centre

### Comparable 'right-siting' questions in Singapore

Stable chronic eye patients (glaucoma, diabetic retinopathy) ['integrated care delivery value chain']



Eve Centre

<u>Patient</u>: emotional attachment to specialist; greater confidence in specialist; fear that is will be difficult to return, increased cost if referred back post-discharge; proximity; etc.

<u>Specialis</u>t: reduced confidence in non-specialist; income generated by seeing patients; etc.

<u>Non-specialis</u>t: feeling uncomfortable managing 'complicated' cases; lack of time; etc.

<u>Health system factors</u>: gap between primary care and hospital care; reimbursement not aligned with care pathway; lack of supporting 'chain' EMR; etc.



#### **Integrated Eye Care Model**

HOSPITAL ADMIN DATA







## Example: existing data from SiDRP study



Pilot service to GPs, private healthcare groups, optometrists in Singapore and overseas




## Conclusions: diffusion of innovations

- Methods not copied, but adapted to fit the local context
- 'Open innovation' and 'co-creation': use industry experts and collaboration to 'seduce' hospital professionals
- Integration of 'clinical' 'admin' 'research' perspectives in professional organisation ('user system')
- Systems approach request systems expertise



## 'Divided house'



### However,

#### patient value =

health results / dollar =

#### integration









# Spread and sustainability of innovations in health services organisations (Greenhalgh et al. 2005)





IMPROVING PATIENT CARE Five System Barriers to Achieving Ultrasafe Health Care

Figure 1. Average rate per exposure of catastrophes and associated deaths in various industries and human activities.



The size of the box represents the range of risk in which a given barrier is active. Reduction of risk beyond the maximum range of a barrier precrossing this barrier. Shaded boxes represent the 5 system barriers. ASA = American Society of Anesthesiologists.

## Look forward!





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