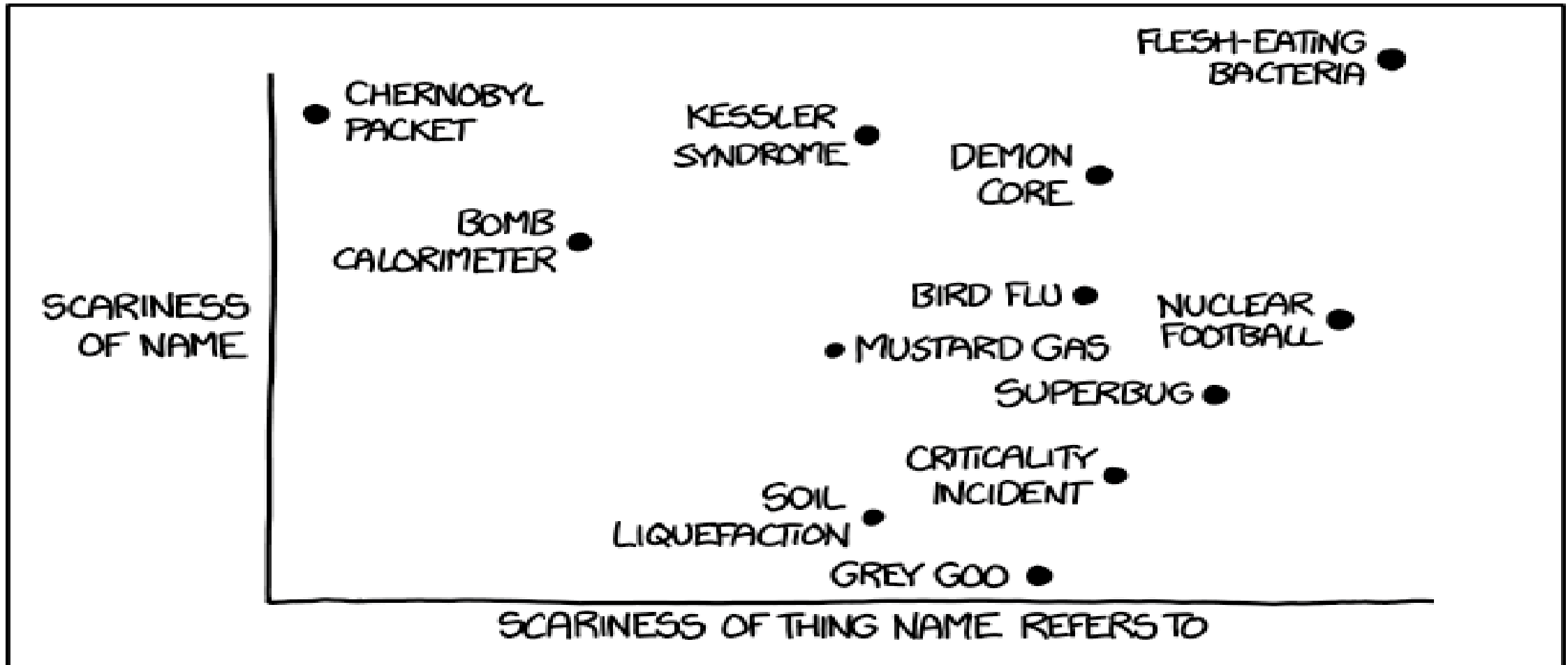


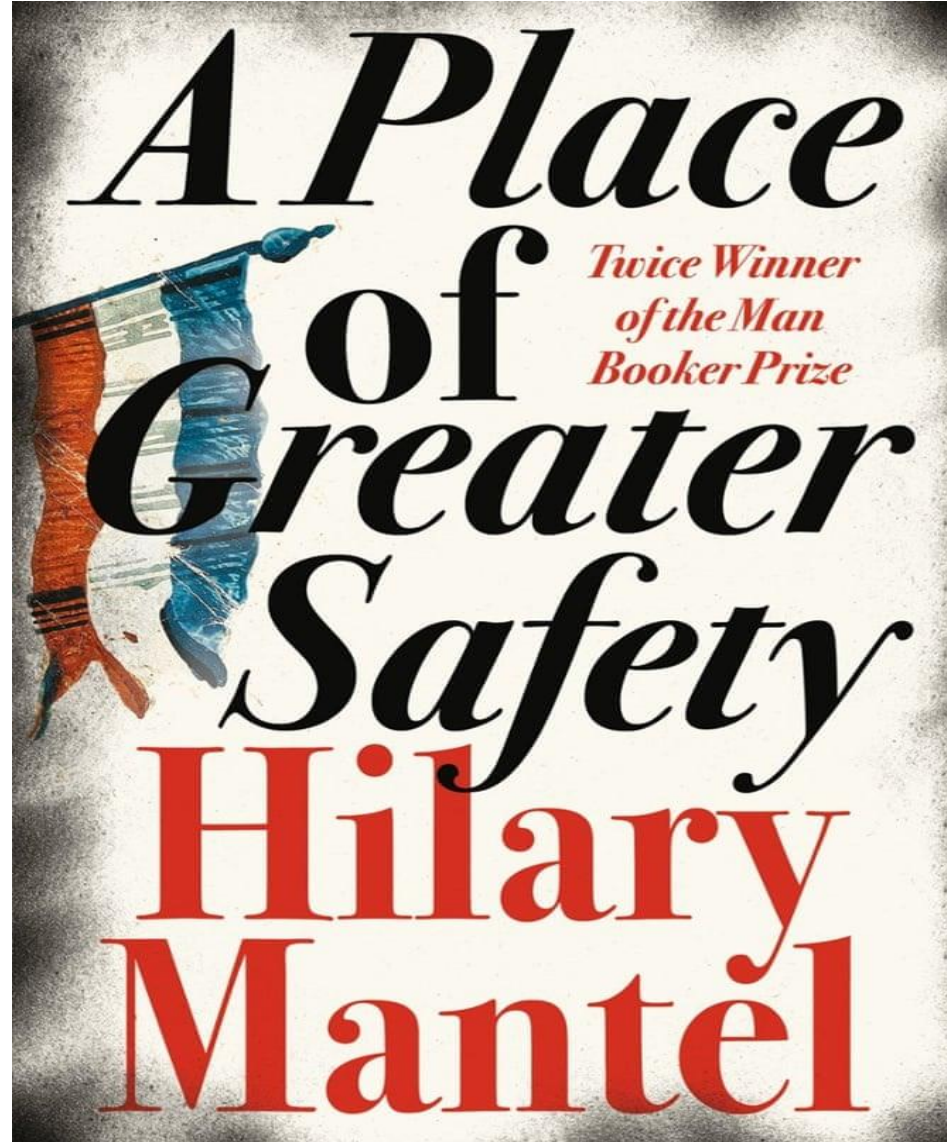
Medical Aspects of Safety Critical Work

AFOEM Trainee Meeting – Auckland 5th May 2019

Tim Sprott Aviation & Occupational Medicine Specialist

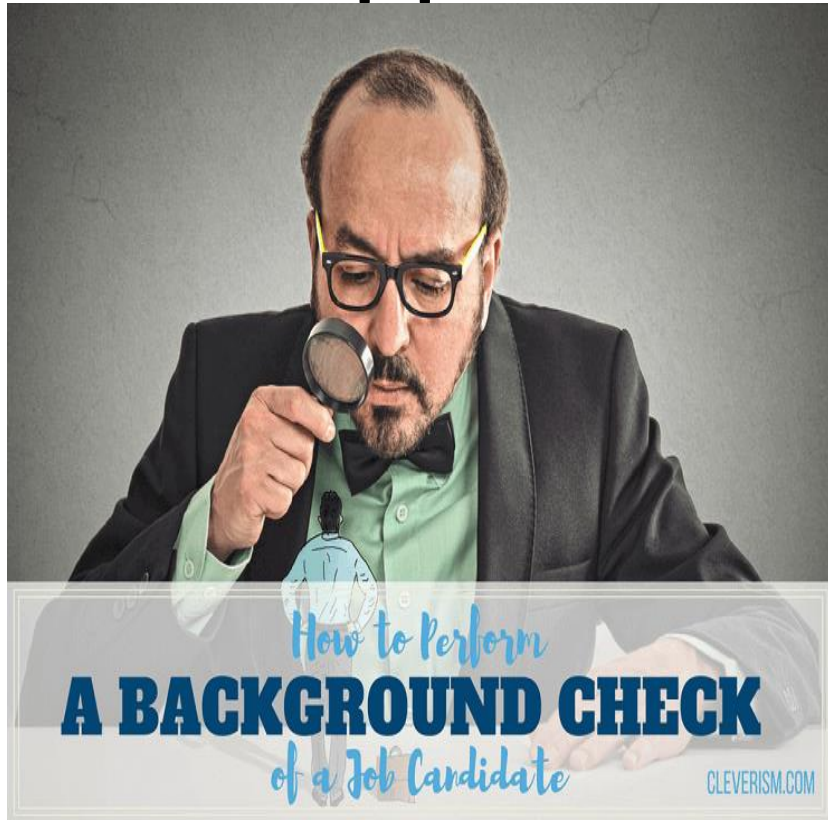


The usual disclosure



None the views expressed are those of, or likely to be supported by, the organisations I work for currently, or in the past.

What is our usual approach?



1) Safety critical work is identified following critical risk assessment by the organization or regulator specific to your industry or workplace.

2) Medical/ health assessment at entry into the workplace/industry, and a periodic basis usually involving various combinations of the following-

- Questionnaire;
- Biometric measures – BP, height, weight, BMI;
- Special senses -Vision testing, audiology;
- Spirometry;
- Skin check;
- Musculoskeletal assessment;
- Shiftwork assessment;
- Mental health assessment;
- AOD testing.

What is our usual approach?



3) Health risk assessment for fitness for role with any relevant recommended restrictions or accommodations using medical standards;

4) Fitness for work certification or notification.

Safety Critical Worker

- is one whose job function is directly related in some way to the safety of others, or who could seriously impact the safety of others by not performing the job correctly.
- is one where *sudden* or *subtle* incapacitation of that individual may compromise their ability to undertake a task defined as essential to safety, thereby posing a significant risk to the health and safety of *themselves* and *others*

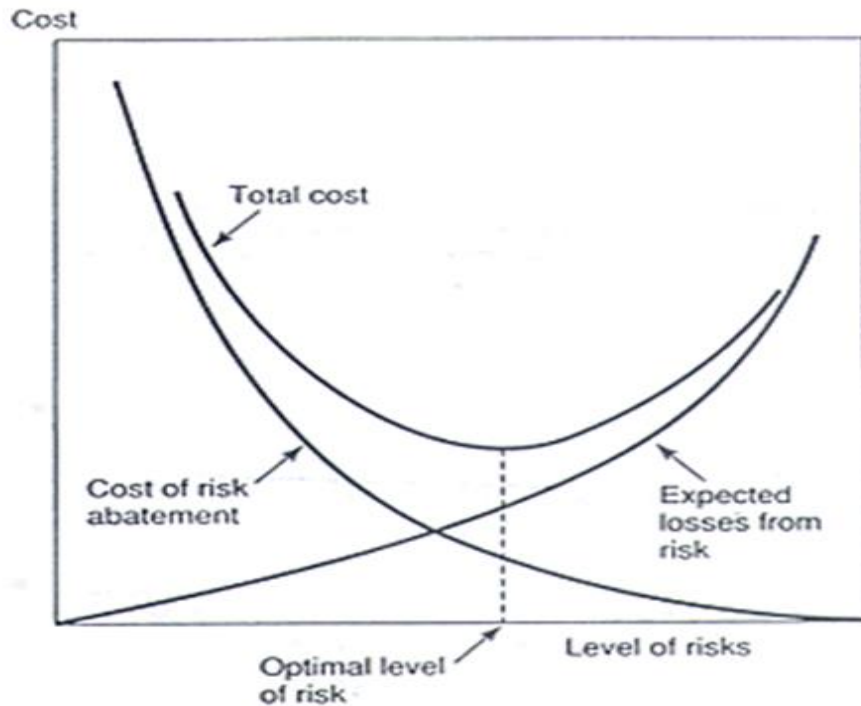
Dodman et al .Occup Med 2012; 62 (7): 480-482.

How about Decision Critical Workers?



- Those workers whose occupational performance depends upon the ability to consistently exercise judgement and insight.
- Where impaired performance leads to adverse workplace consequences may arise from low grade impairment as well as a single event, or error, with serious consequences that may not be immediately apparent.
- What is their “orbit of harm”?

How safe is safe?



Optimal risk as determined by minimum sum of cost of risk abatement and expected losses from risk. (from Morgan, M. Granger. "Choosing and Managing Technology-Induced Risk," IEEE Spectrum, vol. 18, no. 12, pp. 53-60. December 1981.)

Aviation operational acceptable risk for fatal aircraft accident:

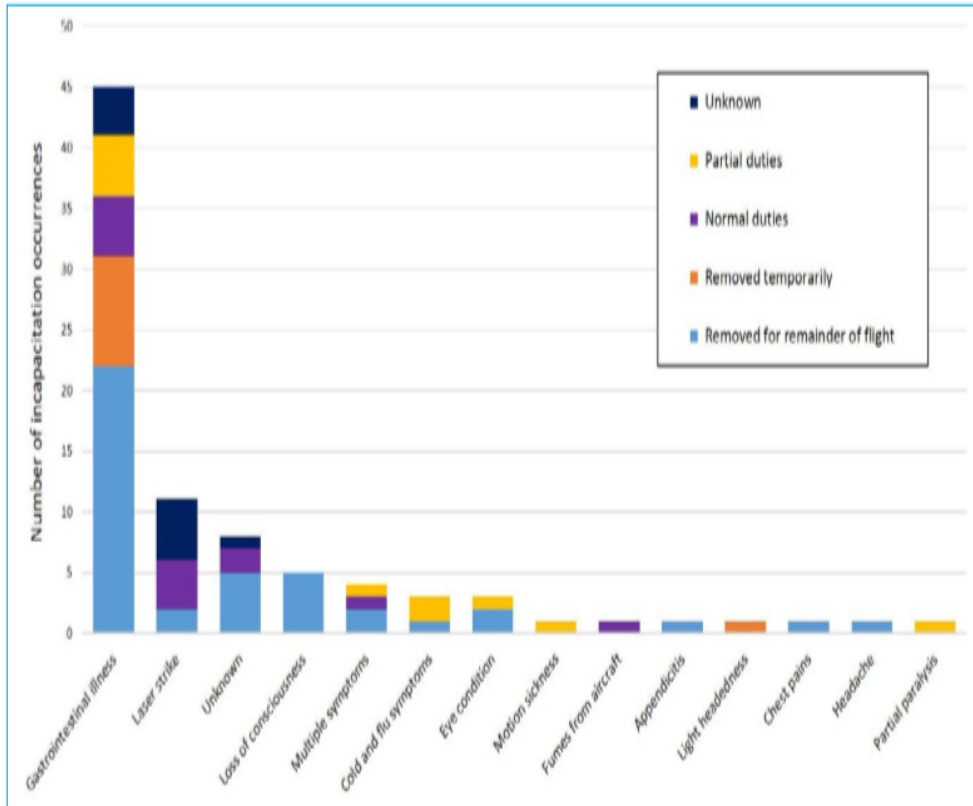
- 1 in 10⁻⁵ flying hours in private recreational flying
- 1 in 10⁻⁷ flying hours in commercial operations
- 1 in 10⁻⁹ flying hours for multi-engined aircraft airline operations.

Link to medical standards via the 1% "Rule"

- 1 in 10⁻¹⁰ flying hours an acceptable risk of an acute medical incapacitation event leading to a fatal aircraft accident
- Presence of a Co-pilot reduces risk of fatal event by 10⁻⁴
- Thus an acceptable level of risk is 1% per year
- About the CVS risk of an average Caucasian male 60-65 yrs

What are the operational risks of medical conditions?

Figure 1: Causes of pilot incapacitation and resultant duty restrictions in high capacity transport operations, 2010 to 2014



Reviews of inflight medical incapacitation and impairment of airline pilots reveals that the leading causes are:

- acute gastroenteritis
- myocardial infarctions,
- cardiac arrhythmias
- epileptic seizures
- loss of consciousness

BUT.....

DeJohn CA, Wolbrink AM, Larcher J. In-Flight Medical Incapacitation and Impairment of Airline Pilots. *Aviation, Space, and Environmental Medicine*. 2006;77(10):1077-9.

DeJohn CA, Wolbrink AM, Larcher J. In-Flight Medical Incapacitation and Impairment of U.S. Airline Pilots: 1993 to 1998. In: Federal Aviation Administration, OoAM, editor. *US Department of Transportation, Federal Aviation Administration, Office of Aerospace Medicine Technical Report*. Oklahoma City, OK 73125: Civil Aerospace Medical Institute; 2004.

But do these medical events contribute to or cause fatal accidents?



Medical cause fatal accidents 1980-2000

Global, 2-pilot aircraft, over 5700 kg

Year	Aircraft	Medical problem	Confidence
1982	DC 8	Schizophrenia *	High
1982	Citation	Alcoholic impairment *	High
1982	Metro	Vomiting (P2)	High
1983	Learjet	Use of marijuana (P1 & P2)*	High
1988	Metro	Use of cocaine	High
1989	FH 227	Alcohol (P2)	High
1990	Learjet	Slurred speech, ? cause *	Medium
1993	Learjet	Alcohol/cocaine (P1)	High (private)
1994	ATR 42	Suicide *	Low
1999	An 26	Alcohol (P1 & P2) *	Medium

* Primary Cause
(Excluding hypoxia, fumes, fatigue)

Other incidents/accident

- 1996: British Airways, BAC 1-11 - FO "frightened of the altitude". Diverted safely to Lyon.
- 2001: Galaxy Air Cargo, DC3 – [Fatalities x 2] Night VFR collision with volcanic mountain. Capt – cocaine, FO two antidepressant drugs
- 2008: Air Canada, B767 – FO "belligerent and uncooperative". Diverted safely to Shannon.
- 2009: Mesaba, Saab 340B – "Flt attendant" no longer coherent". Diverted safely.
- 2012: JetBlue, A320 – Captain "things just don't matter", "we're not going to Vegas", began "a sermon". FO locked the captain out of the flight deck and diverted safely into Amarillo
- 2015: Condor, A320 – Diverted safely to Faro. Copilot subsequently "exhibited behaviour ...that raised psychiatric concerns"

FAA 2018...2013 -2016 study



Federal Aviation
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DOT/FAA/AM-18/8
Office of Aerospace Medicine
Washington, DC 20591

Reporting Incidental Medical Findings in Autopsied U.S. Civilian Pilots Using the AA- IADS System

Eduard M. Ricaurte

Venesco, LLC
14801 Murdock St., Ste. 125
Chantilly, VA 20151

September 2018

Final Report

NTSB Probable Cause (PC)	No. of Conditions
Cardiac Disease	6
Alcohol, Illicit Drugs, Marijuana, Cocaine	3
Sedating Medication	3
Suicide	2
Neurological, Stroke, Psychiatric Disease	1
NTSB Contributory Factor (CF)	
Sedating Medication	10
Alcohol, Illicit Drugs, Marijuana, Cocaine	6
Neurological, Stroke, Psychiatric Disease	4
Fatigue	3
Hearing Aid	1
Total Medical Issues	39

What jumps out?

- In the last 35 years of airline passenger and cargo operations there have been twelve psychological/ mental health/ AOD related incapacitation events leading to a fatal accident or a diversion.
- This pattern is consistent with the 2018 FAA report.
- Very few accidents have arisen from physical incapacitation.
- In airline operations mental/AOD related incapacitation pose greater risks to flight safety than physical incapacitation.
- For these events a second pilot of the flight deck does not prevent fatal accidents, especially for pilot intended crashes.

What does this evidence show?

How appropriate are our medical assessments?

Are our routine health assessments focusing on the critical risks?

Can our current systems detect the variable, the hidden, and the currently unpredictable?

Are we focusing on things we are familiar with but don't have a significant impact on the critical risks?

Now for the truly depressing.....

How effective is our current system?



Federal Aviation
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Comparison of Pilot Medical History and Medications Found In Postmortem Specimens

Dennis V. Canfield
Guillermo J. Salazar
Russell J. Lewis
James E. Whinnery
Civil Aerospace Medical Institute
Federal Aviation Administration
Oklahoma City, OK 73125

May 2006

Final Report

This report compared the known GA FAA pilot medical certification records of pilots in fatal aircraft accidents with medications found in post mortem specimens.

The study involved toxicological evaluations on 4143 pilots between 1 Jan 1993 to 31 Dec 2003.

What did this study find?

Medical Condition	Pilots With Medications	Medical Conditions Reported by Pilots	Medications Reported by Pilots
Cardiovascular	149	69	29
Neurologic	15	1	0
Psychological	223	14	1
Total	387	84	30

Note: Table reflects specific medications and conditions of interest from 4143 individual samples.

How effective is our current system?

Sykes AJ, Larsen PD, Griffiths RF, Aldington S. *A study of airline pilot morbidity. Aviat Space Environ Med* 2012; 83:1001-5.

Introduction: It has long been believed that airline pilots are healthier than the general population. There are a number of reasons why this should be the case. However, there is very little evidence to support this belief as fact. This study investigates the health of the pilot population of an Oceanic based airline compared to the health of the general population. **Methods:** Pilots who conducted their medical certificate renewal at the airline's medical unit between 1 November 2009 and 31 October 2010 were included. A medical questionnaire was completed by each pilot at the time of their medical certificate renewal. Data from the questionnaire was entered into a database as well as the pilot's BMI, blood pressure, lipid profile, and blood glucose level. The comparison population was the population who completed the New Zealand Health Survey (NZHS) between 2006-2007. Demographic, lifestyle characteristics, and health status data from the pilots was compared to the NZHS using a Chi-squared test. **Results:** Included in the study were 595 pilots. With respect to most medical conditions, pilots had a lower prevalence when compared to the general population. Pilots had a higher prevalence of kidney disease (3.3% vs 0.6%) and melanoma skin cancer (19 per 1000 vs 0.4 per 1000). **Discussion:** This study suggests that pilots in New Zealand are healthier than the general population with respect to most medical conditions. The two medical conditions that were identified as being overrepresented in pilots may be the result of the occupational environment.

Most significant pilot health conditions occurred between normal routine CAA medical renewals

Guess what?

Unintended consequences...

Employees lie to us.....



Our conundrum....

“Reports that say that something hasn't happened are always interesting to me, because as we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know.”

How do we influence safety?



Federal Aviation
Administration

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Office of Aerospace Medicine
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Comparison of Pilot Fatalities and Number of Pilot Medical Examinations

Dennis V. Canfield
Kurt M. Dubowski
Guillermo J. Salazar
Estrella Forster
Civil Aerospace Medical Institute
Federal Aviation Administration
Oklahoma City, OK 73125

October 2016

- FAA has a Limits of Agreement (LOA) that the expected pilot fatality rate is 1 pilot per 2000 medicals.
- 3.5% (254) of AMEs had high fatality rates and 1.6% (120) had low fatality rates relative to the 95% of AMEs whose rates were within the LOA.
- 1 AME had 25 fatalities.
- The 3.5% of AMEs with the higher fatality rates had three times as many fatalities as the 95% of AMEs within the agreed LOA and 7 times the fatality rate as the low rate AME group.
- This small group of AMEs accounted for 37.7% (1077 fatalities). The expected LOA fatality rate would have been 387 fatalities over the 10 year period.
- But there was no direct correlation between the number of fatalities and the number of examinations performed by AMEs.

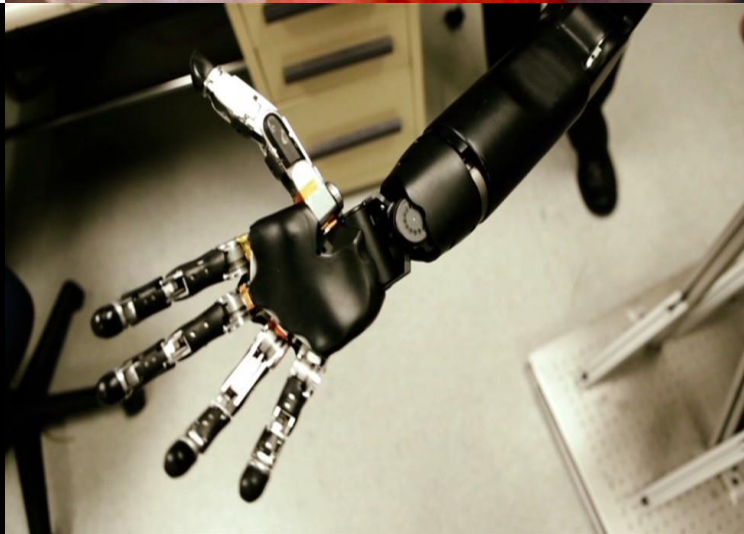
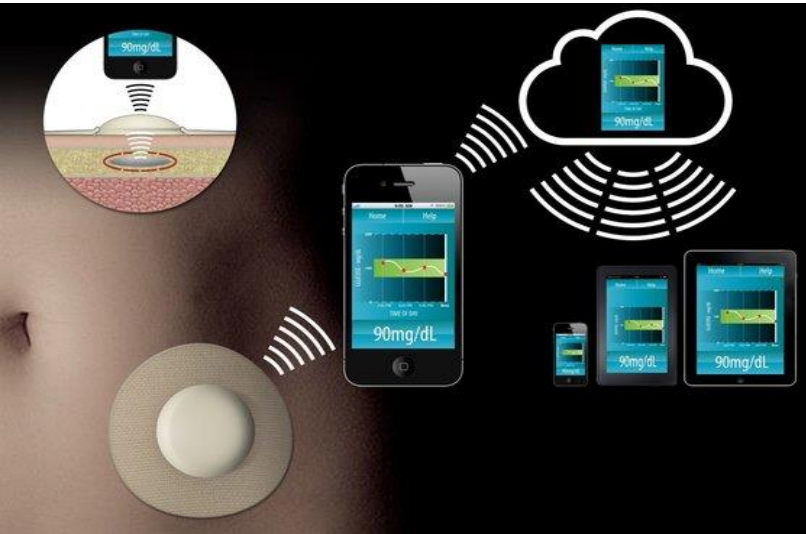
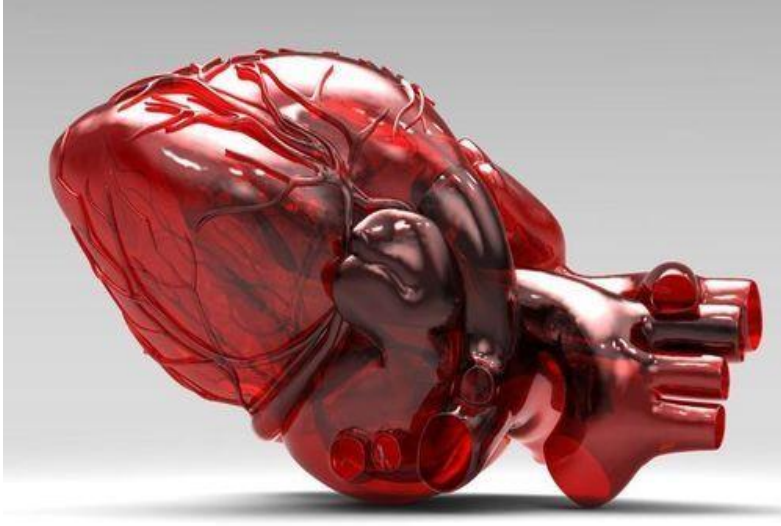
Emerging challenges

Insulin treated diabetes...



Emerging challenges

Biotechnology



So what is our role going to be?

Still need for health risk assessment

- Awareness of limitations of current systems
- Should be more targeted? eg risk and age specific
- Meeting the challenges of mental health, AOD, lifestyle, life events and human factors of employees
- Support cultures that foster disclosure

Need to expand our role

- Integrated into safety management systems
- Human factors, FRMS, AOD, Mental health awareness
- Connected into peer network systems
- Part of multilayered defenses in our SMS

