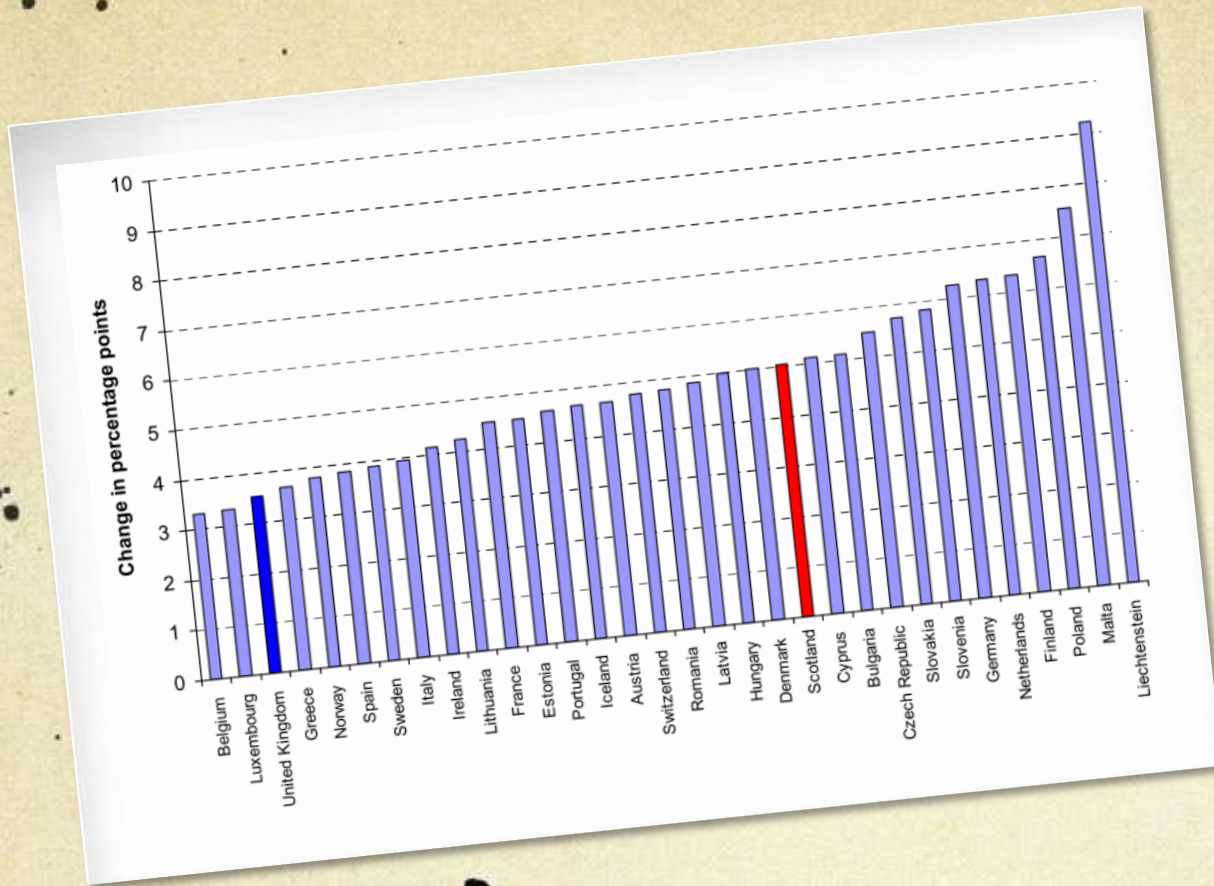




Frailty Framework

Research with CM2000

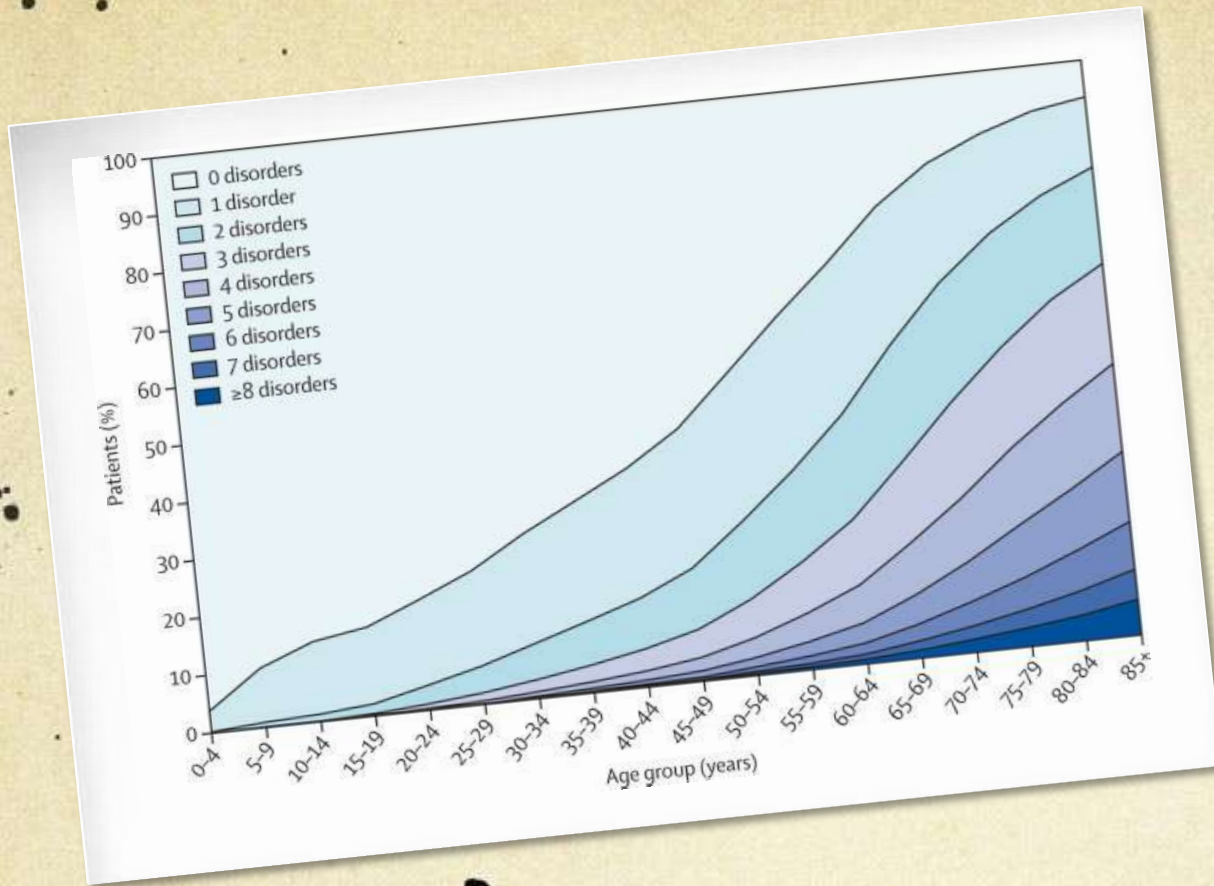
Edinburgh Napier University
Adrian Smales BEng(Hons), MBA
PhD Research Student



Why...?

Demographics - Population

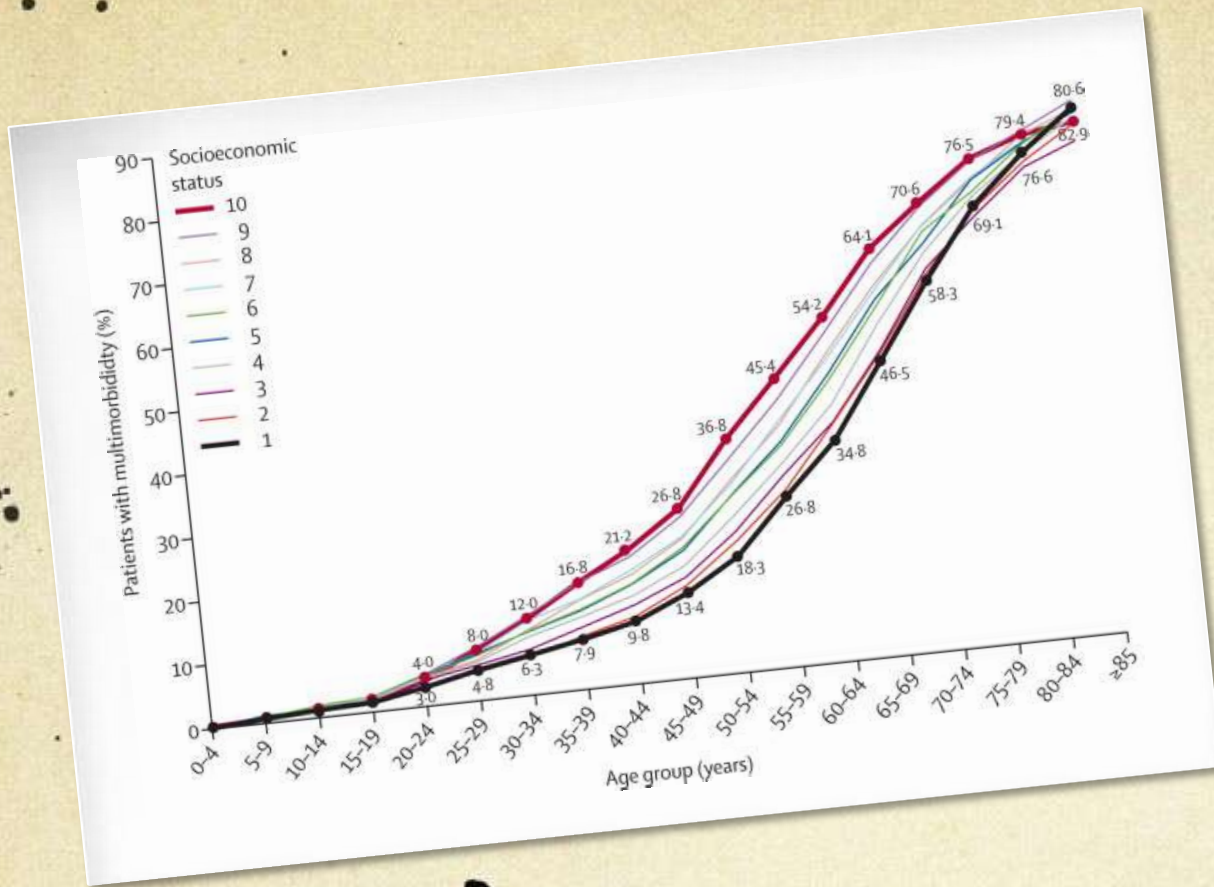
Projected change in proportion of population aged 75 and over from 2010 to 2035 taken from National Records for Scotland inquiry submission to the Scottish Parliament Finance Committee, 2013. *2nd Report, 2013 (Session 4): Demographic change and an ageing population*, The Scottish Parliament.



Why...?

Demographics - Health

Single-Disease-Framework issue - Multimorbidity: Number of Chronic disorders by age group



Why...?

Demographics – Social Status

Prevalence of multimorbidity by age and socioeconomic status

Research - Frailty

- Scottish Government Chief Scientist Office to fund a study within Scotland to look at and determine the *‘Epidemiology of multimorbidity and implications for health care, research and, medical education’*
Barnett et al. (2012) challenged the *‘single-disease framework’* doctrine.
- *‘Most practitioners of medicine have been trained to focus on specific medical diseases when approaching a patient. Frailty does not fit neatly into that practice pattern, because it is almost never the basis for a “chief complaint,” and its presence is often subtle or asymptomatic.*
Fried & Walston (2003)

Research - Frailty

POP QUIZ

Isaacs Set Test... Aid to the Detection of Dementia in Old People

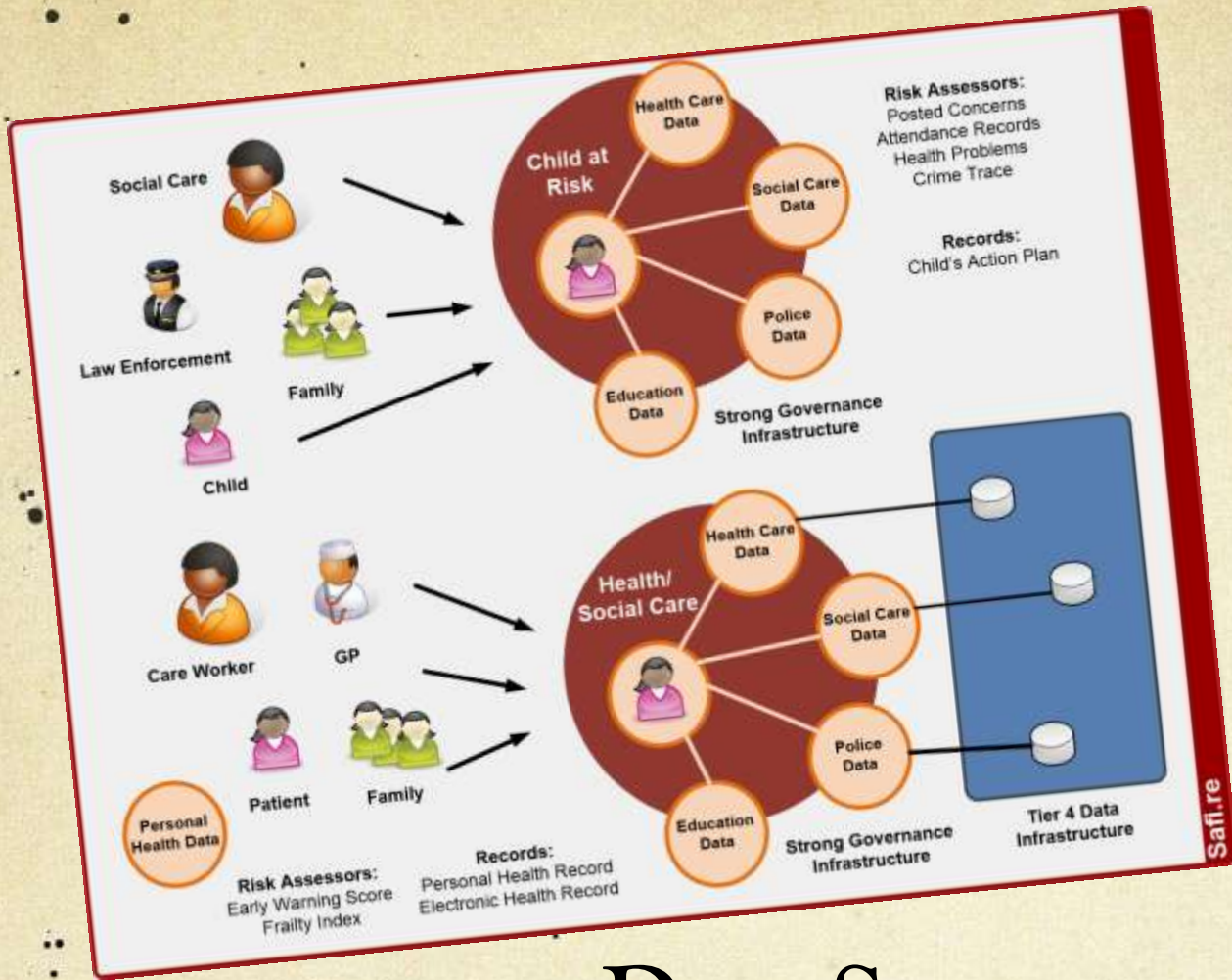
4 sets of questions:

Name as many as you can in the category of:

Colours, Animals, Fruits, Towns

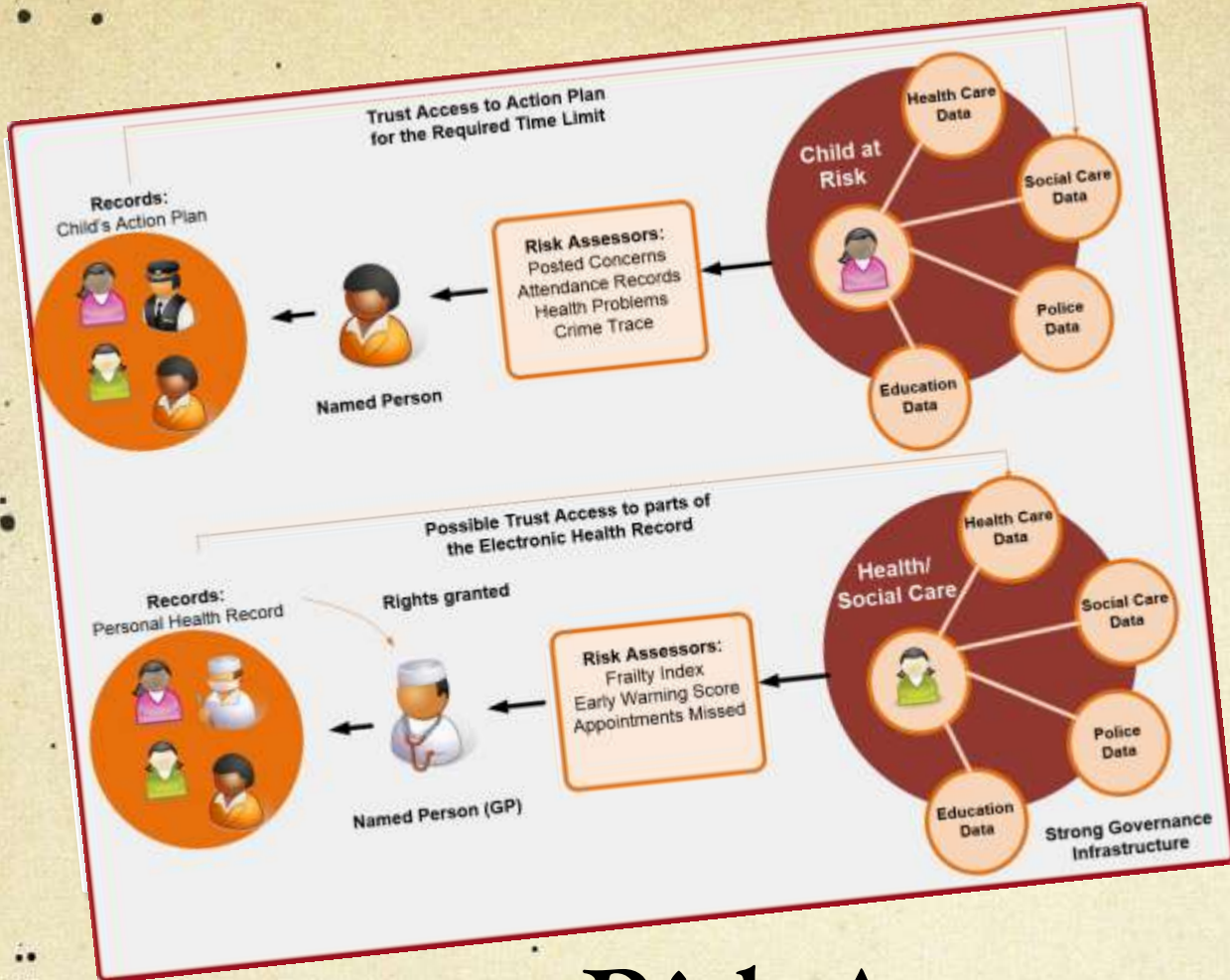
40 Marks available - Good 31 ± 7 ; Bad > 15

95% people score over 15 marks...



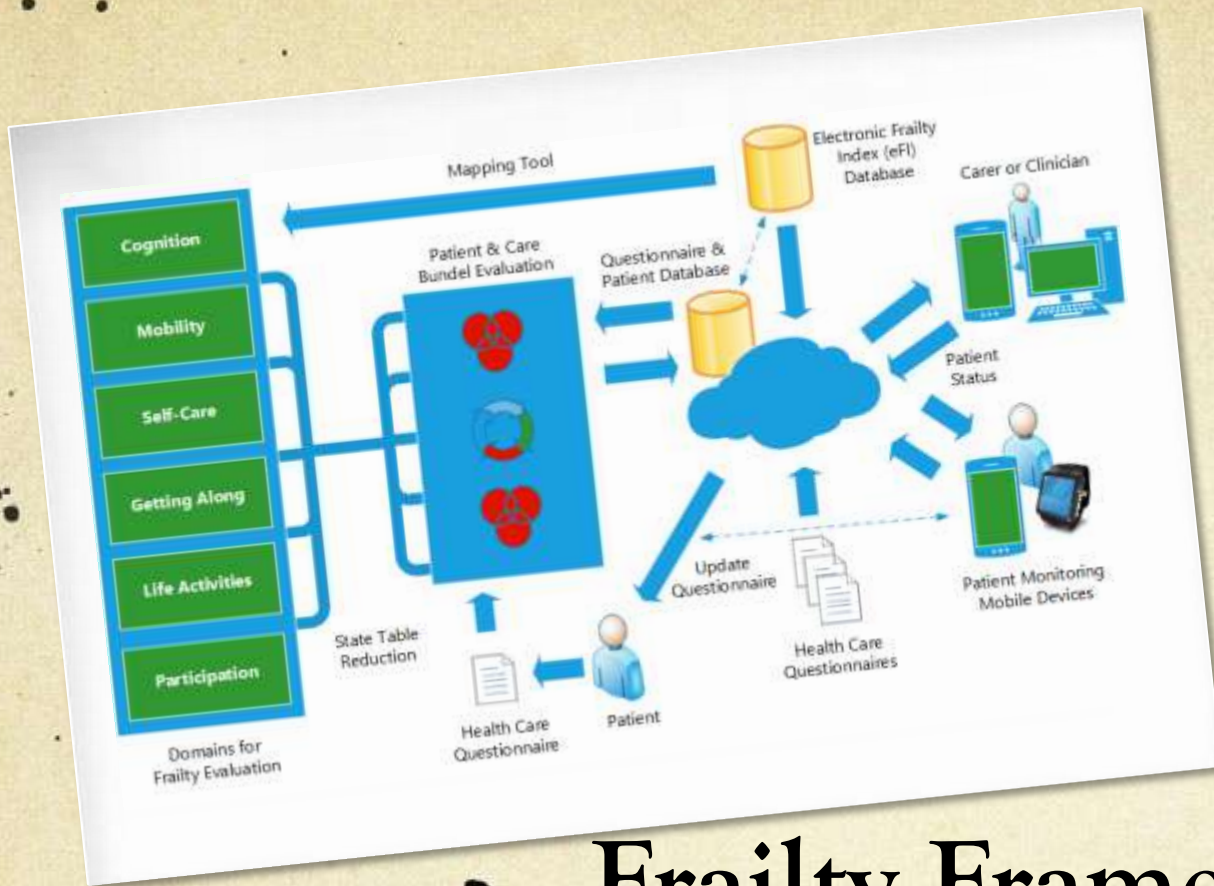
Data Sources and Users

Various stakeholders require trusted and secure data to predict and prevent serious issues.



Risk Assessors

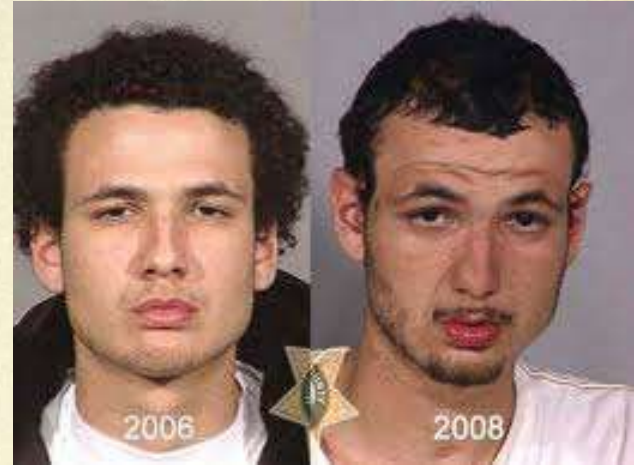
Secure patient data and other information is assessed for preventative and diagnostic risks.

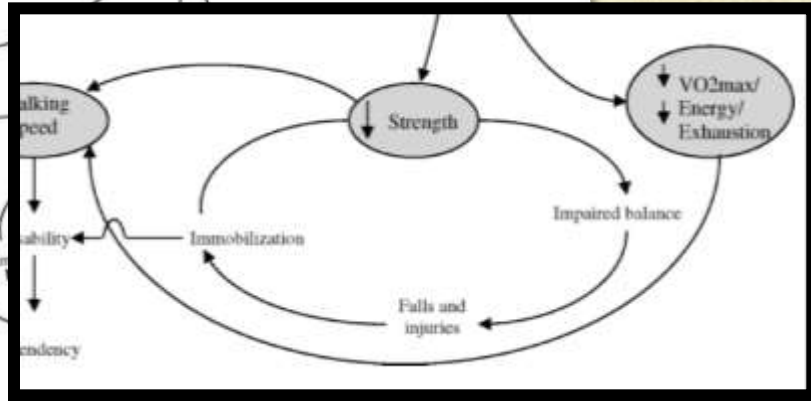
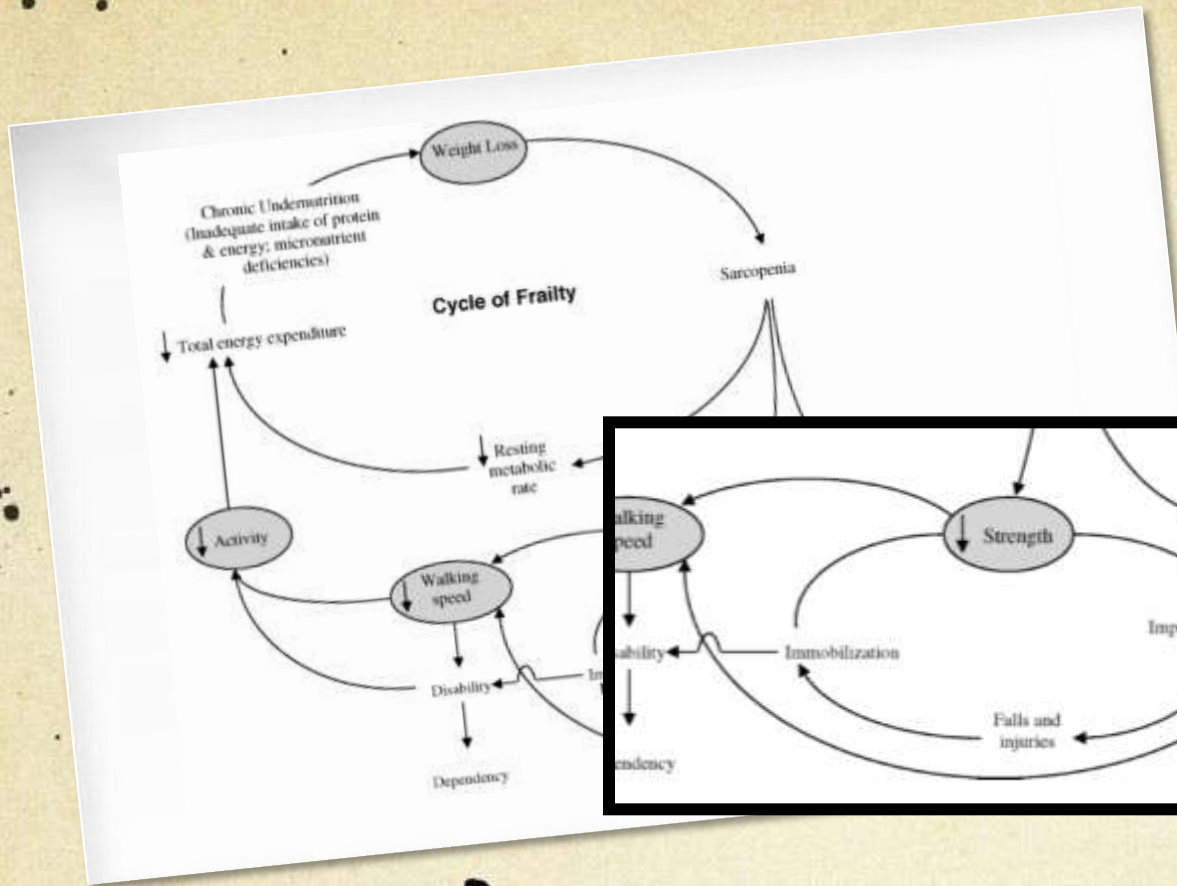


Frailty Framework Abstraction

Technology framework integrating frailty, patient evaluation and patient feedback.

Frailty

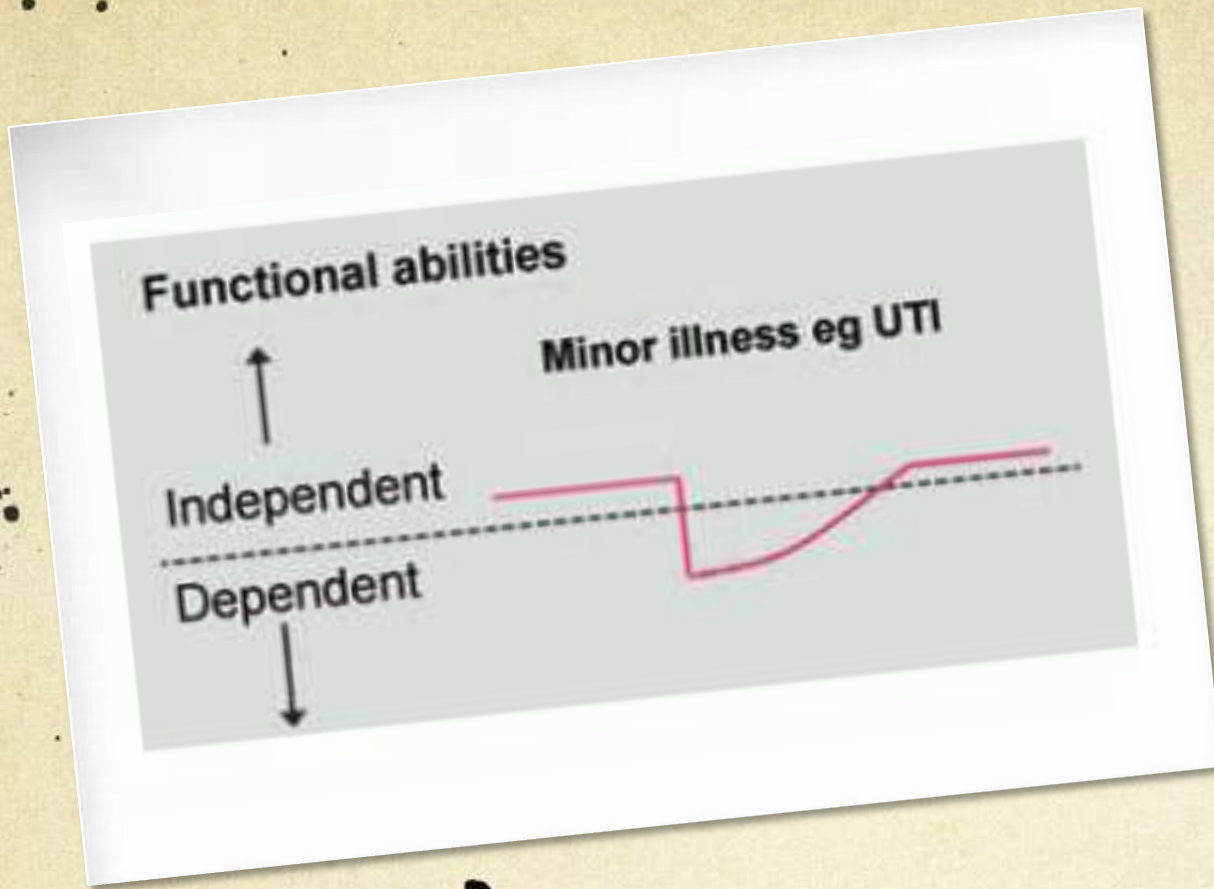




Falls Prevention

Frailty leads to loss of strength...

Our findings suggest that weakness may serve as a warning sign of increasing vulnerability in early frailty development, and weight loss and exhaustion may help to identify women most at risk for rapid adverse progression. Xue, Q.-L. (2008) et al

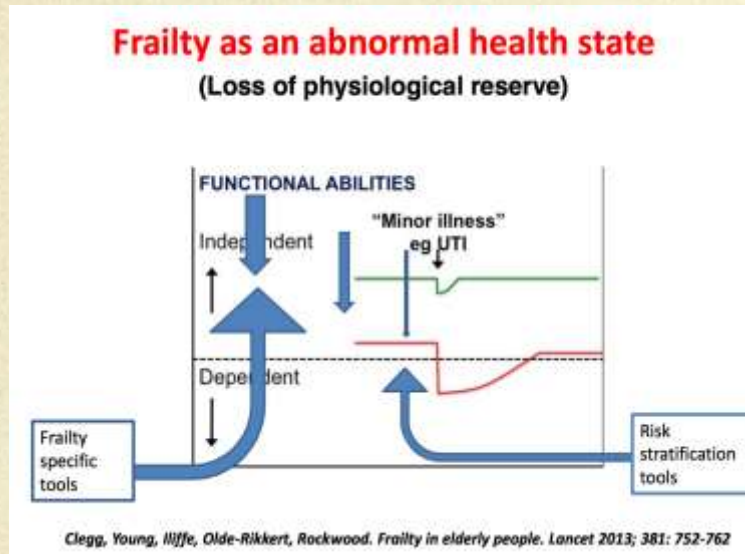


Falls Prevention

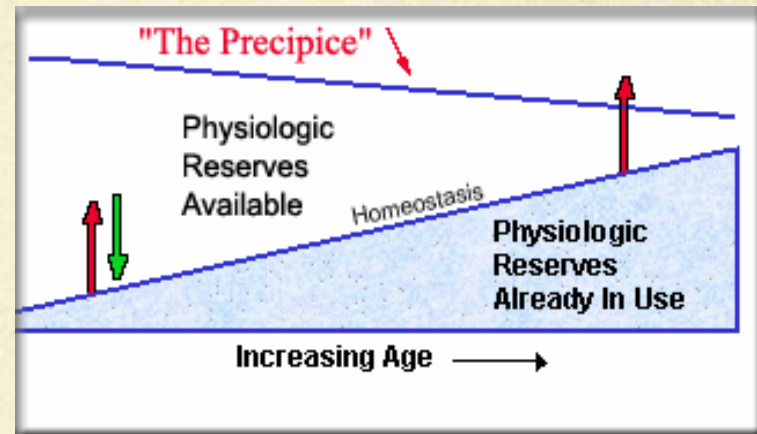
Accumulation of Deficit and
Rapid decline in '*Homeostatic Reserve*'

Homeostatic Stasis

Old (simple) diagram



New "Dynamic" Diagram



Estonian Biobank Study

4 circulating biomarkers predicted all-cause mortality. The 4 biomarkers were:

- *Alpha-1-acid glycoprotein* (hazard ratio [HR] 1.67 per 1-standard deviation increment, 95% CI 1.53–1.82, $p=5610231$)
- *Albumin* (HR 0.70, 95% CI 0.65– 0.76, $p=2610218$)
- *Very-low-density lipoprotein particle size* (HR 0.69, 95% CI 0.62–0.77, $p=3610212$), and
- *Citrate* (HR 1.33, 95% CI 1.21–1.45, $p=5610210$).



Estonian Biobank Study

- The four biomarkers were predictive of the risk of short-term death from cancer, cardiovascular mortality in addition to nonvascular diseases, and in fact 20% of those from the Estonian Biobank cohort that scored within the highest percentile died within the first 12 months of the follow-up, which indicated significant systemic frailty-like activity.



Assessment Evolution

- **First Generation**
 - Are standalone scales designed to measure a single construct for a single purpose.
 - Barthel Index for Activities of Daily Living.

- **Second Generation**
 - Are multidimensional instruments that address many clinical domains with applicability in many settings.
 - Clifton Assessment Procedures for the Elderly (CAPE).

- **Third Generation and Beyond – Toward ‘Dynamic Assessment’**
 - Extend the concept of second generation tools to multiple care settings. They provide assessment processes that can be used across different populations and care settings.
 - Currently the interRAI suite of assessment instruments is the only example of this type.



InterRAI - Instruments

- **Acute Care***
- Assisted Living
- Child and Youth Intellectual/Developmental
- Disability
- Child and Youth Mental Health
- Community Health Assessment
- Community Mental Health
- *Contact Assessment*
- Emergency Screener for Psychiatry
- *Deafblind*
- **Home Care***
- Intellectual Disability
- **Long-Term Care Facilities***
- Mental Health for Correctional Facilities
- Mental Health for In-Patient Psychiatry
- *Palliative Care*
- Post-Acute Care
- Quality of Life
- Wellness

* Translation and adaption of the interRAI suite to local requirements in Belgian hospitals. Wellens et al. BMC Geriatrics 2012, 12:53



Assessment Evolution

○ Fourth Generation

- Dynamic questionnaires, based on a ‘pool’ of questions either that have been designed to work together or collated from highly correlated individual question sets. Patient information is gathered as a consequence of previous data gathered.
- InterRAI is currently the only instrument set capable of this.

○ Fifth Generation

- Incorporating ‘non-diagnostic’ Telehealth real-time or near real-time streaming data into the patients record for analysis.
- E.g. Heart rate, Blood Pressure, Weight, BMI, Movement, Blood Oxygen etc...

○ Sixth Generation– Toward ‘Full Diagnostic Assessment’

- Extend the concept of Fifth generation devices to incorporate diagnostic capability utilising an array of monitoring devices.



Electronic frailty Index (eFI)

43 Candidate Deficits

- | | |
|-------------------------------|---|
| • Memory & cognitive problems | • Chronic kidney disease |
| • Cerebrovascular disease | • Osteoporosis |
| • Dizziness | • Fragility fracture |
| • Parkinsonism & tremor | • Arthritis |
| • Mono/hemiparesis | • Diabetes |
| • Weakness | • Thyroid disease |
| • Sleep disturbance | • Skin ulcer |
| • Visual impairment | • Anaemia & haematinic deficiency |
| • Hearing impairment | • Falls |
| • Hypertension | • Foot problems |
| • Ischaemic heart disease | • Housebound |
| • Atrial fibrillation | • Problems with bathing |
| • Heart valve disease | • Problems carrying out personal grooming and toileting |
| • Hypotension/syncope | • Mobility and transfer problems |
| • Heart failure | • Unable to manage medications |
| • Peripheral vascular disease | • Activity limitation |
| • Dyspnoea | • Social vulnerability |
| • Respirator disease | • Environment problems |
| • Peptic ulcer | • Requirement for care |
| • Faecal incontinence | • Polypharmacy |
| • Weight loss & anorexia | |
| • Urinary incontinence | |
| • Urinary system disease | |

Potentially Preventable

- Alcohol excess
- Cognitive impairment
- Falls
- Functional impairment
- Hearing problems
- Mood problems
- Nutritional compromise
- Physical inactivity
- Polypharmacy
- Smoking
- Social isolation and loneliness
- Vision problems

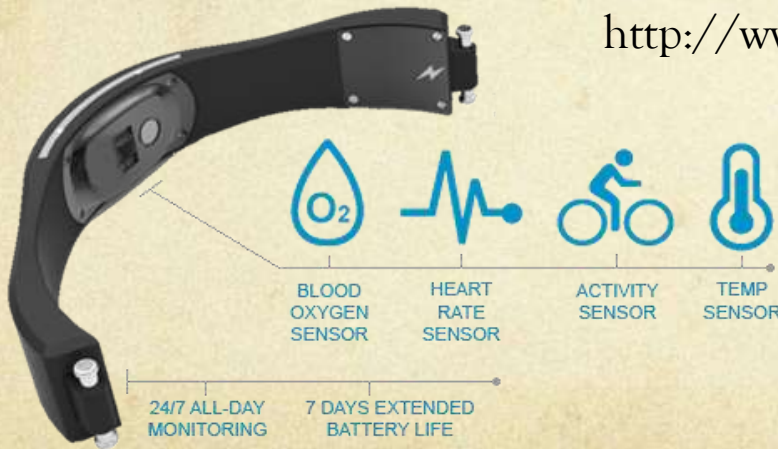
Telehealth Monitoring



Atlas Exercise Monitor
<http://www.atlaswearables.com>



Mio Alpha / Alpha2
<http://www.mioglobal.com>



Angel Health Monitor
<http://www.angelsensor.com>

EXERCISE FINGERPRINTS

	Download Card to Download Files	Regular Pushups	Triangle Pushups	Heart Chest Press
ATLAS				
Crunches	Bicycle Kick Ups	V Ups	BB Side Crunch	Push Ups
Squats	Squat Jumps	Single Leg Squat	Back Squats	Overhead Squats
No Hand Front Squat	Lateral Shoulder Press	Arms Squats	ACSES Bench Press	Incline Bench Press
Overhead Fly	Chest Movement	Standing Bear	Front Shoulder Press	ICE
AC Shoulder Strap Cut	Rowing	Up Row	Young Shoulder Extension	Lunge (Front)

Telehealth Monitoring

Healbe GoBe

<https://healbe.com>

Calorie Monitoring
Diabetes...



 <p>Pulse sensor Measures blood flow and heart rate</p>	 <p>Impedance sensor Measures fluid level in tissues</p>	 <p>Accelerometer Measures activity and body movement</p>
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 <p>Calorie Intake</p>	 <p>Calories Burned</p>	 <p>Heart Rate</p>	 <p>Stress level</p>	 <p>Hydration Levels</p>	 <p>Sleep Status</p>
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Telehealth Monitoring

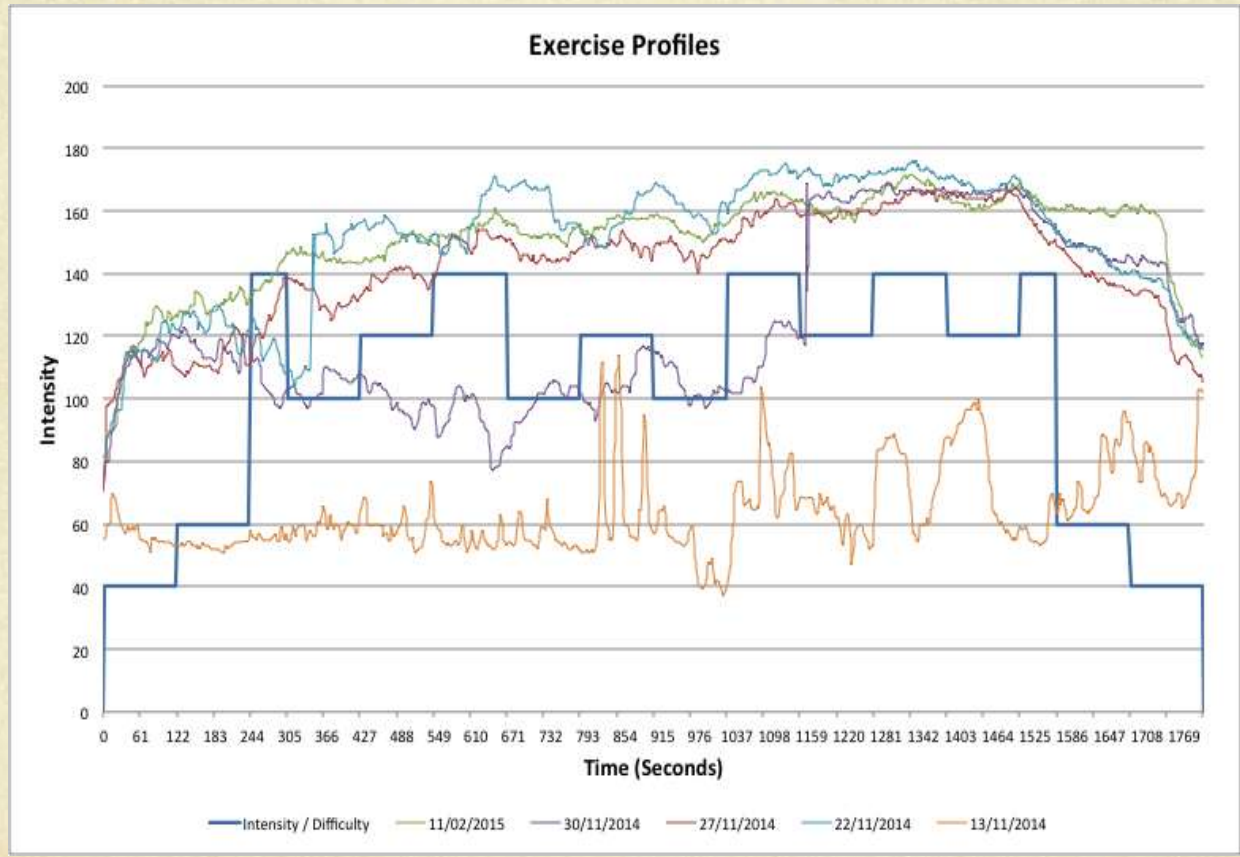
Tanita Europe
<http://www.tanita.eu>

MEASUREMENTS:

- Weight
- Segmental body fat %
- Segmental muscle mass
- Body fat % (age 5 – 99 years)
- Healthy body fat indicator
- Total body water %
- Muscle mass in kg
- Bone mineral mass
- Visceral fat indicator
- Daily Calorie Intake
- Metabolic age
- BMI



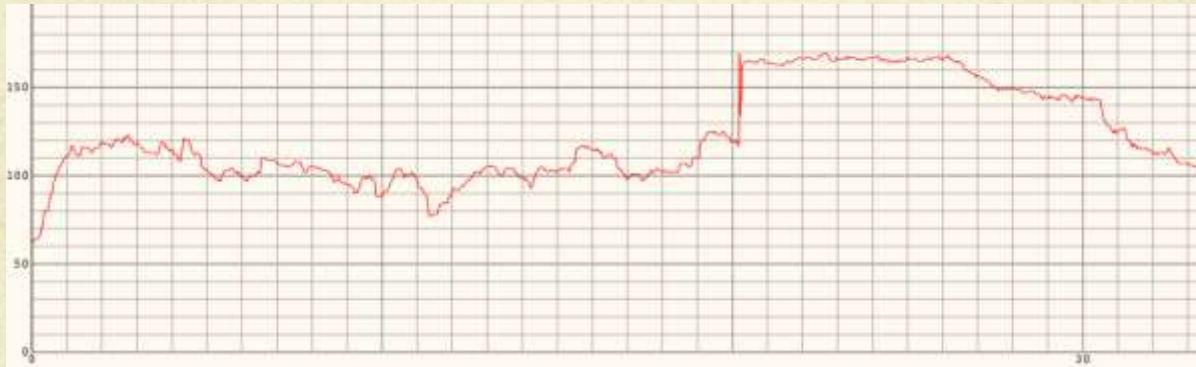
Performance Monitoring



Performance monitoring

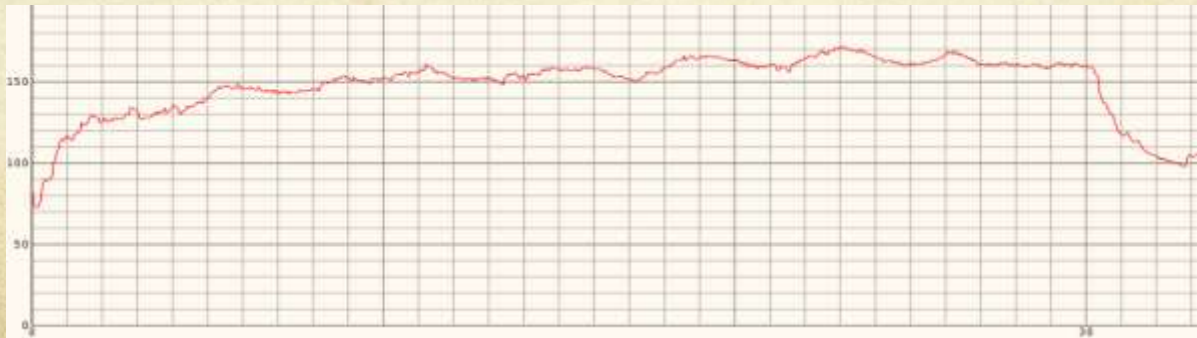
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2015/02/11 06:11:35.465

Interval [0h 33m 34s 908ms] Count 1936, Avg 147.5, Max 172, Min 73



Current Research

DHI Scotland

<https://dhi-scotland.com>



10 Month research into Health & Social Care within a community setting. Research partners include:

- East Dumbarton Council
- Aberdeen Council



Thank You - Questions?

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