The Challenge of Multimorbidity

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Acknowledgements:
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AND
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Stroke Association
GGC endowment
Versus Arthritis
BHF
Marie Curie
MRC
Multiple Morbidity in Scotland

The relationship between age, sex and multimorbidity in predicting all-cause mortality. N = 500,769. LTCs long-term conditions. Adjusted for socioeconomic status (Townsend score), smoking status, alcohol consumption, BMI, and physical activity levels at baseline.
Age as time scale for both analyses. LTC=Long-term conditions; *Adjusted for sex, socioeconomic status based on Townsend score, smoking status, alcohol status, Body Mass Index, and physical activity levels reported at base line.

Multimorbidity and Effects of Socioeconomic Deprivation

**Affluent Participants**

- No long-term conditions
- 1-2 LIDCs
- 4 or more LIDCs

**Deprived Participants**

- No long-term conditions
- 1-2 LIDCs
- 4 or more LIDCs

Proportion of Deaths in % vs. Time in months
Increases in complexity of treatment regimens have been associated with substantially lower adherence, further impairing effective treatment (WHO 2003)
Panel: Key messages in Right Care Series

Overuse and underuse coexist within populations, within systems, and even within patients around the world. Underuse of proven medical care and overuse of unproven services causes suffering to millions of people around the world. The costs are serious: physical, psychological, and social harms for patients and wasteful misallocation of resources for society.

Because most care falls in a grey zone in which benefits and harms are not clear, attention to preferences of patients is essential. The medical community needs to do what patients want rather than what health professionals know how to do. Overuse and underuse are symptoms of a health-care system that does not reflect the ethics of medicine. They undermine the capacity of countries to achieve sustainable universal health coverage and to ensure that health care is a human right. Action is possible and necessary.
“There was a chemist I had to go down and see at the health centre one day and he wanted to discuss my medication... he said you need to be on aspirin, I said no I think from what they said that caused me the problem, oh no you definitely need to be on aspirin...I said you better go and check up on that so he went ...he came back and he said you are right you shouldn’t be on aspirin. Because I had a bleed. And that would have made it worse.” (P2)
Examining patterns of multimorbidity, polypharmacy and risk of adverse drug reactions in chronic obstructive pulmonary disease: a cross-sectional UK Biobank study

Peter Hanlon, Barbara I Nicholl, Bhautesh Dinesh Jani, Ross McQueenie, Duncan Lee, Katie I Gallacher, Frances S Mair
Methods

• Comparison: COPD vs No COPD

• Outcome: risk of adverse drug reactions (3 or more medications)
  • Falls
  • CNS depression
  • Urinary retention
  • Constipation
  • Bleeding
  • Renal injury

• Logistic regression analyses
• Adjusted for age, sex and socioeconomic status, BMI, smoking, alcohol
<table>
<thead>
<tr>
<th>ADR</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falls</td>
<td>1.83</td>
<td>1.71-1.96</td>
</tr>
<tr>
<td>Constipation</td>
<td>2.66</td>
<td>2.39-2.96</td>
</tr>
<tr>
<td>Urinary retention</td>
<td>2.59</td>
<td>2.22-3.0</td>
</tr>
<tr>
<td>Sedation</td>
<td>2.81</td>
<td>2.45-3.22</td>
</tr>
<tr>
<td>Bleeding</td>
<td>3.39</td>
<td>2.40-4.66</td>
</tr>
<tr>
<td>Renal injury</td>
<td>1.84</td>
<td>1.53-2.19</td>
</tr>
</tbody>
</table>

*** : p<0.001

COPD Comorbidity and Adverse Drug Reactions

Bubble plot of showing percentage of participants in each comorbidity category taking 3 or more concomitant medications associated with specific adverse drug reactions.

Comorbidity category
- No COPD (control)
- COPD whole sample
- COPD and pain
- COPD and MH
- COPD and GI
- COPD and CVD
- COPD and Cancer

Adverse drug reaction
- Falls
- Constipation
- Urinary retention
- CNS depression
- Bleeding
- Renal injury

ADR = Adverse Drug Reaction, COPD = Chronic Obstructive Pulmonary Disease, CVS = Cardiovascular disease, GI = Gastrointestinal disease, MH = Mental health conditions. The size of each bubble represents the percentage of participants in each comorbidity group taking 3 or more concomitant medications associated with specific ADRs according to the Scottish Government Polypharmacy Guideline.
Conclusion

- Comorbid cardiovascular disease most strongly associated with taking multiple drugs causing falls/fractures and renal injury.

- Comorbid mental health conditions most strongly associated with taking multiple drugs causing CNS depression, constipation, urinary retention and bleeding.

- Clinical guidelines should emphasize assessment of comorbidities, prescribing and ADR risk.
Polypharmacy is Common

- Co-prescription of drugs with similar ADRs common
- Medications contributing to ADR risk indicated for the treatment of comorbidities
- Future research should examine the impact of these patterns of prescribing on outcomes

Renal injury: combinations with highest effect sizes
adjusted for age, sex, SES, BMI, smoking, alcohol, and MM count

<table>
<thead>
<tr>
<th>Drug combination</th>
<th>N taking combination</th>
<th>HR (95% CI)</th>
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</thead>
<tbody>
<tr>
<td>Aldosterone antagonist and Loop diuretic</td>
<td>496</td>
<td>2.08 (1.6–2.7)</td>
</tr>
<tr>
<td>Aldosterone antagonist and Angiotensin 2 receptor blocker</td>
<td>257</td>
<td>1.98 (1.38–2.86)</td>
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<tr>
<td>Amiloride and Loop diuretic</td>
<td>625</td>
<td>1.72 (1.36–2.18)</td>
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<tr>
<td>Loop diuretic and Thiazide diuretic</td>
<td>212</td>
<td>1.66 (1.1–2.51)</td>
</tr>
<tr>
<td>Loop diuretic and ACE–Inhibitor</td>
<td>2562</td>
<td>1.64 (1.44–1.86)</td>
</tr>
<tr>
<td>Amiloride and Angiotensin 2 receptor blocker</td>
<td>144</td>
<td>1.59 (0.95–2.64)</td>
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<tr>
<td>Loop diuretic and Angiotensin 2 receptor blocker</td>
<td>1264</td>
<td>1.58 (1.32–1.88)</td>
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<tr>
<td>NSAID and Loop diuretic</td>
<td>872</td>
<td>1.56 (1.26–1.93)</td>
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<tr>
<td>NSAID and Amiloride</td>
<td>218</td>
<td>1.43 (0.94–2.18)</td>
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<tr>
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<td>472</td>
<td>1.37 (0.99–1.91)</td>
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<tr>
<td>Amiloride and ACE–Inhibitor</td>
<td>247</td>
<td>1.22 (0.8–1.88)</td>
</tr>
<tr>
<td>Angiotensin 2 receptor blocker and ACE–Inhibitor</td>
<td>783</td>
<td>1.13 (0.86–1.48)</td>
</tr>
<tr>
<td>NSAID and Angiotensin 2 receptor blocker</td>
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<td>Amiloride and Thiazide diuretic</td>
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<td>1 (0.9–1.12)</td>
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<tr>
<td>NSAID and Thiazide diuretic</td>
<td>5224</td>
<td>0.96 (0.86–1.09)</td>
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<tr>
<td>Thiazide diuretic and ACE–Inhibitor</td>
<td>12659</td>
<td>0.95 (0.88–1.03)</td>
</tr>
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</table>
We Need Minimally Disruptive Medicine

Courtesy of BMJ 29 August 2009 Vol 339. May, Montori and Mair. We need Minimally Disruptive Medicine.
For your safety and ours, please limit the discussion with your provider to

one issue per visit

please speak to our staff to book more appointments if needed.
Thinking about the burden of treatment

Should it be regarded as an indicator of the quality of care?

Frances S Mair professor of primary care research¹, Carl R May professor of healthcare innovation²

¹Institute of Health and Wellbeing, College of Medical, Veterinary and Life Sciences, University of Glasgow, Glasgow G12 9LX, UK; ²NIHR CLAHRC, Faculty of Health Sciences, University of Southampton, UK
**Illness burden** = the “work” that patients and their families do to understand and “live with” a chronic illness

**Treatment burden** = self-care practices that patients must perform to manage their treatments and their interactions with HPs

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What is Treatment Burden?

**Learning about treatments and their consequences**
- Gaining an understanding of the illness, investigations, and treatments.
- Knowing when to seek help.

**Engaging with others**
- Gaining support, advice, reassurance relating to treatments.
- Using organisational skills for transport, prescriptions etc.

**Adhering to treatments and lifestyle changes**
- Attending appointments and taking medications.
- Enacting lifestyle changes.
- Overcoming barriers such as accessibility to healthcare and poor continuity of care.
- Integrating treatments into social circumstances. Includes financial efforts.

**Monitoring the treatments**
- Altering management routines.
- Appraising treatments and medical advice.

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We Need Minimally Disruptive Medicine and Less SINC......

Effective treatments + Good treatment adherence = Optimum treatment outcomes

Improved patient knowledge
Decreased treatment burden

Patient education and access to information
Patient centred care delivered by health services

Gallacher K, May CR, Montori V, Mair FS. Treatment Burden in Multimorbidity. In ABC of Multimorbidity 2014
To sum up:

“Aye I feel it’s for the institution, it’s not for the patient, everything is geared for smooth running, that means it’s from the hospital point of view and not the patients view, right or wrong, what do you think?” ID04
Treatment burden arises as a consequence of:

Healthcare workload or Care deficiencies
Need to reduce Burden of Treatment – SIMPLE IS BEAUTIFUL

- Encourage Coordination in Clinical Practice
- Improve Communication
- Acknowledge Comorbidity in Clinical Evidence
- Prioritise from the Patient Perspective TAKING INTO ACCOUNT CAPACITY ISSUES.............
Cumulative complexity: a functional, patient-centered model of patient complexity can improve research and practice

Nathan D. Shippee, Nilay D. Shah, Carl R. May, Frances S. Mair, Victor M. Montori

Open Access PlumX Metrics
DOI: https://doi.org/10.1016/j.jclinepi.2012.05.005

Rethinking the patient: using Burden of Treatment Theory to understand the changing dynamics of illness

Carl R May, David T Eton, Kasey Boehmer, Katie Gallacher, Katherine Hunt, Sara MacDonald, Frances S Mair, Christine M May, Victor M Montori, Alison Richardson, Anne E Rogers and Nathan Shippee

BMC Health Services Research 2014 14:281
Received: 28 January 2014 | Accepted: 16 June 2014 | Published: 26 June 2014
Fig. 1

1. As social and clinical complicating factors accumulate, they add to patient workload demands, reduce patient capacity, or both in various ways.

2. If patient workload expands and capacity dwindles, this creates an imbalance, as the patient passes his/her individual tipping point in one sphere of life or another and becomes overburdened, incapable of carrying out all the required tasks.

3. This imbalance disrupts patterns of access, utilization, and the routine of self-care, influencing how patients make sense of, participate in, achieve, and monitor personal health outcomes—and leading to unplanned prioritization and unaddressed demands.

4. Workload-capacity imbalances may also persist and strengthen over time, as demands create stress, fatigue begets forgetfulness, and unfinished work piles up, leading to even further challenges and overburden.
**Patient workload of demands**
*Examples:
Job, Family, Self-care, Testing, Scheduling/attending appointments, Transportation, Paperwork

*Attributes of workload demands:
Number, Difficulty, Fit

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**Patient capacity**
*Examples:
Physical/mental functioning, Pain, Symptoms, Fatigue, Finances, Literacy, Social support

*Attributes of capacity factors:
Amount, Controllability, Extensiveness

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**Access, Utilization, Self-care**

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**Outcomes**

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**Burden of treatment** (g)

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**Burden of illness** (h)
Personal Health Conditions
Polymyalgia Rheumatica
Diabetes
Atrial Fibrillation
Heart Failure
Hypertension
Coronary Artery Disease
Peripheral Vascular Disease
Carotid Artery Disease
Osteoporosis

Self – Management Work
• Arrange to get medications each month
• Take 10 Different Medications at different times of the day
• Endure side effects
• Attend clinics
• Undergo Investigations
• Increase physical activity
• Change Diet etc etc…….

Other Illnesses He Has to Manage
Mother has dementia
Father has cognitive impairment, AF and frequent blackouts
Older brother with severe COPD, learning disabilities, poor mobility

Lifeworld work
Daughter aged 8yrs
Having fun?

Any Support?
Yes – a very supportive wife
Six factors affected capacity and these were influential on the patient experience:

- Personal attributes and skills
- Support network
- Life workload
- Physical and cognitive abilities
- Financial status
- Environment
Personal attributes and skills

Patience and persistence
Time
Energy
Negotiation & interpersonal skills
Problem solving
Resilience
Health Literacy
Ability to prioritise and juggle commitments
Physical and Cognitive Abilities

Frailty

Multimorbidity

Multimorbidity count

Cognitive Impairment

Practical capabilities e.g. physical, visual, hearing
# Frailty models

## Frailty Phenotype
- Weight loss
- Weakness
- Slow gait speed
- Low physical activity
- Exhaustion

## Frailty Index
- Cumulative count of age-associated deficits
- Calculated as a proportion of the total

| 1-2: Pre-frail |
| 3: Frail |

Recruitment: 503,640 participants

Frailty Phenotype:
493,737 with complete data (98%)
- Weight loss
- Grip strength
- Slow walking pace*
- Low physical activity
- Exhaustion

Not frail
n=291,839 (59.1%)
0 frailty indicators

Pre-frail
n=185,360 (37.5%)
1-2 frailty indicators

Frail
n=16,538 (3.3%)
≥3 frailty indicators

Prevalence of Frailty and Pre-frailty categorised by number of LTCs

- **0 LTCs** (n=169,115)
- **1 LTC** (n=161,432)
- **2 LTCs** (n=93,857)
- **3 LTCs** (n=42,381)
- **4 or more LTCs** (n=25,338)

Frailty category:
- Not frail
- Pre-frail
- Frail
### Hazard ratios of all-cause mortality for frailty status stratified by age and sex, adjusted for socioeconomic status, BMI, smoking, alcohol frequency and multimorbidity count

<table>
<thead>
<tr>
<th>Age Category</th>
<th>Sex</th>
<th>Frailty Category</th>
<th>Total</th>
<th>No. of deaths</th>
<th>95% CI Lower</th>
<th>HR</th>
<th>95% CI Upper</th>
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<td>Male</td>
<td>Not frail</td>
<td>18107</td>
<td>115</td>
<td>(ref)</td>
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<td></td>
<td></td>
<td>Pre-fail</td>
<td>10163</td>
<td>110</td>
<td>1.04</td>
<td>1.36</td>
<td>1.79</td>
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<td>Frail</td>
<td>478</td>
<td>20</td>
<td>1.58</td>
<td>2.7</td>
<td>4.64</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>Not frail</td>
<td>20205</td>
<td>106</td>
<td>(ref)</td>
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<tr>
<td></td>
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<td>Pre-fail</td>
<td>12910</td>
<td>78</td>
<td>0.64</td>
<td>0.87</td>
<td>1.19</td>
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<td>903</td>
<td>16</td>
<td>0.74</td>
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<td>39092</td>
<td>510</td>
<td>(ref)</td>
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<td></td>
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<td>Pre-fail</td>
<td>21194</td>
<td>553</td>
<td>1.33</td>
<td>1.51</td>
<td>1.71</td>
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<td>1441</td>
<td>116</td>
<td>1.9</td>
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<td>Frail</td>
<td>2714</td>
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<td>1.26</td>
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<td>12600</td>
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<td>1.34</td>
<td>1.45</td>
<td>1.57</td>
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<td>600</td>
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<td>14700</td>
<td>767</td>
<td>1.34</td>
<td>1.5</td>
<td>1.68</td>
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<td>1583</td>
<td>180</td>
<td>2.1</td>
<td>2.53</td>
<td>3.04</td>
</tr>
</tbody>
</table>
Support Network

- Friends and family that give practical and emotional support such as information gathering, medications and transport to appointments.
- Volunteers / charities.
- Support groups and other people with similar problems.
- Employment that provides a support network.
Financial Status

• Financial struggles e.g. loss of income, delay in benefits.

• Ability to pay for own mobility aids, adaptations, private healthcare or home care.

• Ability to pay for taxis to get to appointments
Environment

Geographical location e.g. distance from hospital and transport links.

• Home environment e.g. stairs, access to house.

• Availability of aids or gadgets
Life Workload

- Co-morbidities.
- Employment.
- Dependents e.g. spouse, children.
Life Workload – self-management workload is only part of the workload in a person’s life!
Original Investigation
July 2014

Preventing 30-Day Hospital Readmissions
A Systematic Review and Meta-analysis of Randomized Trials

Aaron L. Leppin, MD¹; Michael R. Gionfriddo, PharmD¹,²; Maya Kessler, MD¹,³; et al

Author Affiliations | Article Information

Multimorbidity
Why We Need A Precision Medicine Approach

Our focus should be on developing approaches that are better tailored to patients’ needs (based on genetic, environmental, lifestyle and capacity factors) as well as their personal goals.

A one size fits all approach is unlikely to work........
The most dangerous phrase in the language is “we’ve always done it this way.”

Rear Admiral Grace Hopper (1906-1992)
RISK STRATIFICATION IN MULTIMORBIDITY

This is not a homogenous population
Two simple questions from the HCP may suffice:

1. *Can you really do what I am asking you to do?*

2. *Do you think what I am asking you to do is the right thing for you?*
THANK YOU

Questions: Frances.Mair@glasgow.ac.uk

@FrancesMair

And thanks to Dr B Jani, K Gallacher, P Hanlon, and D Blane some of whose slides I’ve borrowed!