Health inequalities and dementia

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28th January 2015
Dementia describes a syndrome of cognitive & functional decline

Often accompanied by behavioural and psychological symptoms

The commonest cause is Alzheimer disease (50-75%)

Approximately one in 20 older adults is affected

Growing numbers; falling prevalence??

850,000 people in the UK; 36 million worldwide

If dementia were a country it would have a G20 seat
Public health importance

- Financial cost greater than cardiovascular disease and cancer
- Personal cost to those affected unmeasurable
- Approximately half of people are not diagnosed
- Post-diagnostic support now guaranteed in Scotland
- Early treatment can affect outcome, including preserving function and keeping people at home for as long as possible
Mysterious dementia

- Alois Alzheimer described the first case in 1906
- There has been over two decades of intensive research...
- ...and there are still no disease-modifying treatments
- There is an urgent need to understand dementia aetiology
- Delaying or preventing onset would have substantial effects
- Two health inequalities: unscheduled admissions and geography
Dementia in the general hospital

• People with dementia are often admitted to hospital
• 6% of people with dementia are in hospital now (vs 0.6% of the general older population)
• 25% of general hospital inpatients have cognitive impairment
• Only half will have been given a diagnosis
• People with dementia are vulnerable in hospital
• Unscheduled admissions should be avoided, where possible

But…what factors put someone at risk of admission?
Scottish Dementia Research Interest Register

- People from across Scotland
- Diagnosed with dementia (and carers)
- Who have expressed an interest in research
- Demographic, cognitive, functional, and behavioural measures
- Consent to linkage to electronic health records
Electronic health records

- Scottish Morbidity Records 01 and 04
- All general and psychiatric hospital admissions in Scotland
- Community Health Index (CHI) number is a unique identifier:
  
  28 01 15 1234

- Allows linkage of all health data pertaining to this individual
- e.g. identifying who has been admitted to hospital and when
Data recorded

- Addenbrookes Clinical Examination — Revised
- Instrumental Activities of Daily Living scale
- Personal Self-Maintenance scales
- Neuropsychiatric Inventory including Carer Distress
- Clinical Dementia Rating scale
- Details of illnesses and prescribed medications
Survival analysis
Survival analysis
SDRIR sample

- **N = 730**
- **47.8% female**
- **Mean (SD) age 76.3 (8.2)**
- **Range 50 to 94 years**
- **Mean follow up 1.2 years**
- **Range 2 days to 3.3 years**
- **37.5% admitted**
- **Various reasons**
- **Dementia recorded 53.3%**

Predictors of admission

- Male (HR; 95% CI: 1.32, 1.04–1.68)
- Non-AD, non-vascular dementia (1.67, 1.09–2.56)
- Comorbidity (1.28, 1.00–1.65)
- Physical Self-Maintenance scale (1.18, 1.04–1.33)
- Neuropsychiatric Inventory (1.22, 1.09–1.37)
- NPI carer distress (1.14, 1.02–1.28)
Neuropsychiatric symptoms predict admission

- NPI score was the only independent predictor
- One standard deviation increase in score increased risk of admission by 21%
- Risk highest in highest levels of distress
- Agitation may be the most important symptom

Interim conclusions

- Dementia is common and important
- Many people with dementia are admitted to hospital
- Neuropsychiatric symptoms might increase risk of admission
- Can we reduce these symptoms and thus risk of admission?
Geographical variation in disease

- The “Scottish” effect
- Cardiovascular disease
- Leukaemia
- Multiple sclerosis
- Schizophrenia
- Dementia?
Geographical variation in dementia

- ‘Quantitative integrations of the literature’
  - e.g. EURODEM, EUROCoDe

- Methodological difficulties in comparing studies
  - diagnostic criteria
  - methodology
  - population studied
Geographical variation in dementia

- Evidence at most scales of geographical variation in dementia

- Wide variation in quality of studies

- Rural living is associated with an increased risk of AD

- Small area research (most informative) is most scarce

- Geographical variation may help identify risk/protective factors

Association between rurality and dementia

- Prevalence:
  OR 1.11, 90% CI 0.79-1.57

- Incidence: 1.20, 0.84-1.71

- Stronger for AD, particularly early life exposure:
  - prevalence 2.22, 1.19-4.16
  - incidence 1.64, 1.08-2.50

- Definition of rurality

<table>
<thead>
<tr>
<th>Study</th>
<th>OR (90% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ogunniyi et al (2000)</td>
<td>1.57 (0.44–5.56)</td>
</tr>
<tr>
<td>Ogunniyi et al (2000)</td>
<td>2.49 (1.21–5.12)</td>
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<tr>
<td>Lin et al (1998)</td>
<td>1.17 (0.74–1.85)</td>
</tr>
<tr>
<td>Zhang et al (2006)</td>
<td>1.50 (1.29–1.75)</td>
</tr>
<tr>
<td>Jean et al (1996)</td>
<td>1.52 (1.21–1.90)</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td><strong>1.64 (1.08–2.50)</strong></td>
</tr>
</tbody>
</table>

Media coverage

The Daily Telegraph

“People who grow up in countryside ‘twice as likely to develop Alzheimer’s’”

Daily Mail

“Being raised in the countryside ‘doubles Alzheimer’s risk’ but researchers have no idea why”

Daily Express

“Alzheimer’s: ‘Growing up in rural area doubles risk’”
Media coverage

“People who grew up in rural areas ‘at twice the risk of Alzheimer’s’ … Alzheimer’s experts have urged caution about the findings and say there is no compelling reason to flee the countryside for urban life”!

*WebMD UK Health News*

“Health information you can trust”
Small area studies of dementia

Frecker (1991) *J Epidemiol Commun H.*

Questions

- Does the prevalence and incidence of dementia vary by place?

- Is such variation real or artifactual?

- What factors might be associated with this variation?

- Are any of them potentially modifiable?
Swedish Twin Registry

- Established in 1961
- Comprehensive twin register
- 1886 births onwards
- Questionnaire data collected
- All dementia cases identified

1932 Scottish Mental Survey

- Intelligence test of all 11-year-old children (87,498)
- Repeated in 1947
- Unique in the world
- Moray House Test
- Findings published in 1933

1932 Scottish Mental Survey: follow up

- Ledgers discovered by accident
- Local follow-up since 1997
  - www.lothianbirthcohort.ed.ac.uk
  - www.disconnectedmind.ed.ac.uk
  - www.abdn.ac.uk/aberdeen-birth-cohort
- They form a narrow age cohort

Record linkage of entire cohort by the Information and Statistics Division of NHS National Services Scotland (linkage rate 44%)

- Hospital discharge data
- Mortality data
- Greater Glasgow & Clyde Nursing Homes Medical Practice

Bayesian disease mapping

- Many statistical methods assume independence of observations

- Tobler’s first law of geography: close things are more similar than things which are further apart

- Smooths out random variation in disease prevalence/incidence

- Very computer intensive – longest model ran for 10 days!

- Result is relative effect for each small area


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Oesophageal cancer in Germany

Swedish study

- Male and female Swedish twins analysed separately
- Total sample size 27,680 (50% female; 25% monozygotic)
- Mean (sd; range) age:
  - Men: 78.2 years (8.2; 41–103)
  - Women: 80.2 years (8.1; 28–110)
- 993 dementia cases
- Located by 5-digit zipcode of adult residence (mapped by 3-digit zipcode; N = 568)
Swedish twins — genetic effects removed

Scottish study

- Male and female participants analysed separately
- Total sample size 37,597 (48.7% female; all born in 1921)
- 3605 dementia cases
- Located at age 11 by county of school attended (N=38)
- Located in adulthood by postcode sector (N = 953)
- 7854 missing adult location
Scotland: childhood location

Scotland: adult location


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Hypotheses redux

- Both studies support geographical variation of dementia rates
- This was not completely explained by genetic/familial factors
- Something(s) acting in adolescence or later?
- We can speculate whether there is an effect of latitude

Some speculations on mechanisms

Both studies seem to point to a north-south effect so might there be a risk or protective factor related to latitude?

Selenium may have a role in dementia (Loef et al., 2011) and concentrations vary with latitude in Sweden (low in the north)

Lower vitamin D levels have been linked to poorer cognition and increased risk of AD (Balion et al., 2012; Littlejohns et al., 2014)

Previous work suggested the importance of proximity to mining; the majority of mines in Sweden are in the north of the country.

Concluding remarks

- Dementia is a major and growing public health concern
- Neuropsychiatric symptoms relate to risk of hospital admission
- Dementia rates do seem to vary with geographical location
- Should resources be redirected to areas with increased need?
- If environmental factor(s) are responsible, what are they?
- Can we optimise them in everyone and halve dementia rates?
Acknowledgements

Margaret Gatz, Nancy L. Pedersen, Jean Hannah, Grant Wyper, G. David Batty, Ian J. Deary & John M. Starr

TR was supported by Alzheimer Scotland and the Scottish Dementia Clinical Research Network during the course of this work. He is now employed by the University of Edinburgh and NHS Lothian. He is a member of both the Alzheimer Scotland Dementia Research Centre funded by Alzheimer Scotland and the University of Edinburgh Centre for Cognitive Ageing and Cognitive Epidemiology, part of the cross council Lifelong Health and Wellbeing Initiative (G0700704/84698). Funding from the BBSRC, EPSRC, ESRC and MRC is gratefully acknowledged.

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