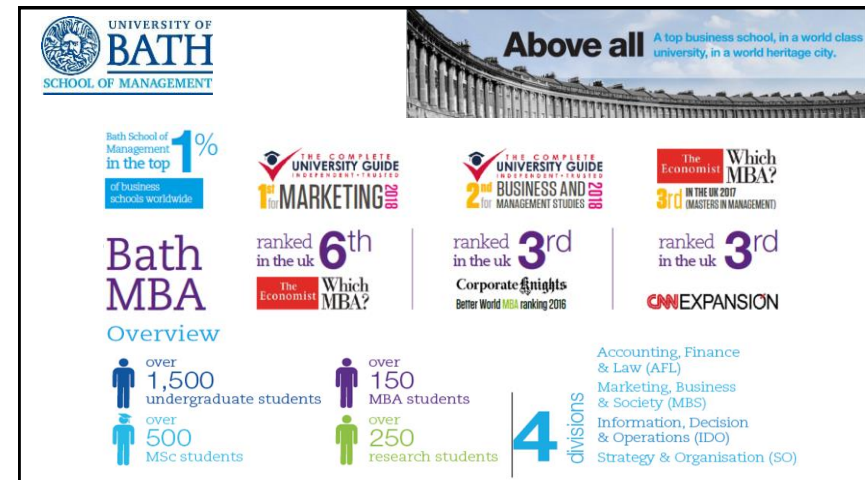


Advanced analytics & operational research in support of decision making in healthcare

Prof Christos Vasilakis, PhD
@ProfChristosV



1



2



3

Above all A top business school, in a world class university, in a world heritage city.

Research themes

Business

- Entrepreneurship and Innovation
- Governance and Risk
- Strategic Change and Leadership

Society

- The Future of Work
- Sustainability and Responsibility
- Healthcare
- Higher Education Management

4

Our vision: to improve the design, delivery and organisation of health and care services through high quality interdisciplinary research



“The task of scientifically re-engineering health care...
is rocket science.”

Prof Donald Berwick
Institute for Healthcare Improvement



5

Our vision: to improve the design, delivery and organisation of health and care services through high quality interdisciplinary research



6

Work programmes



1. Events & engagement
2. Education & training
3. Research & consultancy

7

Engagement



8

Education & training

chi²
Bath Centre for Healthcare Innovation + Improvement

UNIVERSITY OF BATH
West of England Academic Health Science Network



Massive Open Online Course (MOOC)
Quality Improvement in Healthcare:
The Case for Change

6-week runs start every ~Feb, May and Sep each year
<https://www.futurelearn.com/courses/quality-improvement/>

Last run started 25th Feb

>18,000 active learners so far

9

MSc Business Analytics student projects

chi²
Bath Centre for Healthcare Innovation + Improvement

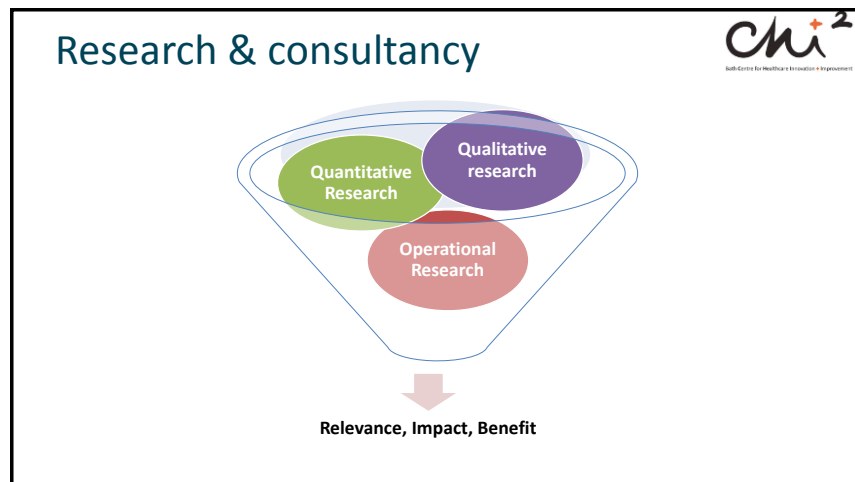


Time Series Forecasting of Clinical Activities to Support National Planning
NHS Improvement, chi², Bath

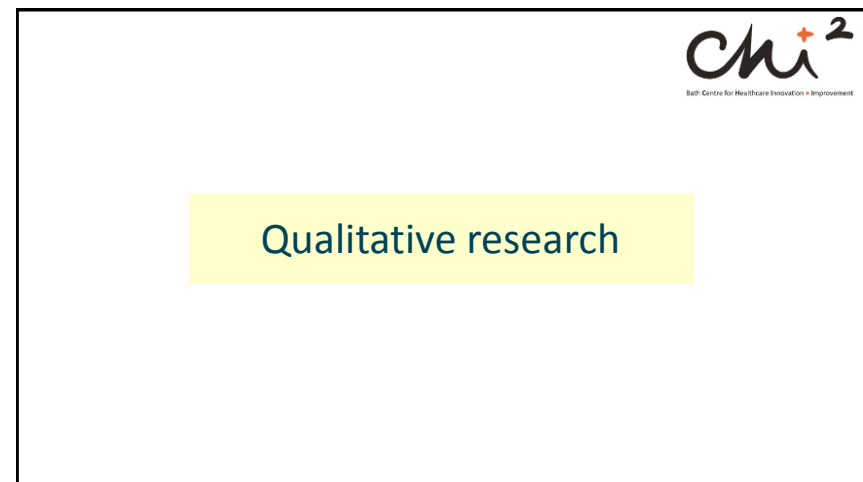
Supporting capacity planning in community care through novel computer simulation models developed in R
Bath

Contributions

10



11



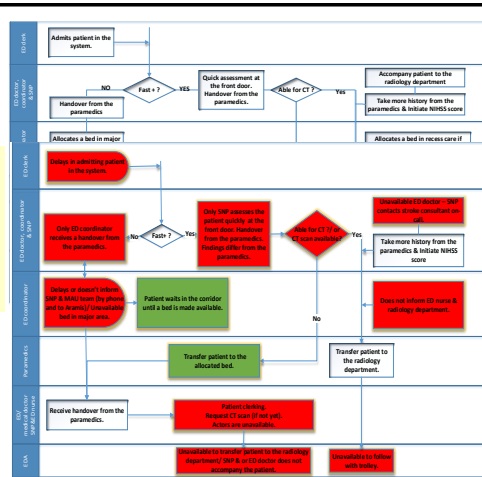
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Frangeskou, Lewis and Vasilakis:
**“Exploring the adoption of
 standardised processes in
 professional service operations:
 implementing the acute stroke care
 pathway in a hospital”**



Won the Chris Voss Best Paper Award

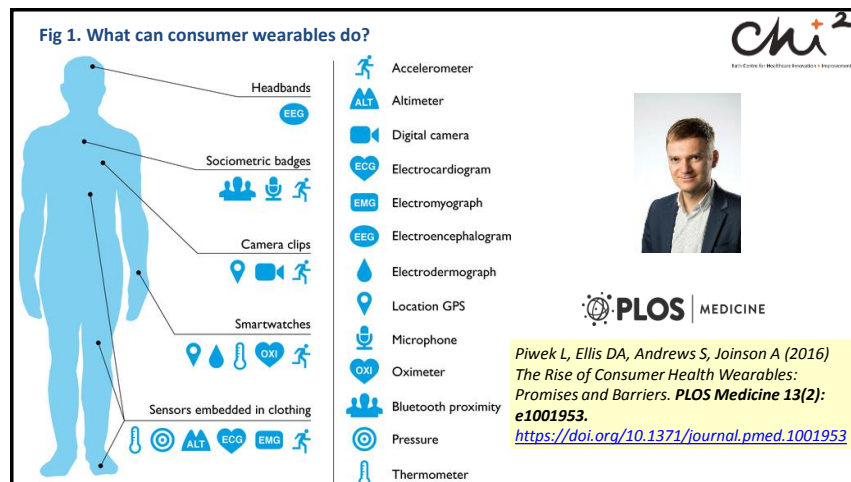


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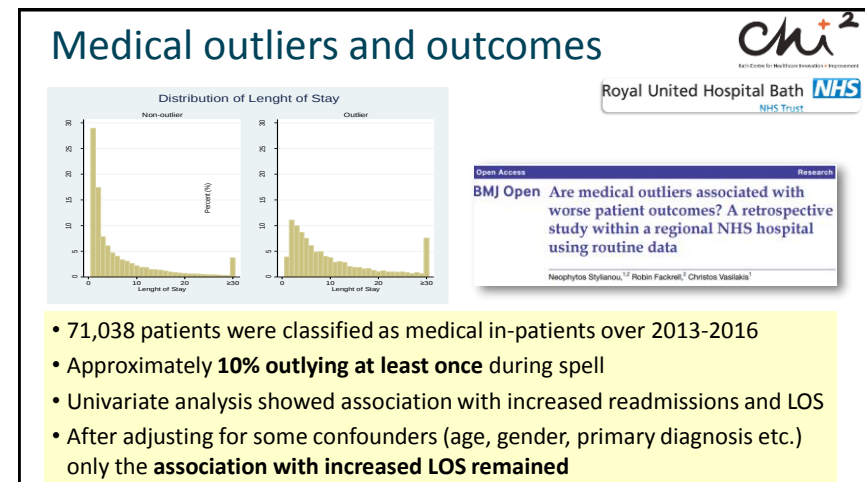


Quantitative research

14



15



16

Operational research (O.R.)



18



Gaining recognition

*p. 34 "Working with NIHR and the Department of Health we will expand **NHS operational research** ... and other methods to promote more rigorous ways of answering high impact questions in health services redesign."*

19

10



Supporting decisions around the provision and allocation of *regional maternity services* with O.R.

Joint work with Gunes Erdogan and Neo Stylianou

**Paper under review*

22

Background



- Maternity care: prenatal, birthing and antenatal services
- NHS Trust in England acquired a number of maternity service locations in 2014
- Result is a “unique model” of maternity service provision
 - 1 large hospital facility offering the full range of care services
 - 5 community facilities scattered around the region offering a different range of services
- Healthcare planners are seeking a “more integrated approach”

23

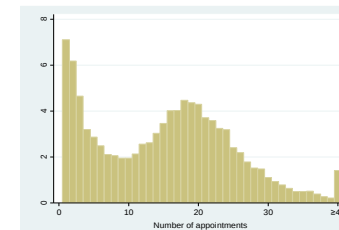
Maternity delivery data

- Two years worth of patient activity data (Apr 2015 – Mar 2017)
- About 20% were C-sections (elective and emergency)
- Significant difference between risk and delivery method (as well as location of delivery)

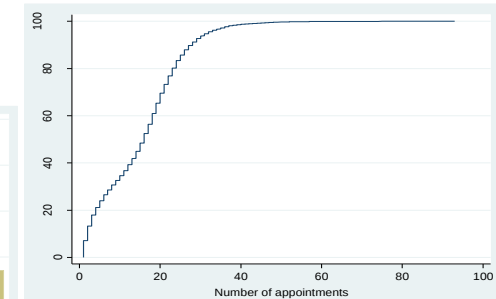
Location	High Risk	Low Risk	Total
H ₀	1,258 (20%)	4,817 (80%)	6,301
C ₁	34 (9%)	354 (91%)	388
C ₂	42 (11%)	350 (89%)	392
C ₃	12 (6%)	184 (94%)	196
C ₄	30 (7%)	378 (93%)	408
Home Birth	31 (14%)	195 (86%)	226
Other	8 (31%)	18 (69%)	26
Total	1,415 (18%)	6,296 (82%)	7,711

24

Location	Frequency	Percent (%)
H ₀	64,595	30.28
C ₁	52,686	24.70
C ₂	22,561	10.58
C ₃	20,326	9.53
C ₄	46,357	21.73
C ₅	6,764	3.17
Other	53	0.02
Total	213,342	100



Maternity outpatient data



25

We were asked to “**evaluate the model of service provision currently in use and to support, through quantitative and geographic analysis, decisions around the strategic reconfiguration of the service**”

26

FLP Spreadsheet Solver

- Solves facility location problems using a range of algorithms
- Open source, proof-of-concept, designed for simplicity
- Bing Maps for mapping data (license is optional)
- Developed by Dr Gunes Erdogan, download from:
<http://people.bath.ac.uk/ge277/index.php/flp-spreadsheet-solver/>

27

Modelling assumptions

**** Warning ****
Assumptions

- **Uncapacitated problem** (we only considered demand for services)
- **Middle layer Super Output Area (MSOA)** for location of demand
- **Population-weighted centroids** for each MSOA location
- **Index of Multiple Deprivation (IMD)** for each MSOA location

Weighted demand = crude historical demand * IMD

Distance = driving duration of fastest path from MSOA centroid to facility

Cost = distance * weighted demand

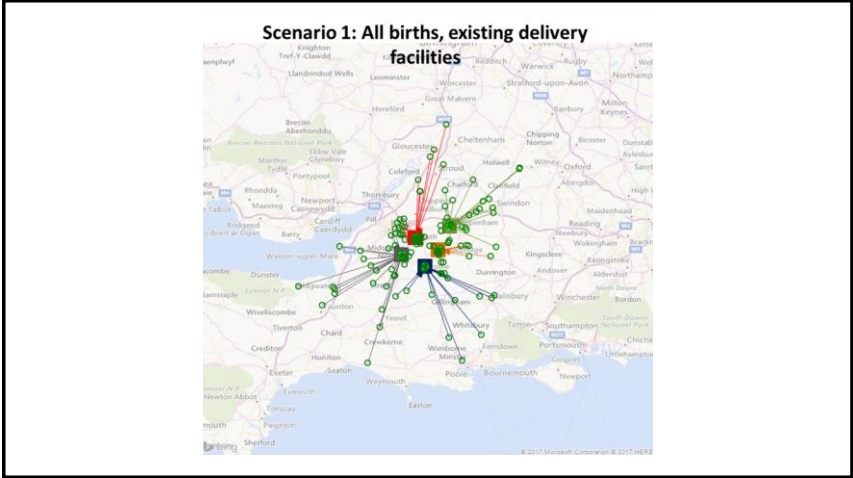
Objective function: minimise total Cost

28

Scenarios for experimentation

Scenario #	Demand type	Low/high risk	Facilities (hospital + community)	Location of community facilities
1	Deliveries	All	As is (1+4)	Existing
2		Low	As is (1+4)	Existing
3		Low	1+3	Existing
4		Low	1+2	Existing
5		Low	1+1	Existing
6		Low	1+3	Anywhere
7		Low	1+2	Anywhere
8		Low	1+1	Anywhere
9		Low	1+1	City limits
10	Outpatients	N/A	As is (1+5)	Existing
11		N/A	1+3	Existing
12		N/A	1+2	Existing
13		N/A	1+1	Existing

29

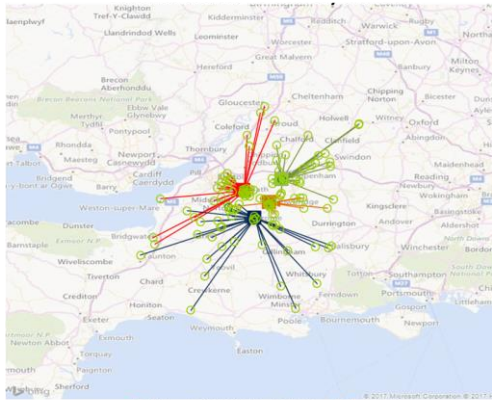


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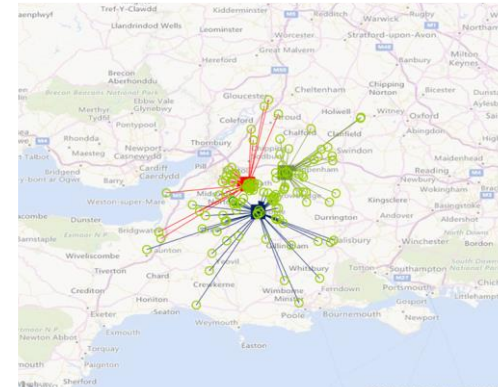
31

Scenario 3: Hospital + 3 community facilities (instead of 4)



32

Scenario 4: Hospital + 2 community facilities (instead of 4)



33

Transforming Maternity Services Together 

About us The need to change Our proposal What this means for you Have your say News Documents



BANES, Swindon and Wiltshire Maternity System

We are proud of the services we provide to the mothers and families of Bath and North East Somerset, Swindon and Wiltshire but we are facing a number of challenges and we think there is more we can do to offer the best care in the best environment.

By using what we have available to us differently, we can make sure our maternity services meet the needs of women and their families now and in the future, and provide staff with a great place to work.

[Find out more](#)

 About us

 The need for change

 Our proposal

 What this means for you

We've listened to our staff and communities, and put together a proposal for the best way to provide our maternity services in the future, which will allow us to offer more women more choice, improve antenatal and post-natal care and strengthen our home birth service.

 Have your say

<http://www.transformingmaternity.org.uk/>

34




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 Chair and Subject Group Lead in Management Science

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35