CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

ORAHS 2011

Cardiff University, 24th - 29th July 2011

OR Informing National Health Policy

ORAHS 2011 - Cardiff

Conference Handbook

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Dear participant,

Welcome to Cardiff, Croeso I Gaerdydd!

It is with great pleasure that we welcome you to ORAHS 2011, the 37th Meeting of the European Working Group on Operational Research Applied to Health Services. This is the first time that the ORAHS Working Group gathers in Wales and we very much hope that you will have an enjoyable time in our capital city, both on a scientific and social level.

The theme of the conference is "OR informing national health policy" and has been chosen to reflect that as a community we could do better in influencing and informing national debate and policy, rather than a tendency (although as still necessary and valuable as it is) to work at a local level of decision making.

Regular participants of ORAHS meetings will find a familiar format in which the sessions include plenty of time not only for the presentations themselves, but also for the discussions at the end of each presentation. Furthermore, we have retained the field trip to a local healthcare facility to provide delegates with an opportunity to appreciate local health services and to facilitate a discussion with medical personnel and health planners.

New for ORAHS this year, we have introduced poster presentations for early career researchers (defined as within 10 years of starting within OR). We are encouraged by the number of posters being presented and wish to take this opportunity to thank LANCS (www.lancs-initiative.ac.uk) for sponsoring the best poster prize.

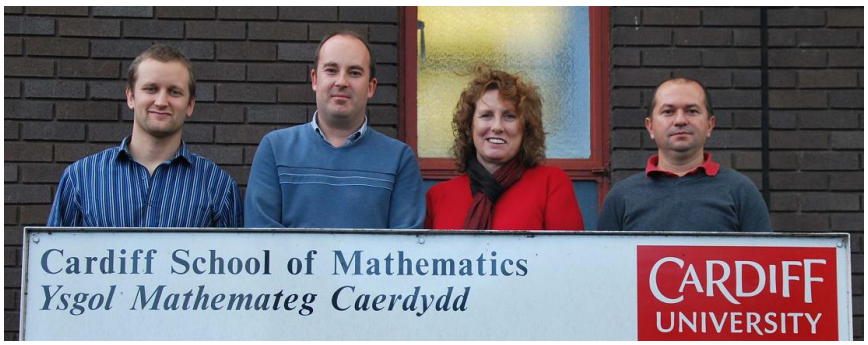
We very much hope you enjoy the social programme that we have planned, which includes a reception in the impressive Welsh Assembly Government building (Senedd) overlooking Cardiff Bay, a guided tour of Cardiff Castle and the Millennium Stadium, as well as a trip to the Brecon Beacons National Park. The conference banquet will take place in the impressive surroundings of the National Museum of Wales.

We wish you a warm welcome and trust that you have a most enjoyable week.

Paul Harper, Janet Williams, Vince Knight and Israel Vieira

Organising Committee

- Paul Harper (Chair)
- Janet Williams
- Vince Knight
- Israel Vieira



The ORAHS 2011 team! From left to right: Vince, Paul, Janet and Israel

International Programme Committee

- John Blake (Canada)
- Sally Brailsford (UK)
- Michael Carter (Canada)
- Vanda de Angelis (Italy)
- Erik Demeulemeester (Belgium)
- Erwin Hans (The Netherlands)
- Marten Lagergren (Sweden)
- Marion Rauner (Austria)
- Angela Testi (Italy)
- Martin Utley (UK)
- Jan Vissers (The Netherlands)
- Xiaolan Xie (France)

We would like to thank the following sponsors for their kind and generous support of ORAHS 2011:

www.cardiff.ac.uk

www.lancs-initiative.ac.uk

www.hmc2.org

www.wimcs.ac.uk

www.wales.nhs.uk

www.euro-online.org

Conference Venue for the Scientific Programme

With the exception of the opening session and keynote talks (Monday morning and Thursday 11.30 – 12.30) all scientific parallel sessions will take place in the Glamorgan Building, Cardiff University, on King Edward VII Avenue, Cardiff, CF10 3WT (Map Reference on page 9: F2). The Monday morning opening session and Thursday keynote will take place in the Bute Building (Birt Acres Lecture Theatre), which is next to the Glamorgan Building. Please note that Monday morning registration and refreshments will be in the Glamorgan Building, and delegates can then move next door to the Bute Building for the opening session.

All rooms for talks within the Glamorgan Building will be well signposted, with up to three rooms are being used for parallel sessions: -1.63 and -1.64 (lower ground floor), and the Council Chamber (ground floor and opposite the committee rooms). See page 10 for the Glamorgan Building room map.

Delegates also have access to a break-out room for discussions or to prepare for their presentation (it contains a PC and audio-visual equipment) which is room -1.56.

Registration

Delegates can register either at the Sunday Welcome Party (17:00 – 19:00) in the Graduate Centre (Map Reference: G1), or between 09:00 – 10:00 on Monday morning in the Glamorgan Building Committee Rooms. The registration desk in the Glamorgan Committee Rooms will always be staffed during the scientific schedule should you require any assistance or are registering late.

Lunches and Refreshment Breaks

Lunches on Monday, Tuesday, Thursday and Friday will be served in Aberdare Hall (Map Reference: E0), which is a short stroll (5 minutes) from the Glamorgan Building.

All refreshment breaks (tea/coffee) will be in the Glamorgan Committee Rooms. Furthermore, there is a shop and cafe area within the Glamorgan Building should delegates wish to purchase refreshments at other times. The shop is open daily between 08:30 and 15:00 and located on the ground floor (rooms 0.54 & 0.55), and contains a pleasant seating area should delegates also wish to use this space.

Internet Access

Free Wi-Fi is available to all delegates. You will need to collect a username and password from the Registration Desk. Wi-Fi will be available throughout the Glamorgan building and in addition delegates may use the computer lab (room 0.88) which is close to the Committee Rooms.

Poster Display and Prizes.

Delegates exhibiting posters should bring them to the registration desk on Monday morning between 09:00 – 10:00. Posters will be on display in the Glamorgan committee Rooms from

Monday morning to Thursday afternoon. On Monday between 14:30 – 15:30 there is a dedicated poster session in the programme where delegates will have an opportunity to speak to the poster presenters who will be standing by their poster.

A poster prize committee will award a first and second prize (£500 and £200 respectively), sponsored by the LANCS Initiative (www.lancs-initiative.ac.uk). Their decision will be announced at the conference banquet on the Thursday evening and the prizes awarded by Prof. Jeff Griffiths (Healthcare Cluster Leader, LANCS).

Accompanying Person's Programme

Accompanying people will join the scientific delegates for the social programme (pages 7 and 8), and in addition have a guided tour of Cardiff city centre on Monday, a visit to St. Fagans National History Museum (a wonderful open air museum) on Tuesday morning, and a day trip along the coast to the Mumbles on Thursday. The Monday tour will commence from the Glamorgan Building at 10.00. Please meet in the Committee Rooms (where registration is taking place).

Getting around Cardiff

Cardiff is a very compact city and can easily be explored on foot, with the majority of the attractions, shops, restaurants, hotels and parklands all within a few minutes of each other. Cardiff Bay is 1km from the city centre. To travel between the city and the bay, you can walk using the footpath the entire length of Lloyd George Avenue, take a regular train service from Queen Street station to Cardiff Bay station, a short taxi-ride, or take a Bendy Bus which runs every 10 minutes at peak times.

Cardiff Bus run an extensive system throughout Cardiff and the area. A single ticket to anywhere in the city is £1.50 adult, and £1 child. A return ticket which allows a day's unlimited travel costs £3.00 adult and £2 child. Tickets are bought from the driver. You must have the exact monies as the drivers cannot give change. Most routes follow an anti-clockwise route around the city-centre and most routes stop in the area behind St David's Shopping Centre.

Black and white cabs are widely available around the city centre, with major taxi ranks located at Cardiff Central Station, Wood Street, St Mary Street and Greyfriars Road. (Dragon Taxis: 029 20 333 333; Capital Cabs: 029 20 777 777)

Emergency

In the UK dial 999 (from both internal University phones and external phones)
You can also contact the local organising committee on:

- Paul Harper +44 (0)785 2434 021
- Janet Williams +44 (0)797 1535 577
- Vince Knight +44 (0)787 8174 632
- Israel Vieira +44 (0)780 9899 969

Social Programme

We really hope that you enjoy the rather full social programme (as is ORAHS tradition!), which we have designed to showcase Welsh culture and traditions, and provide delegates with an opportunity to see Cardiff and the surrounding area.

Sunday 24th of July (17:00-19:00): Welcome Party
Venue: Graduate Centre
Map Reference: G1 (please access the Graduate Centre via Park Place)

We will be welcoming all the delegates to this year's conference with a light buffet and drinks reception at Cardiff University's Graduate Centre.

Monday 25th of July (17:30-20:00): Boat trip and Reception at the Senedd (National Assembly for Welsh Government)
Map Reference: E5 (meet by the river for the boat trip)
Please be at the boat at 17:30 for a 17:40 departure.

After the first day of the conference we will enjoy a boat trip on the river Taff to Cardiff Bay where there is a lovely waterfront, a large selection of restaurants and bars, the Wales Millennium Centre, and the Senedd (the National Assembly for Welsh Government).

On arrival at Cardiff Bay, a drinks and canapé reception will be held at the Senedd for all the delegates to enjoy with the accompaniment of a harpist.

We are extremely grateful to the Right Honourable Lord Dafydd Elis-Thomas PC, AM (Assembly Member, Member of the House of Lords, former leader of Plaid Cymru, and privy counsellor) for formally sponsoring the event to allow us privileged access to the Senedd for the ORAHS reception. Lord Elis-Thomas will address the conference delegates during the evening.

Tuesday 26th of July (18:00-22:00): Hog Roast at the Mountain Centre
(Note this will follow on immediately from the field trip to Prince Charles Hospital - page 11)

We will be visiting the Brecon Beacons National Park.

In the evening at the mountainside we will enjoy a traditional Hog Roast.

Wednesday 27th of July (14:00-22:00): Castle Tour, Millennium Stadium and Dinner
Map Reference: F5 (meeting outside the Castle entrance)

On Wednesday afternoon we will be visiting Cardiff Castle. The Castle is one of Wales' leading heritage attractions and a site of international significance. Over the past 2000 years, the Castle has been a Roman Garrison, a Norman stronghold and in Victorian times was transformed into a gothic fairytale fantasy.

After the visit to a stronghold of the past, we will visit the current stronghold of Wales (!): The Millennium Stadium. This stadium was built in time for the 1999 rugby world cup that was hosted by Wales and is one of the most impressive stadiums in the world.

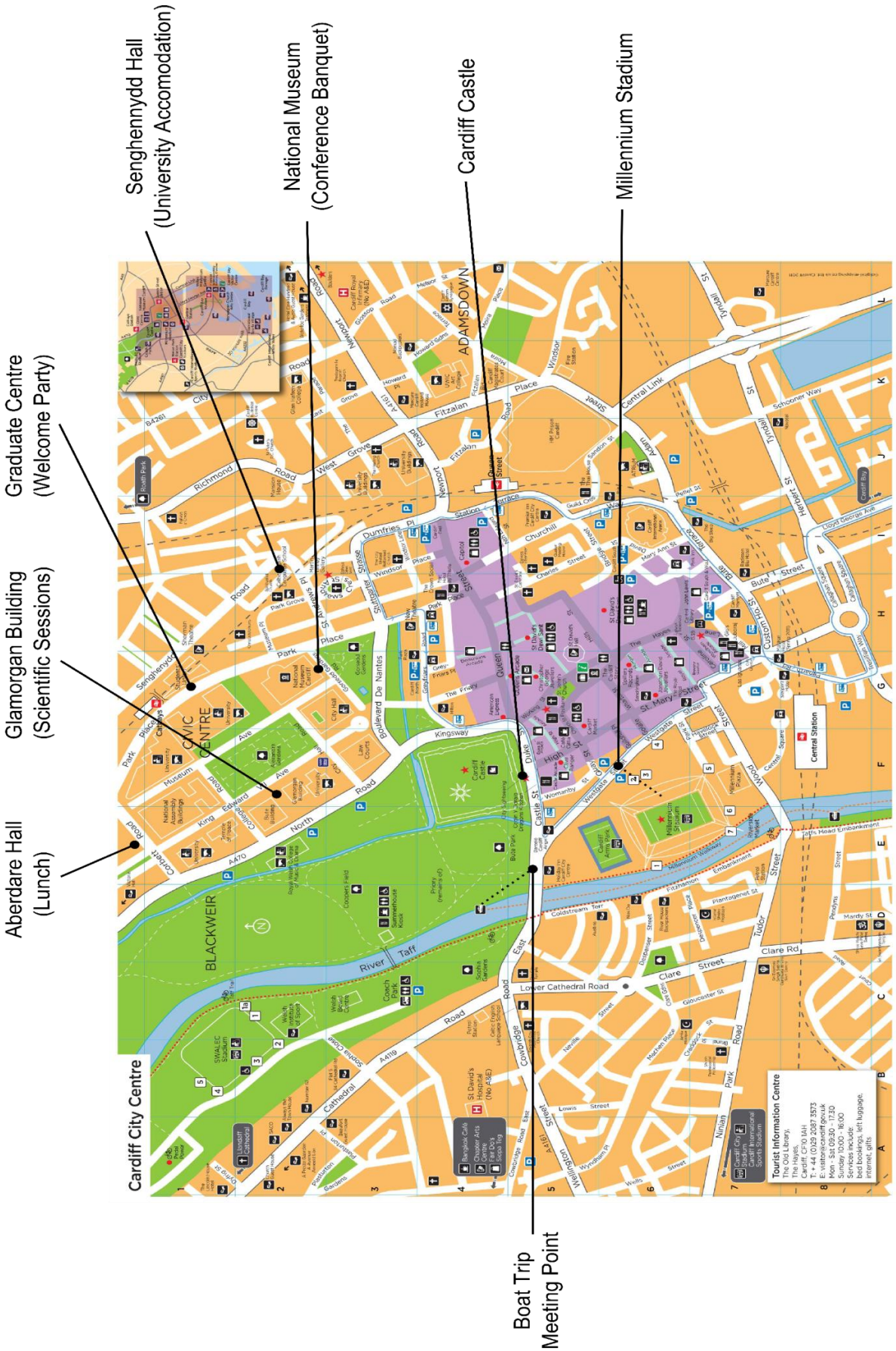
Later in the evening we will then be going to a local restaurant to sample some Welsh fayre.

Thursday 28th of July (18:45 -): Conference Banquet
Map Reference: G2

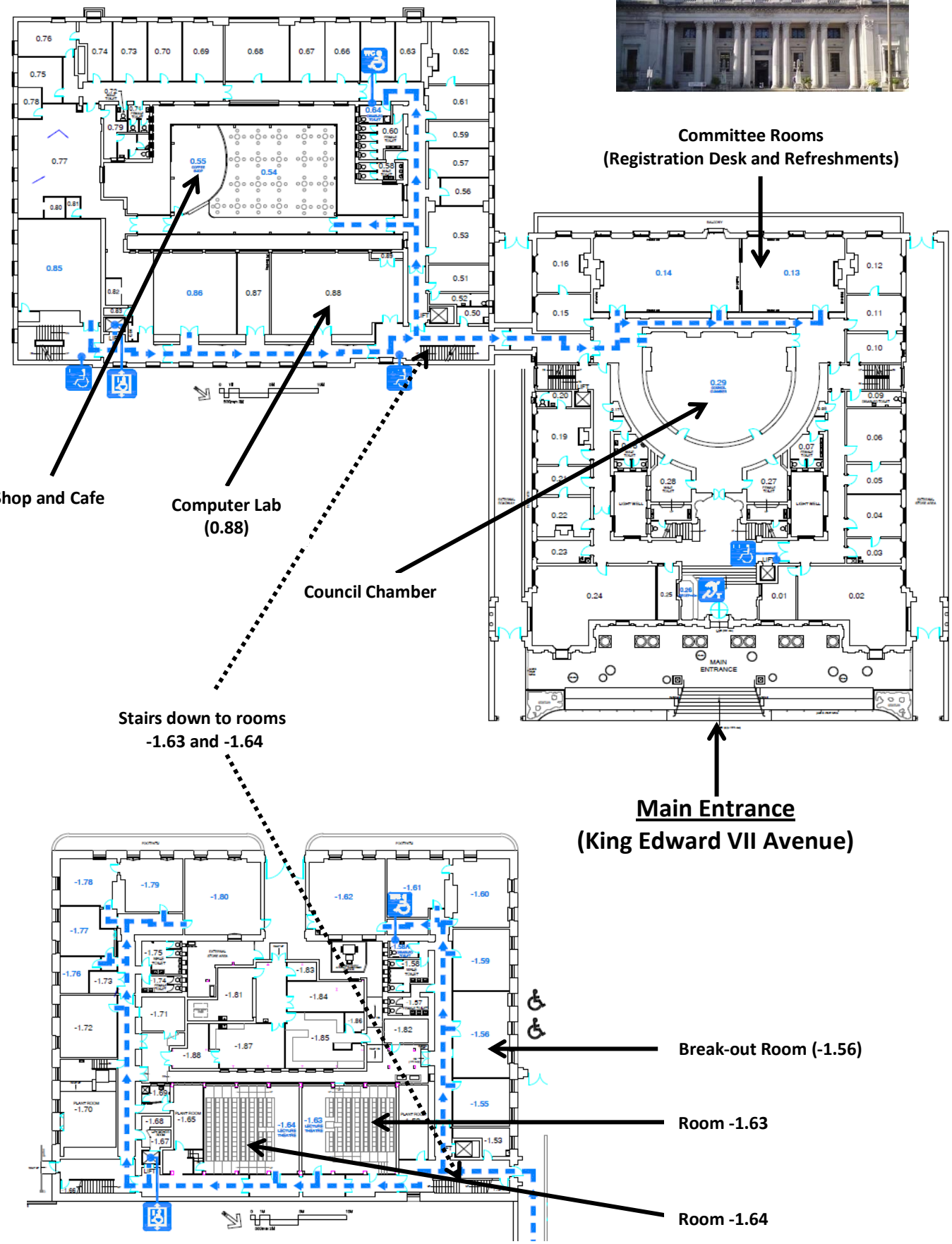
The conference banquet will be held in the Welsh National Museum. We will be joined by another source of Welsh pride: a male voice choir.

We are grateful to the Health Modelling Centre Cymru (www.hmc2.org) for providing sponsorship towards the banquet.

Map of Cardiff City Centre



Map of Conference Rooms (Glamorgan Building)



Field Trip

Tuesday 26th of July (14:30-17:30): Prince Charles Hospital and Health Park, Merthyr Tydfil

Meeting Point: At the front of the Glamorgan Building (Kind Edward VII Avenue)
Map Reference: F2

We will visit, to meet with managerial and medical staff from the Cwm Taf Health Board involved with the planning of a 'Health Park'. £36m is being invested by the Welsh Government to build a state-of-the-art health park designed to improve the lives of people living in the region. It will bring together GP and primary care services, mental health and social care in a three-storey building. It is hoped that the health park, which will transform health services and replace outdated facilities in the borough, will be open by 2013. We will hear several talks about the nature of the services it will provide, the population that it will serve and the associated challenges with delivering an efficient and effective services in the current climate when the health service is facing increased demand but under financial constraints. Although still under construction, we will be able to also visit the site of the park on the outskirts of Merthyr.

This visit will be immediately followed by the social trip to the nearby Brecon Beacons National Park; hence if you wish to join us for the evening social you must be on the coach for the field trip departing at 14:30! Accompanying people will also be on these coaches departing at 14:30 but will have the opportunity for some 'retail therapy' (there is a shopping centre nearby) whilst the scientific delegates visit the hospital.

Artist's impression of the Health Park

Prince Charles Hospital, Merthyr Tydfil

Keynote Speakers

In-keeping with this year's ORAHS theme, "OR Informing National Health Policy" we are delighted to announce that Lesley Griffiths, the Health Minister for Health and Social Services in Wales (Welsh Assembly Government), has accepted our invitation to open the conference.

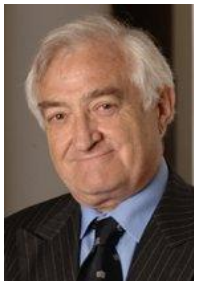
Lesley Griffiths AM

We have great pleasure in announcing that three keynote talks will be delivered by eminent Professors, covering between them expertise in Public Health, Healthcare Systems, and Health Services Research and Informatics. The speakers have been chosen as to challenge our modelling community and facilitate discussions within the conference theme. Abstracts are provided on page 24-25.

Professor Sir Mansel Aylward

Chair of Public Health Wales

Director of the Centre for Psychosocial and Disability Research, Cardiff University



Scheduled for:
Monday 25th July 10.30am

Title of talk:
NHS Wales: Signal successes and challenges for the future.

Professor Sir Mansel Aylward CB MD FFPM FFOM FRCP is Director of the Centre for Psychosocial and Disability Research at Cardiff University, Wales. The Centre is the first of its kind to offer a unique opportunity to extend knowledge and understanding of the psychosocial influence on health, illness and disease, recovery and rehabilitation.

Professor Sir Mansel Aylward is also the first ever Chair of Public Health Wales, a new unified NHS Trust responsible for the delivery of public health services at national, local and community level in Wales. He has undertaken a review of Health Commission Wales' functions, including its decision making processes and appeals mechanism and also gave advice on healthcare provision in Merthyr Tydfil and surrounding areas.

From 1996 to April 2005 Professor Sir Mansel Aylward was Chief Medical Adviser, Medical Director and Chief Scientist to the United Kingdom's Department for Work and Pensions (DWP). He was also Chief Medical Adviser and Head of Profession at the Veteran's Agency, Ministry of Defence.

Mansel was awarded a knighthood in the New Years Honours list 2010 and made a Companion of the Bath in the Queen's Birthday Honours List 2002. In 2001 he was appointed as The Royal Society of Medicine's Academic Sub Dean for Wales.

Professor Terry Young

Chair of Healthcare Systems,
Brunel University

Scheduled for:
Monday 25th July 11.15am

Title of talk:
Healthcare: progress with the puzzle of where OR fits in.

Terry Young joined Brunel as Professor of Healthcare Systems after a career in industry, which started in broadband research and led in the end to healthcare strategy. His initial research, after a PhD in laser spectroscopy, lay in modelling photonic devices and optical circuits. Later, with project and line management, his experience broadened to include business development and corporate technology strategy, mainly in healthcare.

In 2001 he joined Brunel University and he has focused on healthcare since then, winning more than £13M in Research Council grants. The largest of these, MATCH, involves three other universities and looks at the value of technology to care delivery. Another recent project, RIGHT, involved four other universities and explored the use of simulation and modelling in service provision. His recent publications address healthcare delivery at the systems and the technology levels, including commercial and investment decisions, uptake and adoption.

David Ford

University Director, Health Informatics Research Laboratories, Swansea University.

Joint lead of the Health Information Research Unit for Wales (HIRU)

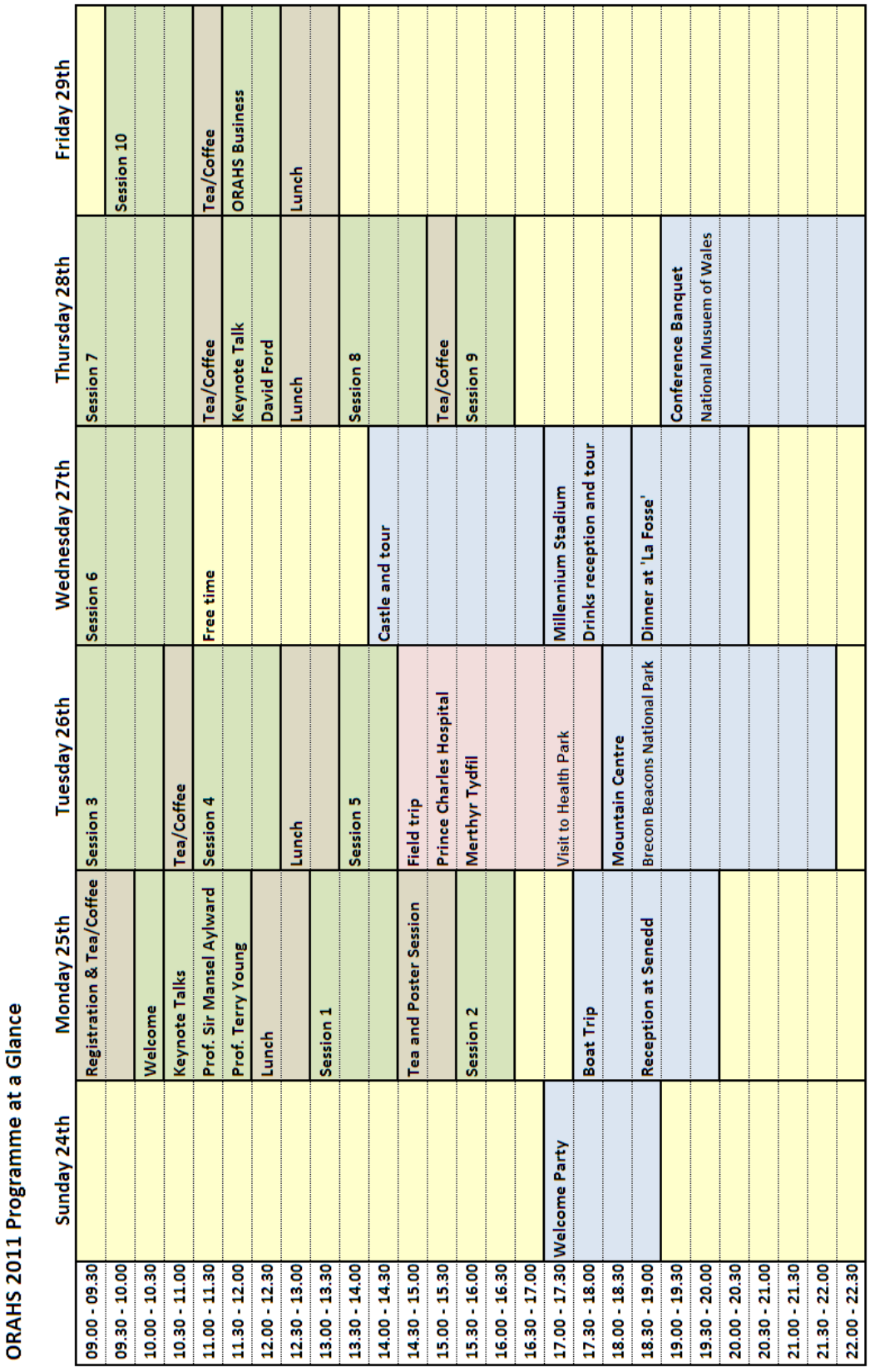
Scheduled for:
Thursday 28th July 11.30am

Title of talk:
Beyond 'Secondary Uses' of health data: secure data linkage platform development – the SAIL databank.

David Ford is the University Director of Health Informatics Research Laboratories at Swansea University. The Research Labs have been created through a collaboration between Centre for Health Information, Research and Evaluation (CHIRAL), School of Medicine, Swansea University and Informing Healthcare, the national programme for NHS IT for Wales and provide a state-of-the-art facility to design, prototype, test and evaluate innovative new information technologies for use in improving health and healthcare.

David is also joint lead of the Health Information Research Unit for Wales (HIRU), a newly established research centre which develops new ways of harnessing the potential of routinely collected information collected in health and other settings. In partnership with many organisations across Wales, HIRU is assembling a large scale, anonymous but linked, population-based data warehouse which uses the School of Medicine's Blue-C supercomputer as the principal computing infrastructure to support analysis and data modelling.

Programme at a Glance



SCIENTIFIC SCHEDULE

MONDAY JULY 25

09:00 - 10:00 **REGISTRATION (GLAMORGAN COMMITTEE ROOMS)**

10:00 - 10:30 **WELCOME**

W Opening Session

Room: *Bute (Birt Acres)*

10:00 - 10:10	***Paul Harper, Vince Knight, Israel Vieira, Janet Williams***	ORAHS 2011 Organising Committee
10:10 - 10:20	***Lesley Griffiths AM***	Health and Social Care Minister, Welsh Government
10:20 - 10:30	***Sally Brailsford***	Chair, ORAHS

10:30 - 12:00 **PLENARY 1**

K Keynote

Room: *Bute (Birt Acres)* ***Chair:*** *Paul Harper*

10:30 - 11:15	***Professor Sir Mansel Aylward***	NHS Wales: Signal successes and challenges for the future
11:15 - 12:00	***Professor Terry Young***	Healthcare: progress with the puzzle of where OR fits in

12:00 - 13:00 **LUNCH**

13:00 - 14:30 **SESSION 1**

1A Methodology

Room: *Glamorgan Council Chamber* ***Chair:*** *Jeff Griffiths*

13:00 - 13:30	***Mike Pidd, Dave Worthington****	Does healthcare modelling have an impact? Could healthcare modelling have an impact? A search for evidence.
13:30 - 14:00	***Mahdi Mahdavi, Tomi Malmstrom, Joris Van de Klundert, Jan Vissers****	Operational modeling of primary health service operations. A literature review.
14:00 - 14:30	***Jennifer Morgan*, Valerie Belton, Susan Howick***	Mixed Modelling of a Radiotherapy Centre: The Complementary Application and Integration of System Dynamics and Discrete Event Simulation

1B Operating Room Planning and Scheduling

Room: *Glamorgan -1.63* ***Chair:*** *Erik Demeulemeester*

13:00 - 13:30	***Angela Testi*, Elena Tanfani, Paolo Landa***	A Chance-Constrained Stochastic Model for Operating Room Assignment
13:30 - 14:00	***JM van Oostrum*, L Evers, APM Wagelmans***	More levelled bed occupancy and controlled waiting lists using Master surgical schedules
14:00 - 14:30	***Guoxuan Ma*, Erik Demeulemeester***	Hospital case mix and capacity planning: A model-based integrative approach

1C Patient Flow Management

Room: *Glamorgan -1.64* ***Chair:*** *John Blake*

13:00 - 13:30	***Kiok Liang Teow*, Joe Sim, Eugene Fidelis Soh, Joanne Yap, Palvannan R.K., Zhecheng Zhu, Sally Brailsford***	An integrated hospital dynamics simulation model
13:30 - 14:00	***Michael Carter, Deborah Marshall, Sonia Vanderby*, Paul Rogers, Tom Noseworthy, Robert Lee,***	A decision support tool for hip and knee osteoarthritis health service delivery

14:00 - 14:30	***Navonil Mustafee*, Fiona Hughes, Korina Katsaliaki, M. D. Williams***	Mapping the Capacity and Demand for Specialist Haematology Outpatient Services

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14:30 - 15:30 TEA AND POSTER SESSION

P **Posters**

Room: *Glamorgan Committee Rooms*

14:30 - 15:30	***Julie Williams*, Paul Harper, Jonathan Gillard, Vincent Knight***	Time-dependent stochastic modelling for predicting demand and scheduling of Emergency Medical Services in Wales
14:30 - 15:30	***M. M Kembe****	A two- stage probability model for HIV/AIDS infection in the presence of antiretroviral therapy
14:30 - 15:30	***Alan Kimber, Chris Maggs, Honora Smith*, Retha Steenkamp, Charlie Tomson***	Towards a decision tool for dialysis patients: a systematic review of prognostic models
14:30 - 15:30	***Muhammad Islam*, Thierry Chaussalet, Nazmiye Ozkan, Eren Demir***	Exploring the Effect of Temperature Variations on unplanned admissions for some selected diseases
14:30 - 15:30	***Christine Currie*, Kathryn Hoad***	Worldwide resource allocation for tuberculosis
14:30 - 15:30	***Leanne Smith*, Paul Harper, Vincent Knight, Israel Vieira, Janet Williams***	Resource Planning and Deployment of Welsh Ambulance Services
14:30 - 15:30	***Valerie Dorval*, Angel Ruiz, Patrick Soriano***	Modeling and forecasting bed utilization for a better hospital capacity management
14:30 - 15:30	***Izabela Komenda*, Jeff Griffiths, Vincent Knight***	Bed Management in a Critical Care Unit
14:30 - 15:30	***Janette McQuillan, Adele Marshall*, Kieran Payne***	Modelling length of stay of elderly patients in hospital in Northern Ireland using the discrete conditional phase-type distribution with a Bayesian network component
14:30 - 15:30	***Maria Guzman Castillo*, Sally Brailsford, Honora Smith***	Understanding the effect of individual and organizational factors on patient length of stay: a hierarchical model approach
14:30 - 15:30	***Helena Hvitfeldt Forsberg*, Daniel Glaser, Hakan Aronsson, Staffan Lindblad***	Simulating logistical changes in a chronic care outpatient department
14:30 - 15:30	***Aleida Braaksma*, Nikky Kortbeek, Post Gerhard, Nollet Frans***	Integral Multidisciplinary Rehabilitation Treatment Planning
14:30 - 15:30	***Mohamed Tadjer*, J, Thierry Chaussalet, Farid Fouladinejad, Salma Chahed***	Towards a Full implementation of Collaborative Care Plan
14:30 - 15:30	***Philip Worrall*, Thierry Chaussalet***	Towards an Optimal Ordering Policy for Nursing Home Placements In Long-Term Care
14:30 - 15:30	***David Puga-Bolio*, Michael Pidd, Jeremy Busby, Andrew Smith***	Organising Patient Safety systems: comments on the implementation of a safety campaign in an acute general hospital in NW England
14:30 - 15:30	***Joe Viana*, Sally Brailsford, Terry Williams, Rachel Dittrich***	Forecasting social care demand in Hampshire
14:30 - 15:30	***Tiago Cravo Oliveira*, James Barlow, Steffen Bayer***	How do medical innovations affect service utilisation and costs?

.

SCIENTIFIC SCHEDULE

15:30 - 16:30 **SESSION 2**

2A Emergency Care Services

Room: *Glamorgan Council Chamber* ***Chair:*** *Mario Oliveira*

15:30 - 16:00	***Marion Rauner*, Helmut Niessner, Ulrike Leopold-Wildburger, Natasa Peric, Teresa Herdlicka***	How do Best Manage Ambulance Services at a Disaster Site? Experimental Analysis of Players Strategies and Success
16:00 - 16:30	***Vincent Knight, Paul Harper****	Modelling Emergency Medical Services with Phase Type Distributions

2B Patient Flow Management

Room: *Glamorgan -1.63* ***Chair:*** *Navonil Mustafee*

15:30 - 16:00	***Renata Konrad*, Tze Chiam, Lori Pelletier, Mark Lawley, Arunachalam Chockalingam***	Investigating Control Policies to Mitigate Hospital Congestion
16:00 - 16:30	***Wim Vancroonenburg*, Frits C. R. Spieksma, Greet Vanden Berghe, Patrick De Causmaecker***	A study of the patient assignment problem with gender constraints

2C Epidemiology and Disease Modelling

Room: *Glamorgan -1.64* ***Chair:*** *Valter de Senna*

15:30 - 16:00	***Lisa Brouwers*, Jessica Dagerborn***	The Swedish mass-vaccination against pandemic influenza was not cost-effective
16:00 - 16:30	***A. R. Rutherford*, B. Ramadanovic, R. W. Wittenberg, K. Vasarhelyi***	Using Mathematical Modelling to Assess Public Health Strategy for HIV/AIDS

SCIENTIFIC SCHEDULE

TUESDAY JULY 26

09:00 - 10:30 **SESSION 3**

3A Methodology

Room: *Glamorgan Council Chamber* ***Chair:*** *Angelico Fetta*

09:00 - 09:30	***Kristian Rotaru*, Leonid Churilov, Andrew Flitman***	Philosophical Positioning of Discrete Event Simulation and System Dynamics as Methodologies for Decision Support in Patent Care Process Modelling
09:30 - 10:00	***Sally Brailsford*, Shivam Desai, Joe Viana***	Towards the holy grail: combining system dynamics and discrete-event simulation in healthcare modelling
10:00 - 10:30	***Israel Vieira****	Hybrid Simulation Models for Healthcare: Putting It all Together

3B Emergency Care Services

Room: *Glamorgan -1.63* ***Chair:*** *Roberto Aringhieri*

09:00 - 09:30	***Thomas Monks*, Martin Pitt***	Understanding acute stroke pathways using simulation
09:30 - 10:00	***Martin Pitt*, Dave Worthington***	A simulation study to determine the impact of extending the treatment window for thrombolytic treatment of stroke
10:00 - 10:30	***Mathias Barra****	A DES prototype for analysing pre-hospital delay factors for stroke patients

3C Operating Room Planning and Scheduling

Room: *Glamorgan -1.64* ***Chair:*** *Angela Testi*

09:00 - 09:30	***Marion Penn*, Chris Potts, Paul Harper***	Hospital Operating Theatre Scheduling – Advanced Booking of Individual Patients
09:30 - 10:00	***Lene Berge Holm****	Multimethodology in surgery optimization: How Soft Systems Methodology and Discrete Event Simulation work together to make surgery more efficient
10:00 - 10:30	***Ines Marques*, M. Eugenia Captivo, Margarida Pato***	Simple heuristics for planning elective surgeries in a Portuguese hospital

10:30 - 11:00 **TEA/COFFEE BREAK**

11:00 - 12:30 **SESSION 4**

4A Emergency Care Services

Room: *Glamorgan Council Chamber* ***Chair:*** *Julie Williams*

11:00 - 11:30	***Giovanni Righini****	Forecasting ambulance missions in Milan
11:30 - 12:00	***Edoardo Amaldi, Giuliana Carello*, Erik Cittadino***	A probabilistic multi-period optimization model for the ambulance location problem
12:00 - 12:30	***Valerie Belanger*, Yannick Kergosien, Angel Ruiz, Patrick Soriano***	Evaluation of redeployment strategies for a fleet of ambulances through simulation

4B Epidemiology and Disease Modelling

Room: *Glamorgan -1.63* ***Chair:*** *Marion Rauner*

11:00 - 11:30	***Lisa Brouwers*, Anders Ekholm, Nils Janlav, Karin Mossler, Pontus Johansson***	Results from the Swedish LEV-project
11:30 - 12:00	***Canan Pehlivan*, Vincent Augusto, Xiaolan Xie***	Modeling of a Large-Scale Perinatal and Neonatal Healthcare Delivery Network

12:00 - 12:30	***Navonil Mustafee*, E Bischoff, Korina Katsaliaki, M. D. Williams***	Use of Agents For Proximity-Based Modelling of Cross-Contamination

4C Location Problems

Room: *Glamorgan -1.64* ***Chair:*** *Honora Smith*

11:00 - 11:30	***Ana Mestre*, Monica Oliveira, Ana Barbosa-Povoa***	Planning hospital networks: a dynamic and multiobjective approach
11:30 - 12:00	***Ingrid Vliegen*, Simme Douwe Flapper, Pieter Wolbers, Rogier van Vliet***	Reusable items in hospitals: how much to stock where?
12:00 - 12:30	***John Blake*, Matthew Hardy***	Using operational research to evaluating network logistics for Canadian Blood Services

12:30 - 13:30 LUNCH

13:30 - 14:30 SESSION 5

5A Performance Measurement and Evaluation

Room: *Glamorgan Council Chamber* ***Chair:*** *Marten Lagergren*

13:30 - 14:00	***Mike Pidd****	Performance measurement in healthcare: some lessons
14:00 - 14:30	***Tom Bowen, Paul Forte****	Modelling integrated care processes: dementia case study

5B Epidemiology and Disease Modelling

Room: *Glamorgan -1.63* ***Chair:*** *Israel Vieira*

13:30 - 14:00	***Martin Utley*, Christina Pagel, Sonya Crowe***	Modelling to support Health Protection Policy
14:00 - 14:30	***Valter de Senna*, Israel Vieira, Paul Harper, Arjan Shahani***	A simple analytical model for the evaluation of screening policies

5C Emergency Care Services

Room: *Glamorgan -1.64* ***Chair:*** *Giovanni Righini*

13:30 - 14:00	***Leonid Churilov*, Audur Fridriksdottir, Ian Mosley, Helen Dewey, Andrew Flitman***	Decision support in pre-hospital stroke care operations: improving eligibility of acute stroke patients for thrombolysis treatment with simulation
14:00 - 14:30	***Mario J. F. Oliveira*, Delana G. Oliveira, Fabio B. Oliveira, Waleska B. Chaves***	Towards an Integrated Emergency Admission System for Major Events

14:30 - 17:30 FIELD TRIP (PRINCE CHARLES HOSPITAL)

SCIENTIFIC SCHEDULE

WEDNESDAY JULY 27

09:00 - 11:00 **SESSION 6**

6A Special Session on Model Implementation

Room: *Glamorgan Council Chamber* ***Chair:*** *Mike Carter*

09:00 - 09:30	***Steven J Burnell****	Policy Strategy and Optimal Implementation
09:30 - 11:00	***Tom Bowen, Sally Brailsford*, Mike Carter, Martin Pitt, Martin Utley***	This house believes that to date, OR academics have failed to make any lasting impact on healthcare practice.

6B Workforce Planning

Room: *Glamorgan -1.63* ***Chair:*** *Bart Veltman*

09:00 - 09:30	***Bernardetta Addis, Roberto Aringhieri*, Marco Gribaudo, Andrea Grosso***	Hybrid algorithms for determining the optimal composition of healthcare teams
09:30 - 10:00	***Julien Crowe*, Patrick Soriano***	Solving various healthcare staff scheduling problems with one heuristic inspired from mathematical decomposition approaches
10:00 - 10:30	***Sebastiao Loureiro, Erika Aragao*, Bethania Almeida, Fabio Mota, Taris Santana***	Competing Technological Trajectories and Health Services Organization Paradigms
10:30 - 11:00	***Egbert Van de Veen, Bart Veltman****	Workforce Formation Planning and Workforce Capacity Management using Annualised Hours

6C Patient Flow Management

Room: *Glamorgan -1.64* ***Chair:*** *Claire Worthington*

09:00 - 09:30	***Rainer Kolisch*, Daniel Gartner***	Hospital-wide flow management of elective patients
09:30 - 10:00	***Anthony Virtue*, Thierry Chaussalet, John Kelly***	A case study using simplified discrete-event simulation models as a tool to reconfigure health care services
10:00 - 10:30	***Lene Berge Holm, Fredrik A. Dahl*, Mathias Barra***	Optimizing hospital bed allocation based on DES model output
10:30 - 11:00	***Claire Worthington*, Stewart Robinson***	Simlean Healthcare: Using Simulation and Lean to Improve Healthcare Systems

11:00 - 11:30 **TEA/COFFEE**

SCIENTIFIC SCHEDULE

THURSDAY JULY 28

09:00 - 11:00 **SESSION 7**

7A Performance Measurement and Evaluation

Room: *Glamorgan Council Chamber* ***Chair:*** *Paul Harper*

09:00 - 09:30	***Vincent Knight*, Paul Harper***	The Price of Anarchy of Healthcare
09:30 - 10:00	***Marek Lubicz****	Measuring and modelling regional and national health issues - an Eastern European perspective
10:00 - 10:30	***M.D. Oliveira*, T.C. Rodrigues, C.A.B.E. Costa, A. Brito de Sa***	Prioritizing Health Care Interventions: A Multicriteria Resource Allocation Model to Inform the Choice of Community Care Programmes
10:30 - 11:00	***Sergio Santos*, Carla Amado, Mauro Santos***	Exploring the use of Data Envelopment Analysis to assess the efficiency of HIV/AIDS prevention around the world

7B Patient Flow Management

Room: *Glamorgan -1.63* ***Chair:*** *Erwin Hans*

09:00 - 09:30	***Ettore Lanzarone*, Andrea Matta***	Stochastic Structural Policies for solving the Nurse Assignment Problem under Continuity of Care in Home Care
09:30 - 10:00	***Marten Lagergren****	What is happening to the special accommodations for elderly persons in Stockholm, Sweden?
10:00 - 10:30	***Adele Marshall*, Mariangela Zenga***	Modelling the elderly patient's length of stay in hospital using the discrete conditional phase-type distribution in Italy
10:30 - 11:00	***Richard Wood*, Jeff Griffiths, Janet Williams***	Modelling Activities at a Neurological Rehabilitation Unit

11:00 - 11:30 **TEA/COFFEE BREAK**

11:30 - 12:30 **PLENARY 2**

K Keynote

Room: *Bute (Birt Acres)* ***Chair:*** *Janet Williams*

11:30 - 12:30	***David V Ford***	Beyond 'Secondary Uses' of health data: secure data linkage platform development - the SAIL databank

12:30 - 13:30 **LUNCH**

13:30 - 15:00 **SESSION 8**

8A Patient Flow Management

Room: *Glamorgan Council Chamber* ***Chair:*** *Jan Vissers*

13:30 - 14:00	***Evin Jacobson*, Steffen Bayer, James Barlow***	Simulation modelling for stroke care delivery in Scotland
14:00 - 14:30	***Peter J.H. Hulshof, Richard J. Boucherie, Erwin W. Hans*, Johann L. Hurink***	Tactical Resource Allocation and Elective Patient Admission Planning in Care Pathways
14:30 - 15:00	***Sylvia Elkhuizen*, Jan Vissers***	Unit utilization versus care-pathway throughput time: finding a balance.

8B Performance Measurement and Evaluation

Room: *Glamorgan -1.63* ***Chair:*** *Monica Oliviera*

13:30 - 14:00	***Steve Gallivan*, Sonya Crowe***	Paediatric cardiac transplantation a suitable case for renewal theory?

14:00 - 14:30	***Onur Ozturk*, Andras Sebo, Marie-Laure Espinouse, Maria Di Mascolo***	An optimal bin-packing algorithm to minimize the number of washing cycles in a hospital sterilization service
14:30 - 15:00	***Teresa Cardoso*, Mónica Oliveira, Ana Barbosa-Póvoa, Stefan Nickel***	Modelling the demand and supply of Long-term Care services under uncertain conditions

8C Appointment Scheduling

Room: *Glamorgan -1.64* ***Chair:*** *Izabela Komenda*

13:30 - 14:00	***Semih Yalcindag*, Andrea Matta, Evren Sahin***	Literature Review on the Human Resource Scheduling and Routing Problem in Home Health Care Context
14:00 - 14:30	***Daniel Chalk****	Can diabetes patients with the lowest risk of diabetic retinopathy be screened every two years, without negatively affecting patient welfare?
14:30 - 15:00	***Ger Koole*, Gerven van Gerven, Sonja Zweegman***	Implementing rapid cancer diagnostics

15:00 - 15:30 TEA/COFFEE BREAK

15:30 - 16:30 SESSION 9

9A Emergency Care Services

Room: *Glamorgan Council Chamber* ***Chair:*** *Leonid Churilov*

15:30 - 16:00	***Penelope M Mullen****	Should misuse of emergency departments be encouraged? And what role could OR play?
16:00 - 16:30	***Mieke Defraeye*, Inneke Van Nieuwenhuyse***	Setting staffing levels in emergency departments whilst controlling excessive waiting times

9B Patient Flow Management

Room: *Glamorgan -1.63* ***Chair:*** *Sally Brailsford*

15:30 - 16:00	***Sarah Dalton*, Thierry Chaussalet***	Towards Modelling Patient Pathways through the Perinatal Network System focusing on high dependency cots in the local neonatal unit
16:00 - 16:30	***Angele Pieters*, Henk Akkermans, Kim Oorschot, Thierry Dessel, van, Charlotte Oorschot, van***	The dynamics of inter-organizational collaboration: On redesigning obstetric care.

9C Operating Room Planning and Scheduling

Room: *Glamorgan -1.64* ***Chair:*** *Leanne Smith*

15:30 - 16:00	***Isabelle Beaulieu*, Angel Ruiz, Patrick Soriano***	Operating Rooms Planning and Scheduling a case study
16:00 - 16:30	***Alessandro Agnetis, Alberto Coppi, Gabriella Dellino, Carlo Meloni, Marco Pranzo****	Long term policies for operating room planning

SCIENTIFIC SCHEDULE

FRIDAY JULY 29

09:30 - 11:00 **SESSION 10**

10A Location Problems

Room: *Glamorgan Council Chamber* ***Chair:*** *Vincent Knight*

09:30 - 10:00	***Carlos Rodriguez-Verjan*, Vincent Augusto, Xiaolan Xie, Valerie Buthion***	A Healthcare-at-home structures location-allocation problem
10:00 - 10:30	***Catherine Crenn Hebert*, Elodie Lebreton, Claudie Menguy, Annie Serfaty***	How a specific Health Information System (HIS) can help Regional Health Authority (RHA) of Parisian region (IDF) in perinatal health decision making?
10:30 - 11:00	***Yannick Kergosien*, Patrick Soriano, Angel Ruiz, Michel Gendreau***	Managing a fleet of ambulances to respond to emergency or standard patient transportation demands

10B Appointment Scheduling

Room: *Glamorgan -1.63* ***Chair:*** *Marion Penn*

09:30 - 10:00	***Tugba Cayirli, Evrim Didem Gunes****	Outpatient Appointment-Scheduling in Presence of Seasonal Walk-ins
10:00 - 10:30	***Gillian Mould*, John Bowers, Mikhail Ghattas***	Improving patient doctor consultation times in an orthopaedic outpatients clinic
10:30 - 11:00	***Na Geng*, Xiaolan Xie, Zhibin Jiang***	Time slots allocation and two-day advance cancellation of MRI examinations for stroke patients

11:00 - 11:30 **TEA/COFFEE BREAK**

11:30 - 12:30 **ORAHS BUSINESS MEETING (GLAMORGAN COUNCIL CHAMBER)**

12:30 - 13:30 **LUNCH**

ABSTRACTS

KEYNOTE

NHS Wales: Signal successes and challenges for the future

PLENARY 1 - K

Professor Sir Mansel Aylward

MON PLENARY 1 | BUTE (BIRT ACRES) | 10:30 - 11:15

Keywords: NHS Wales, challenges for the future

NHS Wales follows a path that increasingly differs from healthcare provision in many European countries. NHS Wales provides healthcare for the people of Wales in a model that is true to the principles of Aneurin Bevan who was the architect of the British National Health Service. Wales will be steadfast in ensuring that NHS Wales will provide:

* Comprehensive treatment within available resources
* Universal access, based on need
* Services delivered free at point of delivery

Further principles implicit in the original intention for the NHS have now been elaborated and underpin its ethos and delivery. Fundamental changes and considerable progress have been realised since the abandonment of the internal market and the inception of major programmes of reforms. They will be described and discussed. However the challenges of economic stringency and those brought by demographic change in the longer term can only be fully and successfully addressed by further significant change. The right structures and motives are in place in Wales to deliver the vision, and now we need to get on with it.

Healthcare: progress with the puzzle of where OR fits in

PLENARY 1 - K

Professor Terry Young

MON PLENARY 1 | BUTE (BIRT ACRES) | 11:15 - 12:00

Keywords: Healthcare, progress, puzzle

While OR has perhaps not made the impact it feels it deserves in many sectors, there are those that clearly make good use of techniques such as modelling, simulation, risk prediction, regression and a highly numerate approach to management. Healthcare, however has not been one of them. Under the RIGHT project and now the Cumberland Initiative, we are trying to understand how these techniques may support better care delivery. The paper will take a personal, and at times, ideosyncratic, approach to understanding this problem, reviewing the progress we have all made with the puzzle. The emerging picture is complex, and indeed the complexity of healthcare appears to be a big part of the challenge. In some ways, healthcare leads ther sectors with its use of statistics and controlled trials, while from other perspectives, it lags significantly. The conclusion, therefore, is that healthcare has both much to teach, and to learn from, ther sectors.

ABSTRACTS

Beyond 'Secondary Uses' of health data: secure data linkage platform development - the SAIL databank

PLENARY 2 - K

David V Ford

THU PLENARY 2 | BUTE (BIRT ACRES) | 11:30 - 12:30

Keywords: SAIL databank, Health data, Secure data linkage

Public and private organisations routinely collect ever increasing amounts of electronic data about us. Most of this data are held in person-identifiable form and is subject to the Data Protection Act and other legislative and good-practice frameworks. These data are also commonly very dispersed, held in completely different systems, using markedly different technologies and structures, and are subject to widely differing management controls. Consequentially, it is rare that these data are combined in order to address important research questions. It is clear however that these complex, challenging data are a remarkable new 21st century resource. Considered by some as a necessary but inconvenient by-product of organisational activity, the prospect of re-using this data for research is an exciting one. However, to realise this potential, great care has to be taken to ensure that personal privacy is maintained, and that analyses take account of the context and purpose of the original data collection. The SAIL Databank is a pioneering resource, combining robust technology and strong procedures with the requisite knowledge and expertise, built to safely and systematically address and exploit the data explosion that is such a feature of recent years. Designed to support Wales' aspiration to be a "small smart country", SAIL is already the cornerstone of many millions of pounds of research activity, and is increasingly supporting the NHS and Welsh Government's information needs. SAIL is now extending its work with health, social care, housing, education and local government, into new areas, and working with an increasing range of research colleagues to across Wales and the UK.

ABSTRACTS

APPOINTMENT SCHEDULING

Literature Review on the Human Resource Scheduling and Routing Problem in Home Health Care Context

SESSION 8 - 8C

Semih Yalcindag*, Andrea Matta, Evren Sahin

THU SESSION 8 | GLAMORGAN -1.64 | 13:30 - 14:00

Keywords: Home Health Care, Survey, Routing, Travelling Salesman Problem, Vehicle Routing Problem

Home Health Care (HHC) service takes place as an alternative to the conventional hospitalization. The goal is delivering medical, paramedical and social services to patients at their homes to help them to improve and to keep their best clinical, psychological and social conditions. Since a large number of resources (i.e. material and human) participate in delivering the HHC service, there are many issues that should be considered explicitly. Among these, the resource scheduling and routing problem (i.e., deciding in which sequence each operator will visit the corresponding patient) is one of the important issues that is encountered while planning HHC resources. In this work, we review studies in the literature that address the scheduling problem as a Traveling Salesman Problem (TSP) or Vehicle Routing Problem (VRP) in the home health care context. We analyze each study according to four main categories. The first one is the classification of each study. In this category we classify each study according to the models used (TSP or VRP) and solution approaches applied. The next category that we define is the modelling characteristics. Here, we group each work according to the time horizon, visiting structure of resources and constraints that are directly related with patients. The third one is based on the network characteristics. The geographical information (number of districts), resource and visit related characteristics are the main parts in this group. The last category of our analysis is the data characteristics. As a result of this review, we show the treated and untreated issues of modelling the resource scheduling problem as TSP or VRP and so we point out the possible future research opportunities on this topic.

Can diabetes patients with the lowest risk of diabetic retinopathy be screened every two years, without negatively affecting patient welfare?

SESSION 8 - 8C

Daniel Chalk*

THU SESSION 8 | GLAMORGAN -1.64 | 14:00 - 14:30

Keywords: Retinopathy, Screening, Simulation, Classification, Policy

Retinopathy is a very serious complication of diabetes, but its development can take place over decades, and annual screening for retinopathy for all patients may therefore be excessive. The question has been raised as to whether those diabetes patients with the lowest risk of developing retinopathy could be screened less frequently, thereby freeing up resources that coulod be better used to screen those at higher risk. I have developed two models to ascertain the effectiveness of the suggested intervention. First, a classification model categorises patients according to their risk of developing retinopathy - rather than their state of progression - using a new three-tier grading system that defines patients as being low risk, medium risk or high risk. The classification of patients risk is dependent on a set of risk factors that have been shown to be related to the development of retinopathy. Second, a simulation model implements the risk-classified population in a scenario in which low risk patients are screened every two years, medium risk patients every year, and high risk patients every six months. This is compared with the current scenario (in which low risk patients are screened annually and high risk patients more frequently) in terms of the burden on screening and treatment resources, screening and treatment costs incurred, the proportion of patients that develop retinopathy-related vision loss, and the proportion of patients who are successfully treated for retinopathy.

ABSTRACTS

Implementing rapid cancer diagnostics

SESSION 8 - 8C

Ger Koole*, Gerven van Gerven, Sonja Zweegman

THU SESSION 8 | GLAMORGAN -1.64 | 14:30 - 15:00

Keywords: Simulation optimization, appointment scheduling

We report on the redesign and implementation of over 20 oncological clinical pathways in the VU university medical center, an academic tertiary care centre in Amsterdam. In most of the paths time until diagnosis was reduced from several weeks to days. We will pay special attention to the relation between the paths, the variability of the demand and the factors that are crucial to a successful implementation.

Outpatient Appointment-Scheduling in Presence of Seasonal Walk-ins

SESSION 10 - 10E

Tugba Cayirli, Evrim Didem Gunes*

FRI SESSION 10 | GLAMORGAN -1.63 | 09:30 - 10:00

Keywords: Appointment scheduling, simulation, seasonality, walk-ins

This study investigates appointment systems, as combinations of access rules and appointment rules, that are explicitly designed for dealing with walk-in seasonality. In terms of access rules, alternative strategies are tested for adjusting capacity through intra-week, monthly seasonality of walk-ins, or their combined effects. In terms of appointment rules, strategies are tested to determine which particular slots to double-book or leave open in cases where seasonal walk-in rates exceed or fall short of the overall annual rate, taking into consideration the intra-day variations in walk-in arrivals. In that regard, this study integrates capacity and appointment decisions, which are usually addressed in an isolated manner in previous studies. Simulation optimization is used to derive heuristic solutions to the appointment-scheduling problem, and the findings are compared in terms of in-clinic measures of patient wait time, physician idle time and overtime. The goal is to provide practical guidelines for healthcare practitioners on how to best design their appointment systems when seasonal walk-ins exist.

Improving patient doctor consultation times in an orthopaedic outpatients clinic

SESSION 10 - 10E

Gillian Mould*, John Bowers, Mikhail Ghattas

FRI SESSION 10 | GLAMORGAN -1.63 | 10:00 - 10:30

Keywords: Simulation, out-patients, pathway mapping

The orthopaedic outpatient clinic in NHS Fife was experiencing considerable congestion and was failing to provide an acceptable service to patients who would often have to wait an excessive time. The associated scenes of overcrowded waiting areas led to increased stress for staff. The obvious but costly solution seemed to be to employ an additional consultant. In order to understand the causes of the problems, the patient pathways through the clinic were mapped, this showed that the majority of patients took similar routes through the services in the clinic. A significant patient tracking exercise was undertaken for over 600 patients detailed timings were collected on their journey through the clinic. The analysis of this data set showed that many patients waited a long time for a 3 minute consultation with the consultant. This rich data set was then used together with the pathway mapping to construct a simulation model of the clinic. The model was used to experiment with the treatment regimes and the appointment system. A few changes to the scheduling of appointments and a reclassification of some categories of patient led to noticeable improvements. A second large scale tracking exercise was undertaken one year later to check that the improvements were being sustained. The paper shows how the pathway mapping, the patient tracking and the simulation all played a part in bringing about the improvements in the clinic.

ABSTRACTS

Time slots allocation and two-day advance cancellation of MRI examinations for stroke patients

Na Geng*, Xiaolan Xie, Zhibin Jiang

FRI SESSION 10 | GLAMORGAN -1.63 | 10:30 - 11:00

Keywords: Magnetic resonance imaging (MRI), Markov Decision Process, Advance Cancellation, Contract, Neurovascular

Quick diagnosis is critical for the patients in the neurovascular department. Diagnosis of these patients needs the assistance of expensive and heavily used imaging equipment, which results in long waiting time and potentially threatens patients life. It is very important for the neurovascular department to improve the service level by reducing the waiting time for imaging examinations. To deal with this problem, this paper proposes a contract-based reservation process between the neurovascular department and the imaging department. The reservation process is characterized by: contracted time slots (CTS) reserved for stroke patients, requests for lengthy regular time slots (RTS) and two advance cancellation modes to cancel CTS one-day or two-day before. The optimal control under a given contract is formulated as an average cost Markov Decision Process (MDP) in order to minimize stroke patients waiting times, unused CTS and CTS cancellation. Structural properties of optimal control policies are established via the corresponding discounted cost MDP problem. Numerical results show that two-day advance CTS cancellation can significantly improve the contract-based solution.

ABSTRACTS

EMERGENCY CARE SERVICES

How do Best Manage Ambulance Services at a Disaster Site? Experimental Analysis of Players Strategies and Success

SESSION 2 - 2A

Marion Rauner*, Helmut Niessner, Ulrike Leopold-Wildburger, Natasa Peric, Teresa Herdlicka

MON SESSION 2 | GLAMORGAN COUNCIL CHAMBER | 15:30 - 16:00

Keywords: Experimental Economics, Management Games, Discrete Event Simulation, Decision Support System, Disaster Planning for Ambulance Se

Due to an increasing number of mass casualty incidents, their high complexity and uniqueness, decision makers need Operations Research-based policy models for training emergency staff on planning and scheduling at the incident site. We develop a discrete event simulation policy model which is applied by the Austrian Samaritan Organization. By calculating various emergency scenarios from realistic small, simple, urban to a rather big complex, remote mass casualty ones, our policy model helps enhance the quality of planning and outcome. Furthermore, the organization of an advanced medical post can be improved in order to decrease fatalities as well as quickly treat and transport injured individuals to hospitals. The purpose of this paper is to analyze the best balanced strategies to manage staff of ambulance services for maximizing quick treatment of patients and fast evacuation of the incident site as well as for minimizing the number of fatalities. Using a realistic predetermined disaster scenario, players act in the experiment as on site commanders to decide on sending staff to triage, to different treatment rooms for care and on-site transportation, as well as to transportation to hospitals. We investigate to what extent players succeed in the simulation and improve over time. Furthermore, we examine differences among player groups such as students and practitioners.

Modelling Emergency Medical Services with Phase Type Distributions

SESSION 2 - 2A

Vincent Knight, Paul Harper*

MON SESSION 2 | GLAMORGAN COUNCIL CHAMBER | 16:00 - 16:30

Keywords: EMS planning, Coxian phase type distributions, Ambulance service times, Simulation

Effective and efficient emergency medical services (EMS) are a critical part of a national healthcare system. On-going work within the OR group at Cardiff University, in collaboration with the Welsh Ambulance Services NHS Trust (WAST), is exploring various aspects of EMS planning across Wales. This includes forecasting national and regional daily demand, and the use of maximal survival and simulation modelling approaches to advise on the location and deployment of EMS vehicles. In this paper we present recent work which has involved the fitting of Coxian phase type distributions to ambulance cycle (service) times. Distributions have been fitted to both the overall cycle time for different classes of patient priorities, as well as to sub-phases. Sub-phases are the distinct identifiable parts of the ambulance cycle time, such as travel times, time on scene and turnaround time at the hospital. The Coxian phase type fits have then been used within a priority simulation model to provide guidance on the numbers of ambulances required to meet response time targets. Results from using various numbers of phases from the fitted Coxian distributions are compared. The proposed benefit of using sub-phase fits is that it more readily permits scenario modelling within the simulation, such as evaluating the impact of reducing the turnaround time on the overall response times in the ambulance system.

ABSTRACTS

Understanding acute stroke pathways using simulation

SESSION 3 - 3B

Thomas Monks*, Martin Pitt

TUE SESSION 3 | GLAMORGAN -1.63 | 09:00 - 09:30

Keywords: Acute, Stroke, Discrete-Event Simulation, Implementation

This talk provides an overview of some research currently underway at Peninsula Medical School, in Exeter, focusing on the time taken to treat patients suffering an acute ischemic stroke. When acute stroke is treatable it is particularly important to do so as quickly as possible in order to reduce long term disability. This process is made more difficult by two factors. Firstly, the only drug licensed to treat acute ischemic stroke must be applied within a short number of hours after the onset of symptoms. Secondly, stroke is relatively rare compared to other types of emergency and so a special effort must be made to get patients through an already congested system quickly. To understand the behaviour of a treatment pathway such as this, and how possible interventions may affect it, it is essential to analyse how decisions for treatment made by health clinicians are affected by patient attributes and waiting time targets. This talk will review the collaboration between Peninsula Medical School and a local hospital to identify alternative treatment pathways for stroke patients using simulation and, importantly, how modelling is being used to help multiple stakeholders reach an agreement on implementation.

A simulation study to determine the impact of extending the treatment window for thrombolytic treatment of stroke

SESSION 3 - 3B

Martin Pitt*, Dave Worthington

TUE SESSION 3 | GLAMORGAN -1.63 | 09:30 - 10:00

Keywords: Stroke, Simulation, Thrombolysis

Thrombolytic treatment for acute ischaemic stroke using intravenous alteplase (rtPA) is critically time-dependent, with an exponential decay in the odds of a favourable outcome from one 90-minute interval to the next after stroke onset. Current marketing approval for rtPA treatment is up to 3 hours after stroke onset despite clinical studies which demonstrate efficacy up to 4.5 hours. This evidence therefore seems to support lengthening the treatment window from 3 to 4.5 hours; however extending the time window may also lessen the urgency of treatment which could in turn reduce the population benefit from any extension. In order to investigate this, we analysed registry data for 3830 UK stroke patients treated with rtPA between 2005 and 2010. We found statistical evidence of a relationship between time remaining to treat and time taken to treat after adjustment for censoring. We labelled this the 'deadline effect' since the analysis suggests that average treatment times reduce as the deadline to treat approaches. We then developed a Monte-Carlo simulation model to assess the impact of extending rtPA treatment to 4.5 hours from onset given the predicted changes to treatment times associated with an extended time window. The simulation shows that as the 'deadline effect' increases, the extension of the time window for rtPA treatment results in an increasing number of patients treated at a progressively lower absolute benefit to a point where the population benefit from extending the time window is entirely negated. The model also predicts the significant potential benefit accrued if a universally applied reduction in treatment times could be attained equivalent to that induced by the 'deadline effect' (i.e. if the treatment urgency associated with the deadline effect could be obtained for all patients regardless of the remaining time available to treat).

ABSTRACTS

A DES prototype for analysing pre-hospital delay factors for stroke patients

SESSION 3 - 3B

Mathias Barra*

TUE SESSION 3 | GLAMORGAN -1.63 | 10:00 - 10:30

Keywords: Stroke, DES, pre-hospital delay, thrombolysis

A detailed yet general prototype discrete event simulation (DES) model of pre-hospital delay factors is presented. Its purpose is to study their impact on the fraction of stroke patients who will arrive at an ECU in time for thrombolysis. The study's main focus is to obtain a model with which one can exploit empirical data on the impact of various inputs, such as education of the public, education of paramedics, tele-radiology, or the introduction of a mobile CT-scanner which could be brought to suspected stroke patients. Time is the critical factor, since medical indication for this potent treatment ceases after three to four hours after debut of symptoms. The DES model is being developed in AnyLogic a modelling tool offering standard off-the-shelf model components combined with the full force of Java for customization and the prototype accommodates easy introduction of future empirical data and alternative treatment regimes. In order to fit the model with appropriate delay-time distributions we collaborate with clinical researchers at Akershus University Hospital investigating which are their major drivers. We have therefore tried to be as general as possible in the development of the model, so as to have a ready-to-use framework for exploiting novel findings. Due to demographical shifts in age composition caused by higher life expectancy, strokes and post-stroke complications are expected to be on the rise during the next decades. We expect a potential impact on decision makers in our own hospital. With growing concerns for the future finances of the Norwegian national health care programme amongst politicians and hospital managers, we are certain that the model can aid in cost/efficiency analyses to demonstrate that resources spent on getting stroke patients to hospitals in time for thrombolysis treatment are well spent.

Forecasting ambulance missions in Milan

SESSION 4 - 4A

Giovanni Righini*

TUE SESSION 4 | GLAMORGAN COUNCIL CHAMBER | 11:00 - 11:30

Keywords: Forecasting, EMS

Demand forecasting is of paramount importance in emergency systems management. The demand level tpically exhibits three seasonalities with periods equal to one year, one week and one day, and different kinds of outliers: predictable (sport events) and not predictable (exceptionally averse weather conditions), in fixed dates (Christmas) or variable dates (Easter), affecting single days or whole periods (seasonal winter flu). We report on the use of different techniques to deal with seasonalities and outliers in a case study in Milan (Italy).

ABSTRACTS

A probabilistic multi-period optimization model for the ambulance location problem

SESSION 4 - 4A

Edoardo Amaldi, Giuliana Carello*, Erik Cittadino

TUE SESSION 4 | GLAMORGAN COUNCIL CHAMBER | 11:30 - 12:00

Keywords: Ambulance location, multi-period model, probabilistic model, integer linear programming, Lagrangian based approach

An Emergency Medical Service (EMS) is a service providing first care to patients with illnesses and injuries. A key performance issue for an EMS system is the early response, which substantially increases the probability of full recovery. Since the location of emergency vehicles across the considered area plays a fundamental role in EMS management, the problem has been extensively investigated in the optimization literature. A variety of models have been proposed, ranging from deterministic and static models to dynamic and probabilistic ones, see e.g. [1]. The aim is to capture the dynamic and probabilistic aspects of the problem while being able to solve real-life instances. In this work we propose a probabilistic multi-period ambulance location model based on a recent robust optimization model for the Uncertain Set Covering problem [2]. The model takes into account different demand scenarios (amount and distribution) which must be faced by the emergency vehicles and allows to relocate ambulances during the considered time horizon. We show that medium-size instances can be solved to optimality with state-of-the-art mixed integer programming solvers and propose a Lagrangian-based approach to tackle larger instances and to derive both lower and upper bounds. Tests are carried out on Milano and Lombardia real-life data. The model is also extended to take into account fleet dimensioning, as additional ambulances can be reserved through different types of contracts with volunteer associations (e.g., white cross, green cross, etc). [1] L. Brotcorne, G. Laporte, F. Semet. Ambulance location and relocation models. European Journal of Operational Research, 147:451-463, 2003. [2] M. Fischetti, M. Monaci, Robustness by cutting planes and the Uncertain Set Covering Problem, Manuscript, Univerisita di Padova, Italy, 2009.

Evaluation of redeployment strategies for a fleet of ambulances through simulation

SESSION 4 - 4A

Valerie Belanger*, Yannick Kergosien, Angel Ruiz, Patrick Soriano

TUE SESSION 4 | GLAMORGAN COUNCIL CHAMBER | 12:00 - 12:30

Keywords: Emergency medical services, Ambulances, redeployment, location, simulation

In order to ensure an adequate service to the population, emergency medical services use a given number of ambulances located strategically over the territory to be served. The arrival of calls being highly uncertain and evolving throughout the day, the available fleet of vehicles may, at some point in the day, not cover properly all regions, even if the coverage had been carefully planned in the static phase. Some corrective actions may therefore be required during the day in order to achieve better performances. One of these possible actions is the redeployment of ambulances. The redeployment problem consists in relocating available vehicles in response to changes in order to maintain a good service at all times. So far, some models have been proposed in the literature to tackle this problem and it has been shown that using such strategies can help to improve overall performances. However, the relocation of vehicles generates movements that lead to undesirable consequences from both economical and human resources management standpoints. A question then remains: Is the relocation worth the effort? And if so, when and under which circumstances? Unfortunately, this issue has been less addressed up to now. This study thus focuses on evaluating and analyzing redeployment strategies through simulation. It aims at quantifying the benefit of redeployment over static deployment but also to compare different redeployment strategies, from simple ones to more sophisticated ones, considering several demand profiles and ambulances fleet sizes. To perform this comparison, several scenarios will be generated and tested using a simulation model developed for this purpose. Results will be analyzed with a special interest to the trade-off between potential benefits and management inconveniences.

ABSTRACTS

Decision support in pre-hospital stroke care operations: improving eligibility of acute stroke patients for thrombolysis treatment with simulation

SESSION 5 - 5C

Leonid Churilov*, Audur Fridriksdottir, Ian Mosley, Helen Dewey, Andrew Flitman

TUE SESSION 5 | GLAMORGAN -1.64 | 13:30 - 14:00

Keywords: Stroke, pre-hospital services, simulation

Stroke is the third most common cause of death and the sixth most common cause of disability worldwide. Treating acute ischemic stroke with thrombolytic therapy within 4.5 hours from symptom onset is effective in improving patient outcomes. The time from stroke onset to arrival to hospital has been identified as the single most important issue in determining patients eligibility for stroke thrombolysis. There is a need for a solution capable of simultaneous systemic evaluation of multi-factorial interventions in pre-hospital acute care systems aimed at increasing patients eligibility for stroke thrombolysis. In this paper an OR solution is proposed in the form of a simulation model that provides clear measure of the relative benefit of alternative potential interventions, thus demonstrating how OR modelling can be used for providing decision support in pre-hospital stroke care operations.

Towards an Integrated Emergency Admission System for Major Events

SESSION 5 - 5C

Mario J. F. Oliveira*, Delana G. Oliveira, Fabio B. Oliveira, Waleska B. Chaves

TUE SESSION 5 | GLAMORGAN -1.64 | 14:00 - 14:30

Keywords: Integrated Emergency Admission System, Simulation

The Municipal Health Service of Rio de Janeiro has recently proposed a study to evaluate the service capacity of their emergency hospitals in order to cope with natural disasters and to support the organization of the next World Cup and Olympics. However, the problem of managing emergency admission systems is complex and there is more to do be done to improve the accessibility and quality of such services than meet the eyes. It is well known that an emergency call activates a chain of events and actions exclusive of the different services offered to the community and this fact requires a series of decisions to be taken by different entities involved in the rescue, hospital admission and treatment of the victims. The response time in providing the service is very important and, in many instances, means the difference between the life and the death. A number of studies, in this subject, have been carried out by an existing research group. Some of the outcomes have appeared in the past meetings of the ORAHS working group. The previous work focuses on particular aspects of the emergency admission system of some emergency hospitals in Rio de Janeiro. An evaluation of these pieces of work points to the need to put together these initiatives into a single model. This model is based upon theoretical and practical results obtained, the experience gained by the research group and the consequences of the previous contributions. The objective of this paper is to propose an integrated tool that enables a flexible variation of the demand and supply. The study comprises three modules: Pre-hospital services, emergency admission system and hospital care, featuring four major emergency hospitals in the city. The goal is to reduce waiting times and to propose the configuration of human and material resources for critical scenarios. A discrete-event simulation tool is used to evaluate alternative measures as the demand increases. It is argued that an integrated model contributes to improve the overall performance of the system.

ABSTRACTS

Should misuse of emergency departments be encouraged? And what role could OR play?

SESSION 9 - 9A

Penelope M Mullen*

THU SESSION 9 | GLAMORGAN COUNCIL CHAMBER | 15:30 - 16:00

Keywords: Emergency, Primary Care

Many OR studies have been carried out on various aspects of the operation of Emergency Departments (EDs). Studies from different countries, with different health care systems, frequently comment on the problems caused by the misuse of EDs, notwithstanding the fact that there is often little clarity about what constitutes proper use. Many proposals have been forwarded to prevent or minimise misuse, including provision of urgent-care facilities, increasing the number of primary-care centres, improved information and imposing differential charging, However, an argument could be made for encouraging, or at least planning for, misuse mainly, but not solely, out-of-normal-working-hours, both on the grounds of access and of cost to the health care system. Such misuse or wider use would also acknowledge the role of EDs as part of first-line access primary care, rather than considering them solely as secondary care. This short paper will review the question of the proper use of EDs, explore some of the arguments for and against encouraging their misuse and consider potential roles for OR. The aim is to foster debate, so please come and be prepared to join in!

Setting staffing levels in emergency departments whilst controlling excessive waiting times

SESSION 9 - 9A

Mieke Defraeye*, Inneke Van Nieuwenhuyse

THU SESSION 9 | GLAMORGAN COUNCIL CHAMBER | 16:00 - 16:30

Keywords: Emergency department, time-varying demand, personnel capacity

In an emergency department (ED), capacity decisions are an important tool to account for the presence of time-varying arrival patterns. Service is mainly related to the length of the customer's waiting time (in particular the longest waits) and hence, controlling excessive waiting times is a primary goal. However, most approaches proposed in the literature focus on expected waiting times and the probability that a patient has to wait upon arrival. Additional complexities result from the relatively small system sizes (i.e. a small number of physicians or nurses) and the presence of customer impatience (customers abandon when they consider their waiting time to be unacceptably high). Assuming a single-stage multiserver M(t)/G/s(t)+G queueing system with general abandonment and service times and time-varying demand for service, we suggest an extension of the simulation-based Iterative Staffing Algorithm (ISA) proposed by Zohar Feldman and others, as a method to set staffing levels throughout the day. A main advantage of our extension is that it enables the use of performance measures based on the probability of an excessive wait, instead of the common focus on delay probability. Advantages of the traditional ISA (general applicability, automatic validation) remain valid. Additional advantages of the suggested extension include: the ability to deal with smaller service systems (and the discreteness they display), an explicit consideration of staffing intervals (or intervals during which capacity remains unchanged) and the possibility to measure performance by means of the excess wait probability (or the probability that a customer's waiting time exceeds the maximal acceptable wait). The proposed method was tested for a large system size with sinusoidal arrival pattern and a more realistic small ED system. The solution meets the target performance for both settings, although larger systems require more computation time.

ABSTRACTS

EPIDEMIOLOGY AND DISEASE MODELLING

The Swedish mass-vaccination against pandemic influenza was not cost-effective

SESSION 2 - 2C

Lisa Brouwers*, Jessica Dagerborn

MON SESSION 2 | GLAMORGAN -1.64 | 15:30 - 16:00

Keywords: Influenza, epidemiology, vaccination, simulation, intervention

The cost-effectiveness of the Swedish mass-vaccination against pandemic influenza A(H1N1) has been analysed taking a health-economic perspective. By using an individual-based simulation model, scenarios with and without vaccination and with different start days for the vaccination campaign were simulated. The costs from the disease were compiled from different data sources, and included health care consumption, laboratory costs, workplace absenteeism and lost quality adjusted life years (qalys). Mass-vaccination costs were weighed against the reduced disease costs from fewer infections, based on simulated outcomes. The results show that the mass-vaccination was not cost-effective. The cost per saved qaly was more than double what is normally consider acceptable. If vaccination had started three weeks earlier it would have been cost effective and with a more severe form of pandemic the vaccination would have been highly cost-effective.

Using Mathematical Modelling to Assess Public Health Strategy for HIV/AIDS

SESSION 2 - 2C

A. R. Rutherford*, B. Ramadanovic, R. W. Wittenberg, K. Vasarhelyi

MON SESSION 2 | GLAMORGAN -1.64 | 16:00 - 16:30

Keywords: HIV/AIDS, epidemiology, disease modelling, public health policy, disease surveillance

An important measure of the success of public health strategies for containing the HIV/AIDS epidemic is incidence, the rate at which new infections appear in the population. However, a patient infected with HIV may not become symptomatic for as long as 8 years. This means that the number of new positive tests is not necessarily a good indicator of disease incidence. In Canada, it is often accepted that as much as 25% of the HIV population may be undiagnosed. A new pilot project called Seek and Treat for the Optimal Prevention of HIV and AIDS pilot project (STOP HIV/AIDS) is being rolled out by the Government of British Columbia. As one of the approaches to evaluating the success of STOP HIV/AIDS, we have developed a compartmental disease model which relates public health surveillance data to the epidemiological parameters of the epidemic. Key advantages of combining disease modelling with existing public health surveillance data over traditional methods of estimating incidence, such as backcalculation and cohort studies, are that it is a relatively inexpensive approach and that it provides near real-time feedback on the state of the epidemic. Our model estimates that the fraction of the HIV positive population in British Columbia that has been diagnosed has risen from approximately 60% in 1990 to 80% in 2008 and that the annual transmission rate per HIV positive individual has dropped from 0.2 to 0.05 over the same period. In addition to validating the model historically, we have determined signatures in the public health surveillance data that the model establishes as indicators of whether STOP HIV/AIDS is having a significant impact on HIV incidence.

ABSTRACTS

Results from the Swedish LEV-project

SESSION 4 - 4B

Lisa Brouwers*, Anders Ekholm, Nils Janlav, Karin Mossler, Pontus Johansson

TUE SESSION 4 | GLAMORGAN -1.63 | 11:00 - 11:30

Keywords: Health care, elderly care, simulation, policy

The Ministry of Health and Social Affairs has used a unique microsimulation model (SESIM) to simulate how 300 000 individuals age from year-to-year up to 2050 and the future needs for health care and care for the elderly. Three different health scenarios were simulated; compression of morbidity, dynamic equilibrium, and expansion of morbidity. In the two health-scenarios the costs of health and elderly care per individual will decrease, mainly due to a higher level of education contributing to a reduced consumption. The total costs will nevertheless increase, as there will be more elderly people. The costs of care for the elderly are expected to rise by around 70 per cent and health care costs by nearly 30 per cent between now and 2050 when only the demographic factors are included. Including only demographically driven costs the share of care for the elderly in GDP (also expected to grow) would increase by just over one percentage point while the share of health care would remain unchanged. However, when an increased level of ambition/technology effect is included, the share of health care would increase by just over two percentage points resulting in an increase in the share of health and elderly care from the present-day level of around 13 per cent to 16 per cent in 2050. Different ways of meeting the challenge are presented, both increasing incomes and decreasing costs. To keep the share of health and elderly care in GDP unchanged a 0.5-0.6 per cent per year increase in productivity is required for health care and a 0.7-0.9 per cent increase per year for care of the elderly. Examples of measures leading to a more efficient health and elderly care are presented. The simulations show that there is time to implement changes and that the future needs can be met.

Modeling of a Large-Scale Perinatal and Neonatal Healthcare Delivery Network

SESSION 4 - 4B

Canan Pehlivan*, Vincent Augusto, Xiaolan Xie

TUE SESSION 4 | GLAMORGAN -1.63 | 11:30 - 12:00

Keywords: Capacity Planning, Large Scale Network, Markov Chain, Demand modeling

In this paper we introduce a framework for determining capacity requirements of healthcare resources in a large-scale network. Our case study will be based on the Perinatal and Neonatal Network in Paris, France. This large-scale network is composed of hierarchical facilities which have the ability to give different level of services to pregnant women who may have different needs in each stage of their pregnancy. These facilities are Consultation Offices, Test Centers, Maternity Services which provide lower level of services (deal with low risk pregnancies), and Maternity Departments in hospitals which provide higher level of services (deal with both low risk and high risk pregnancies). The resources considered in the study are Gynecologists, Midwives, Anesthesiologists, Test centers, Imagiary Services, Delivery rooms, Operating Rooms, Beds, and Neonatal Cots. In this primary work, we capture the organization and process flow of the healthcare delivery perinatal and neonatal network with an adequate detail level and we specifically focus on the modeling of the demand for different types of its resources. Our aim is to define demand with its fluctuations in order to determine/match the resource capacity requirements in large scale healthcare network. In our model, we make use of the fact that needs of pregnant women are changing according to their health states (the month and the criticality level that they are in). In that respect we consider the possible evolution of their health states which is highly variable. In order to match the resource requirements with the fluctuating demand, we developed a Markov Chain model whose states are composed of the possible health stages in pregnancy and where the implications of these health stages generate the demand for the perinatal and neonatal healthcare delivery network.

ABSTRACTS

Use of Agents For Proximity-Based Modelling of Cross-Contamination

SESSION 4 - 4B

Navonil Mustafee*, E Bischoff, Korina Katsaliaki, M. D. Williams

TUE SESSION 4 | GLAMORGAN -1.63 | 12:00 - 12:30

Keywords: Agent Based Simulation, Cross-Contamination, Proximity Modelling, Storage and Transport of Perishable Items

The use of modelling in healthcare is not limited to the management of activities necessary to deliver care alone. It is also used for the study of several topics related to healthcare, for example, air pollution, pharmacokinetics and food poisoning. The research presented in this paper focuses on one such topic the cross-contamination of clinical items during storage and/or transportation. Agent Based Simulation (ABS) is used to model a scenario wherein several boxes of degradable items (i.e., items that deteriorate over time) are stored in close proximity. In the healthcare context, these boxes may represent blood units, donor organs, vaccines and medicines, all of which have limited shelf life and can potentially cross-contaminate other items. Although there are several examples of studies that have used ABS for modelling epidemics and transmission of diseases, the novelty of our approach is on proximity modelling, in other words, we define inter-agent relationships based on agents locations in the three dimensional storage spaces. The main objective of our feasibility study is to investigate the trade-off between optimisation of physical space for storage/transportation and the potential for cross-contamination among boxes containing perishable clinical items. In pursuit of the stated objective, we designed experiments that have used a variant of the Cutting and Packing Optimization (CPO) algorithms from literature and have developed an ABS model in AnyLogic that, (a) uses the output of the CPO to define the arrangement of the boxes (transformed as agents) in 3-D space, and (b) simulates cargo cross-contamination by modelling the spread of contaminants inside the well-defined space. The contribution of this research is the demonstration of the feasibility of using ABS for proximity-based modelling in the healthcare sector.

Modelling to support Health Protection Policy

SESSION 5 - 5B

Martin Utley*, Christina Pagel, Sonya Crowe

TUE SESSION 5 | GLAMORGAN -1.63 | 13:30 - 14:00

Keywords: Health Protection, Policy

The Clinical Operational Research Unit at University College London provides a responsive research facility to the Department of Health, undertaking projects related to Health Protection Policy. In this presentation, recent and ongoing projects will be described including work to inform decisions related to counter measures to pandemic influenza and transmission of variant Creutzfeldt-Jacob Disease via blood transfusion. In addition, general points will be made about developing models to inform policy in the face of considerable uncertainty about the disease concerned.

ABSTRACTS

A simple analytical model for the evaluation of screening policies

SESSION 5 - 5B

Valter de Senna*, Israel Vieira, Paul Harper, Arjan Shahani

TUE SESSION 5 | GLAMORGAN -1.63 | 14:00 - 14:30

Keywords: Disease policy modelling, mathematical disease models, breast cancer screening , screening policies evaluation, breast cancer di

Screening for an early detection of disease is considered to be an important element of preventive medicine. However, screening a community will usually be an expensive undertaking and questions about the likely benefits of a screening programme arise quite naturally. We explore the possibility of using a simplified mathematical model to evaluate those benefits, avoiding the need for complex stochastic computations. We developed a set of equations that take into account transition and screening times, both patient detection and screen detection at different disease stages, and allow us to evaluate very fast and accurately different measures of efficiency, like patient and screen detection delays, total delay at a given disease stage, expected costs etc. Unlike results obtained through simulation, these are nearly exact values, obtained by superposing a fine grid over which the equations are computed. We present some results obtained for breast cancer screening. Breast cancer is by far the commonest cancer in women in the UK, accounting for 31% of all cases, with an estimated lifetime risk of 1 in 9. The results demonstrate that detailed attention to the many variables and processes involved in the screening times, detection rates and disease evolution are, as expected, of fundamental importance. An easy to compute, yet detailed operational model is therefore a very useful tool in helping to make decisions about screening at national and local levels.

ABSTRACTS

LOCATION PROBLEMS

Planning hospital networks: a dynamic and multiobjective approach

SESSION 4 - 4C

Ana Mestre*, Monica Oliveira, Ana Barbosa-Povoa

TUE SESSION 4 | GLAMORGAN -1.64 | 11:00 - 11:30

Keywords: Dynamic location model, multiobjective, public facility planning, health care planning, hierarchical location model

Planning hospital networks involves making decisions that should remain suitable for future configurations of the system. Typically, those decisions are hardly reversible, extremely expensive and often have political impacts. Therefore, future conditions should be accounted at the planning level when designing hospital systems. Also, when planning public facilities, trade-offs between access and costs have to be established. While the decision-maker might wish to improve access through the supply of smaller hospital facilities near the populations, this might only be obtained at the expense of higher inefficiencies and costs. So a balanced solution between these two aspects is needed. In this work a dynamic mathematical programming model is presented to assist the reorganization of hospital networks. The model includes a time dimension that allows for modelling critical moments where changes in the network might occur. Location-allocations decisions in each stage are accounted and adapted to deal with information on future need for hospital care. Given the trade-off between access and costs, a multiobjective approach is used to deal with these conflicting objectives. Such methodology provides a set of possible solutions that are presented to the decision maker that should then choose the best compromise solution. Within the mathematical programming model, hospital network characteristics are modelled in detail through: a hierarchical structure with two-tier levels (with ascendant and descendent flows between levels), hospitals as multiservice providers (considering inpatient, outpatient and emergency), flows of patients between tiers and hospital services, and through the use of constraints to capture institutional settings and the policy context. The model is applied to a case study based in the South Region of Portugal, providing illustrative results on how it can assist health care planners. Results show the following model outputs, under different scenarios: hospital network structure, hospital capacity, hospital catchment areas and a schedule for system changes.

Reusable items in hospitals: how much to stock where?

SESSION 4 - 4C

Ingrid Vliegen*, Simme Douwe Flapper, Pieter Wolbers, Rogier van Vliet

TUE SESSION 4 | GLAMORGAN -1.64 | 11:30 - 12:00

Keywords: Inventory, reuse, location-allocation

Within hospitals, many reusable items are used, for instance beds and infusion pumps. Questions that arise are where to locate the stock points of these items, how much to stock, and how to deal with possible stock-outs. A trade-off needs to be made between costs, service level for the patient, and employee satisfaction. In this paper we study a general problem seen in many hospitals regarding the location and allocation of reusable items. We study policies from literature on spare parts management and reusable transport items, and show the applicability and the shortcomings of these policies for the situation seen in hospitals using mathematical models. We study the impact of several input variables, and show in what situation each of the policies is preferable. Finally, we present a case study with data from a hospital on infusion pumps.

ABSTRACTS

Using operational research to evaluating network logistics for Canadian Blood Services

SESSION 4 - 4C

John Blake*, Matthew Hardy

TUE SESSION 4 | GLAMORGAN -1.64 | 12:00 - 12:30

Keywords: Logistics, Simulation, Network planning

Canadian Blood Services (CBS) has developed a consolidation plan for blood component production, distribution and support functions for the Maritime Region of Atlantic Canada. Once consolidated, blood products for New Brunswick hospitals will be distributed from the new Dartmouth production facility either directly or via a stock holding unit (SHU) located in Saint John, New Brunswick. This papers describes the results of a simulation experiment to evaluate and compare expected service levels for customers supported through Saint John under the current and to be distribution networks. A simulation model of the Saint John facility was constructed in Rockwell Arena Version 13. The simulation was designed to model the current situation where collections are processed at Saint John as well as the to be situation where collections are processed at the proposed Dartmouth facility and delivered to Saint John via ground transport. The simulation model is able to reproduce processes of inventory management: collections, testing, end-labelling, and distribution and to represent order arrivals, order backlogs, and order completion and dispatch. An MS-Access database is used to simulate the CBS production database and to track the physical location and status of all units. System performance metrics (order fill time and outdate rates) were recorded for both the current and proposed distribution networks using the simulation model as a test platform. A comparison of means tests (Î± = 0.05) indicates that the proposed network has performance metrics that meet, or exceed, those of the existing network.

A Healthcare-at-home structures location-allocation problem

ESSION 10 - 10A

Carlos Rodriguez-Verjan*, Vincent Augusto, Xiaolan Xie, Valerie Buthion

FRI SESSION 10 | GLAMORGAN COUNCIL CHAMBER | 09:30 - 10:00

Keywords: Healthcare at Home, Location-Allocation, Facility Location, Healthcare

The main objective of a healthcare policy is to ensure the coverage at the lowest possible cost. Location of healthcare structures seeks to locate (most of the time) hospitals or emergency services in an area such as to minimize costs, times or distance; or to maximize coverage. These problems are classified as NP-Hard (Garey and Johson, 1979). There is a lack of studies on Healthcare-at-home structures location even if their importance in the healthcare system is growing. Existence of elements like different treatments, different types of medical activities, several actors with different skills, the geographical aspects or uncertainties about the demand, inherent to healthcare applications, are hard to take into account and real data is often out of reach. We propose a location-allocation model applied to healthcare-at-home facilities that introduces different treatments, information about patients mobility status, different skills necessary to realize activities and the allocation, not only of treatments to healthcare structures but also authorization to realize some parts of treatments in several structures.

ABSTRACTS

How a specific Health Information System (HIS) can help Regional Health Authority (RHA) of Parisian region (IDF) in perinatal health decision making?

SESSION 10 - 10A

Catherine Crenn Hebert*, Elodie Lebreton, Claudie Menguy, Annie Serfaty

FRI SESSION 10 | GLAMORGAN COUNCIL CHAMBER | 10:00 - 10:30

Keywords: Perinatal care, health information system, social health inequalities, health service research, territorial health access

Background About 180 000 babies are born in 2009 in the IDF region in 100 birth sites. Writing a new health plan, need to assess perinatal health and to identify health inequalities. Objective To provide to the RHA, perinatal health indicators provided by the perinatal HIS, using existing databases, established since 2006 with health professionals involvement. Material and Methods Data sources: Hospital discharge system for mothers and babies, both live and stillborn and hospitalised newborns in neonatal units . Geographical analysis by mother place of residence was carried out. We relate indicators of care and outcome to neighbourhood socioeconomic and supply characteristics using an ecological approach. Results The completeness of inclusions, assessed by comparing the number of births with vital statistics, was 97.3% of 181312 births from IDF resident mothers. 27% of births take place in the 15 level III perinatal centres (maternity with on-site neonatal intensive care - PCIII). Neonatal intensive care unit size and availability varies among the districts. 80% (versus 78% in 2007) of babies born alive weighting less than 1500g were born in a PCIII but with increasing gaps between districts from 66% to 86%. Preterm birth rates varied by district from 0.89 to 1.1% for live births (<1500g); neonatal mortality in newborn units from 0,9 to 1,6%. Social disadvandage is measured for each district with education attainment and employment. The less affluent districts also have the less access to health facilities with the worst health results. Conclusion The Parisian region faces to marked inequalities in population characteristics and health outcomes. Implementing routine surveys about health access and inequalities in outcomes on a territorial basis is required for decisions in perinatal policy. Social disadvantage criteria linked to place of residence may be used when social informations are missing data

Managing a fleet of ambulances to respond to emergency or standard patient transportation demands

SESSION 10 - 10A

Yannick Kergosien*, Patrick Soriano, Angel Ruiz, Michel Gendreau

FRI SESSION 10 | GLAMORGAN COUNCIL CHAMBER | 10:30 - 11:00

Keywords: Ambulance , dial a ride problem, relocation problem, EMS

EMS (emergency medical services) have a mission to provide medical assistance and transport patients to care centers. These transports are performed by paramedic crews on ambulances that are generally deployed at strategic locations in order to respond as soon as possible to random emergency calls. However, EMS also have another mission, which is to respond to non-emergency transportation requests between hospitals and sometimes to or from the patients' homes. Even though all requests are not known at the beginning of a day and occur in real time, they can be scheduled in advance on ambulance routes. Both types of demands, "emergency" and "standard", can be performed by the same crews and ambulances. However, some organizations in Canada manage both missions with two separate fleets, such as it is the case with our real case study of "Urgence-Santé" (a public organization in Montreal). This option was chosen to simplify management, but it appears to be less efficient than an integrated fleet management dealing with both types of demands. Taking this into consideration, this study aims to design and evaluate management strategies in order to make better use of ambulance resources and improve the service quality of both types of interventions. Several objectives may be pursued: to minimize the sum of the delays of standard transports, to maximize the total demand covered, and to minimize the costs as the sum of empty running of ambulances as well as the number of crews used. To do this, a discrete event simulation model has been developed to show results of potential for improvements.

ABSTRACTS

METHODOLOGY

Does healthcare modelling have an impact? Could healthcare modelling have an impact? A search for evidence.

SESSION 1 - 1A

Mike Pidd, Dave Worthington*

MON SESSION 1 | GLAMORGAN COUNCIL CHAMBER | 13:00 - 13:30

Keywords: Healthcare, Modelling, Impact

ORAHS is concerned with the application of OR in health services. Funding of UK research at universities has recently undertaken to reflect impact. Bids for research money (or indeed consultancy projects) would be much stronger if we could promise major financial savings or major gains in effectiveness and/or efficiency. We have therefore taken this opportunity to undertake a modest search for evidence that OR has led to savings, gains or other impacts in the past, and use it to speculate about potential savings, gains or other impacts in the future.

Operational modeling of primary health service operations. A literature review.

SESSION 1 - 1A

Mahdi Mahdavi, Tomi Malmstrom, Joris Van de Klundert, Jan Vissers*

MON SESSION 1 | GLAMORGAN COUNCIL CHAMBER | 13:30 - 14:00

Keywords: Primary operations, modelling, review

Many (operational) researchers have addressed operations management problems in health services. But apart from offering solutions and support to problems, there seems not to be much advancement in the development of theory of how to apply operational modeling in the health care field. What does the scientific literature offer in selecting an appropriate model for the problem of operational modeling of a health care delivery process in a specific setting? Given the vast amount of literature, a structure for the various models, a typology for operational modeling of primary operations, is needed to answer this question systematically. Similar typologies exist already for theoretical models such as scheduling models or queuing models, or more practically, for supply chain operations. For health service operations, such a structure appears to be lacking. Because of our involvement in a European project on the use of operations management and demand-based approaches to managing outcomes in health care, we performed a systematic literature review. We searched in medical databases (Pubmed) for papers on service operations, and in business management databases (SCOPUS) for papers on health service specific operational models. We found more than 1000 recent papers that were relevant for our study. After applying our inclusion criteria for the actual review we had 118 papers left that were used in the detailed review. We performed a systematic analysis of all papers on a number of criteria grouped to answer the following questions: - why are models used: purpose of the model, process/patient group considered, setting modeled; - how are models developed: technique used, software used; - what are the achievements: objective, results, implementation. We will report on the results of these analyses and on the conclusions drawn to provide support for the use of operational modeling for primary health service operations.

ABSTRACTS

Mixed Modelling of a Radiotherapy Centre: The Complementary Application and Integration of System Dynamics and Discrete Event Simulation

SESSION 1 - 1A

Jennifer Morgan*, Valerie Belton, Susan Howick

MON SESSION 1 | GLAMORGAN COUNCIL CHAMBER | 14:00 - 14:30

Keywords: Multi-methodology, System Dynamics, Discrete Event Simulation, Radiotherapy Planning

Both System Dynamics (SD) and Discrete Event Simulation (DES) have been successfully applied within the healthcare context and this work examines how they can be used in a complementary and interacting manner. This work has applied the two simulation approaches within the radiotherapy planning and treatment process at the Beatson West of Scotland Cancer Centre to provide insight into the behaviour of the system. The unit is subject to resource constraints yet is driven to keep up with Research and Developments in the Radiotherapy field. How it might implement new more complex radiotherapy techniques in practice is explored in this work. A SD model represents the policy of progressive implementation of complex treatment regimes and captures the increasing treatment times, the learning processes involved and delays within the system. A DES captures the activity within the system: from the booking and initial imaging of patients, through the planning process and onto treatment. It is used to explore the impact of employing new more complex radiotherapy treatment regimes, depicting the impact such changes have on the capacity of the system and the day to day running of the centre. The combined application of the approaches allows the progressive implementation of new regimes to be explored to ensure timely treatment of patients and limit excessive queueing. This work sits within the multi-methodology field and how the two models add value to the project is reflected upon, and the interaction between the models is discussed.

Philosophical Positioning of Discrete Event Simulation and System Dynamics as Methodologies for Decision Support in Patent Care Process Modelling

SESSION 3 - 3A

Kristian Rotaru*, Leonid Churilov, Andrew Flitman

TUE SESSION 3 | GLAMORGAN COUNCIL CHAMBER | 09:00 - 09:30

Keywords: Discrete event simulation, system dynamics, critical realism

This paper examines main philosophical assumptions underlying the Discrete Event Simulation (DES) and System Dynamics (SD) simulation worldviews by adopting the philosophical position of Critical Realism and utilizing practical simulation experience in patient care process systems. The novelty and original contribution of this research is in mapping distinct phases of SD and DES life-cycles onto the ontological domains of Critical Realism thereby allowing the comparison of SD and DES knowledge generating/decision making steps and the respective outcomes. Particularly, this relates to the use of the available empirical data (generally more value-laden in case of SD than DES) in order to identify the generative mechanisms that trigger the puzzling behaviour of the complex process systems. While using different sets of grammatical constructs, both simulation methodologies aim at understanding the underlying structural pattern that triggers the behaviour of the complex process systems. Hence, without denying the criticality of understanding the impact of randomness (the factor that operates at the ontological level of empirical) upon the behaviour of the system under study, our perspective informed by Critical Realism epistemology demonstrates the need for a more structured inquiry into the logic that guides conceptual model building as part of the DES-induced decision making process. The outcomes of this research are targeted at the health care manager, who is the contributor to, as well as the end-user of simulation model of a patient care process system and, as such, could benefit from clear understanding of how management knowledge is generated through the modelling process. Furthermore, the outcomes of this research are targeted at the health care modeller who chooses to use simulation modelling to support management decision-making in patient care process systems and requires in-depth understanding of the scientific bases of respective modelling methodologies to apply it in a truly scientific manner.

ABSTRACTS

Towards the holy grail: combining system dynamics and discrete-event simulation in healthcare modelling

SESSION 3 - 3A

Sally Brailsford*, Shivam Desai, Joe Viana

TUE SESSION 3 | GLAMORGAN COUNCIL CHAMBER | 09:30 - 10:00

Keywords: Methodology, DES, SD

The idea of combining discrete-event simulation and system dynamics has been a topic of debate in the operational research community for over a decade. Many authors have considered the potential benefits of such an approach from a methodological or practical standpoint. However, despite numerous examples of models with both discrete and continuous parameters in the computer science and engineering literature, nobody in the OR field has yet succeeded in developing a genuinely hybrid approach which truly integrates the philosophical approach and technical merits of both DES and SD in a single model. In this talk we consider some of the reasons for this and briefly describe two practical healthcare examples of combined DES/SD models, which nevertheless fall short of the holy grail which has been so widely discussed in the literature over the past decade. We evaluate progress to date and reflect on whether the holy grail is in fact attainable.

Hybrid Simulation Models for Healthcare: Putting It all Together

SESSION 3 - 3A

Israel Vieira*

TUE SESSION 3 | GLAMORGAN COUNCIL CHAMBER | 10:00 - 10:30

Keywords: Methodology, Hybrid Models, Simulation, Healthcare Applications, OR Software

Healthcare systems are embedded into the community they serve, they integrate a large network of service providers and exhibit dynamic, detailed and behavioural complexity. Health systems are highly intolerant to failure and are under constant and sustained pressure to deliver better services. Effective and sustainable decision making in healthcare requires tools that can encompass complexity, handle variability and foresee the consequences of actions. In considering simulation models for healthcare, there are three major methodologies widely used for model development: System Dynamics (SD), Discrete Event Simulation (DES) and Agent Based Simulation (ABS). The first two were introduced in the 1950's and 1960's respectively and are well established in the field, whilst agent based modelling was adopted by simulation practitioners in 2000 and has since gained popularity. In practice, SD models deal with high-level abstractions and excel on encompassing dynamic complexity. DES models capture detailed complexity and are widely used to support operational decision making. ABS models can handle both dynamic and detailed complexities; however ABS strength is on capturing autonomous behaviour at the individual level. In this talk we evaluated the extent to which hybrid models can capture the dynamics of complex healthcare systems, review existing tools supporting the development of multi-method models, and define best practice for combining methodologies into one model.

ABSTRACTS

OPERATING ROOM PLANNING AND SCHEDULING

A Chance-Constrained Stochastic Model for Operating Room Assignment

SESSION 1 - 1B

Angela Testi*, Elena Tanfani, Paolo Landa

MON SESSION 1 | GLAMORGAN -1.63 | 13:00 - 13:30

Keywords: Operating room planning, Random surgery durations, Stochastic programming, Monte Carlo simulation

This paper deals with the Operating Rooms (ORs) planning problem, considering stochastic surgery durations. Given a surgery department made up of different surgical sub-specialties sharing a fixed number of ORs and beds, the aim is determining patients allocation to operating blocks along a given planning horizon. The problem is firstly formulated by a chance-constrained stochastic model that considers the variability pertaining surgery durations by means of probabilistic capacity constraints for each OR block. The solution approach starts by the patient assignment obtained assuming deterministic Expected Operating Time (EOT) for each patient. The deterministic plan can be obtained by means of an exact 0-1 model, previously published, or by ad hoc metaheuristic methods. Afterwards, a Montecarlo simulation algorithm generates for each patient the Real Operating Time (ROT) following several probability distributions. Then, a Local Search algorithm is applied to swap patients inside and outside the OR deterministic plan until a robust solution is reached and the cost of uncertainty is minimized. The results of the solution framework are tested comparing several instances varying the basic feasible initial solution (exact 0-1 model, Tabu search and greedy algorithms), search parameters as well as probability distributions for surgery durations.

More levelled bed occupancy and controlled waiting lists using Master surgical schedules

SESSION 1 - 1B

JM van Oostrum*, L Evers, APM Wagelmans

MON SESSION 1 | GLAMORGAN -1.63 | 13:30 - 14:00

Keywords: Master surgical scheduling, hospital planning and scheduling, health care efficiency, operating rooms

Scheduling surgical patients is one of the complex organizational tasks hospitals face daily. Master surgical scheduling is one way to optimize utilization of scarce resources and to create a more predictable outflow from the operating room towards subsequent hospital departments. The paper addresses two aims. First, the effect of planning parameters in a master surgical scheduling approach such as the length of a planning horizon on patients waiting time, schedule stability and hospital efficiency are determined. Second, the master surgical scheduling approach is compared with a standard operating room planning approach on levelled bed occupancy. The assignment of patients to a master surgical schedule is carefully described. Using real case data from a regional hospital in the Netherlands a simulation study is performed. Results show that only the planning horizon has substantial influence on outcome parameters waiting time, schedule stability and hospital efficiency. We found that increasing the planning horizon increases patients waiting time on the one hand, but also increases schedule stability and hospital efficiency on the other hand. Regarding our second aim, we found that using an MSS substantially decreases variability in bed occupancy levels. The approach is applicable to any other hospital.

ABSTRACTS

Hospital case mix and capacity planning: A model-based integrative approach

SESSION 1 - 1B

Guoxuan Ma*, Erik Demeulemeester

MON SESSION 1 | GLAMORGAN -1.63 | 14:00 - 14:30

Keywords: Patient case mix, capacity planning, master surgery scheduling, resource efficiency, service level

Hospital case mix and capacity planning involves the decision making both on patient volumes that can be treated at a hospital and on resource requirements and capacity management. In order to advance both the resource efficiency and the service level, a multilevel integrative approach to the hospital planning problem is proposed based on the techniques of mathematical programming modeling and simulation analysis in this research. It consists of three stages, namely the case mix planning phase, the master surgery scheduling phase and the operational performance evaluation phase. At the case mix planning phase, hospitals are prone to choose the optimal patient mix that can bring maximum profits from the viewpoint of resource efficiency. Then, in order to improve the health care service level, the total expected bed shortages due to the variable length of stay of patients are minimized through leveling the daily bed occupancy of each ward at the master surgery scheduling phase. After that, a discrete-event simulation model is developed to evaluate the operational performance of the decision-making on patient case mix and resource capacity under variability. Moreover, in order to enhance the trade-offs between efficiency and service, a few effective operational policies are suggested and analyzed through simulation experiments at the operational performance evaluation phase. The three stages are interacting and are combined in an iterative way to make sound decisions on hospital case mix and capacity planning.

Hospital Operating Theatre Scheduling – Advanced Booking of Individual Patients

SESSION 3 - 3C

Marion Penn*, Chris Potts, Paul Harper

TUE SESSION 3 | GLAMORGAN -1.64 | 09:00 - 09:30

Keywords: Simulation, Operating Theatres, Stochastic Programming

Hospitals face demanding targets to reduce waiting times and avoid cancellations, whilst being required to work within increasingly tight budgetary and resource constraints. Therefore, it is important that hospitals make efficient use of their resources through detailed planning and efficient systems. The use of operating theatres plays a significant role in this, as they are a costly resource to run and are often needed for patients with long care pathways. After a brief discussion of the literature, this talk demonstrates how mathematical simulation allows the exploration of different scheduling strategies for booking operations. The results of this simulation illustrate the potential impact of changing strategies on the waiting times for patients using ophthalmology data from a local hospital. The simulation model has being developed in collaboration with staff at the hospital to allow them to test scheduling strategies, including consideration of the circumstances in which the strategies perform badly. The results include some scenarios suggested by the hospital staff as well as others developed by the research team. Discussion of ongoing and further work considers the potential use of stochastic programming to provide optimal solutions to compare to those achieved by the simulated strategies. This stochastic programming may suggest improvements to the scheduling strategies.

ABSTRACTS

Multimethodology in surgery optimization: How Soft Systems Methodology and Discrete Event Simulation work together to make surgery more efficient

SESSION 3 - 3C

Lene Berge Holm*

TUE SESSION 3 | GLAMORGAN -1.64 | 09:30 - 10:00

Keywords: Multimetodology, Soft systems methodology, Discrete event simulation , Surgery optimization

The Central Surgery Unit of Akershus University Hospital (Ahus) consists of 14 operating rooms (ORs) and handles emergency surgeries and surgeries for in-patients at the hospital. Due to a restructuring of the hospital districts of the greater metropolitan area of Oslo, Ahus is expecting to increase the number of surgeries by 35 percent in 2011. The overall aim of this project was to investigate how and whether the unit would be able to meet this increase without increasing the number of ORs and with minimal use of staff overtime. For this, a combination of the problem structuring method soft systems methodology (SSM) and discrete event simulation (DES) modelling was used. The original seven step process of SSM was in general followed, with the DES model development inbetween. In step five the conseptual world from the SSM parts of the project was compared to the real world as viewed from the DES models persepctive in order to identify improvements which are both desirable and feasible. The results show that an average surgery occupies one OR for 176 minutes. From the simulation model we see that there are no critical bottlenecks in the system but rather that it is the sum of each small activity which is the time consuming factor. From the SSM parts of the project several areas of improvements were identified, the most important being communication and cooperation; teamwork and team leadership; capacity of other hospital units; and work schedules. Suggestions for improvements with both direct and indirect impact on the surgical activity were presented for and well received by the hospital management. This project shows that using a combination of SSM and DES works well when analysing health care systems where both patient flow and human interactions are central.

Simple heuristics for planning elective surgeries in a Portuguese hospital

SESSION 3 - 3C

Ines Marques*, M. Eugenia Captivo, Margarida Pato

TUE SESSION 3 | GLAMORGAN -1.64 | 10:00 - 10:30

Keywords: Operating rooms, Elective case scheduling, Heuristics

Resources rationalization is an imperative of our times, also present in health care services sector. This is an objective highlighted in the National Health Plan for 2004-2010. As a priority objective for the health sector, this plan also aims to reduce waiting lists for surgery. This work is motivated mainly by these two strategic factors for health care in Portugal, for which we intend to give a contribution using operational research. Two conflicting objective functions were considered: maximize surgical suite occupation and maximize the number of surgeries scheduled. Constructive and improving heuristics to address those objectives in the elective surgeries planning problem were developed. Hybrid heuristics were also tested, using part of the constructive procedure together with the optimization of a reduced integer linear programming model. The work was based on a real case of elective surgery planning in a Portuguese hospital, located in the health service sub-region of Lisbon, and incorporated within the Portuguese National Health Service. The heuristics developed were applied to real data from the hospital studied. The heuristics have showed to be very fast and provided good quality solutions for the two objectives under study. At the talk, the heuristics developed will be presented and the results of its application to real data from the hospital will be discussed and compared with results from an integer linear programming approach. The surgical plans obtained from the methodologies proposed were simulated in order to analyze its viability. The results are analyzed and compared with the actual performance of the surgical suite regarding the impact on productivity indicators of the surgical suite, namely on the regular time occupancy rate and on the waiting list reduction rate.

ABSTRACTS

Operating Rooms Planning and Scheduling a case study

SESSION 9 - 9C

Isabelle Beaulieu*, Angel Ruiz, Patrick Soriano

THU SESSION 9 | GLAMORGAN -1.64 | 15:30 - 16:00

Keywords: Surgery planning, case scheduling, operating rooms, case study, survey

Operating rooms are considered as one of the most resource consuming services in modern day hospitals. Operating room managers must face conflicting constraints in order to manage resources efficiently. Schedules which both maximize resource utilization and minimize cancellations and overtime must be built. In this project, we are working with Centre hospitalier de université Laval (CHUQ), a major teaching hospital, located in Quebec City. This institution is composed of three surgical suites located in different buildings across the city. Each center has its own subspecialties and is facing its own challenges. Through a series of interviews with various managers from the CHUQ, we mapped their planning process from the strategic to the operational level. Then, we compared their approach to what has been found in the literature. Our analysis covers waiting list management, pre-anaesthesia resources coordination, OR planning and scheduling, OR resources management, uncertainty management and post-anaesthesia care. This comparative analysis allowed us to identify the main factors influencing the decisions pathway. From there, we built a survey that is currently forwarded to OR managers in different types of hospital in order to confirm the influence of the main factors identified on the decisions pathway.

Long term policies for operating room planning

SESSION 9 - 9C

Alessandro Agnetis, Alberto Coppi, Gabriella Dellino, Carlo Meloni, Marco Pranzo*

THU SESSION 9 | GLAMORGAN -1.64 | 16:00 - 16:30

Keywords: Operating room planning, elective surgery, algorithm, simulation

This paper deals with the Operating Room planning problem. Given an Operating Theater composed of several (and possibly different) Operating Rooms, and given for each surgical discipline a waiting list of elective surgeries to be performed, the aim is to allocate operating rooms to surgical disciplines and elective surgeries to operating rooms so to minimize delays and reduce waiting times. In this paper, we study different management policies for computing the weekly Master Surgical Schedule and to allocate surgical cases to be performed during the week. The proposed policies are implemented by means of mathematical formulations and heuristics and are evaluated on the basis of an annual simulation. Several indicators are computed for each simulation run including operating rooms utilization, throughput and lateness, and these indicators are used to assess the effectiveness of each proposed policy. Computational results obtained by applying the proposed models to a medium size hospital in Tuscany are presented.

ABSTRACTS

PATIENT FLOW MANAGEMENT

An integrated hospital dynamics simulation model

SESSION 1 - 1C

Kiok Liang Teow*, Joe Sim, Eugene Fidelis Soh, Joanne Yap, Palvannan R.K., Zhecheng Zhu, Sally Brailsford

MON SESSION 1 | GLAMORGAN -1.64 | 13:00 - 13:30

Keywords: System dynamics, hospital planning

Access to care and quality of care are strongly dependent on the availability of manpower and infrastructure, both of which are scarce and expensive. Hospital operations are highly complex: cause-effect mechanisms may not be obvious and can take a long time to become apparent. In addition, population ageing and other changes to the healthcare landscape will also influence the demand for various hospital services. The aim of our research study is to create a System Dynamics model to capture the complex interactions within a hospital for medium to long-term planning. Our planning horizon is about 6 months to 3 years. The main service centres modelled will include A&E, specialist outpatient clinics, inpatient wards and operating theatres. This will be a joint study with two existing hospitals and one new hospital, still at the planning stage, to be ready in 2014. Together with the hospital administrators, the research team (comprising mainly operations researchers, with support from health services research, epidemiology and health economics) will identify the strategic issues and map the linkages between hospital units and the policy levers available to management. We plan to carry out the development in three phases. Phase 1 will capture the patient flows between various service centres and will validate the model with hospital-level data. In phase 2, we will disaggregate the model into more detailed sub-systems, e.g., by key medical specialties. We will also include feedback mechanisms manifested as the hospitalâ€™s explicit or implicit reactions to workload or service level changes. In phase 3, we shall explore feedback loops which are more qualitative in nature. This research is funded by Health Services Research Grant, Ministry of Health, Singapore.

A decision support tool for hip and knee osteoarthritis health service delivery

SESSION 1 - 1C

Michael Carter, Deborah Marshall, Sonia Vanderby*, Paul Rogers, Tom Noseworthy, Robert Lee,

MON SESSION 1 | GLAMORGAN -1.64 | 13:30 - 14:00

Keywords: System dynamics, osteoarthritis, modelling, simulation, service delivery

Osteoarthritis (OA)is an incurable chronic condition in which joint cartilage deteriorates leading to pain, stiffness and swelling. Joint replacement surgery is the only effective treatment for end-stage OA. OA typically affects older adults, with obesity and family history being key risk factors. Given Canada's aging population and rising obesity, the prevalence of OA is expected to grow, placing additional pressure on the health care system which is already contending with poor medical management and lengthy wait times for consultations and joint replacement surgeries. Improved resource and system planning are crucial to achieving system improvements. This research examines the OA care process in the province of Alberta. OA wait times are a priority area for the provincial government, which is focused on improving the quality of care, particularly in terms of accessibility, effectiveness and efficiency. Alberta Health Services wishes to evaluate the effect of several factors, such as OA incidence and service wait times, on the future demand for health services and resource requirements, yet lack tools that are capable of such analysis. We present a system dynamics model we develop to meet these needs. The model encompasses the complete care process, from the onset of OA, through self treatment, medical management and surgical interventions, post-surgical care as well as short and long-term follow-up. Multiple workshops with experts from across the system were held to determine the existing care process as well as the key factors affecting patient flow across the system, the resources, time factors and costs involved with the system. Data to populate the model were obtained from numerous sources including administrative databases and population survey data. This presentation will include the results of the model under various "what-if" scenarios.

ABSTRACTS

Mapping the Capacity and Demand for Specialist Haematology Outpatient Services

SESSION 1 - 1C

Navonil Mustafee*, Fiona Hughes, Korina Katsaliaki, M. D. Williams

MON SESSION 1 | GLAMORGAN -1.64 | 14:00 - 14:30

Keywords: Discrete Event Simulation, Simulation Model Reusability, Consultant Clinics, Modelling Haematology OPD Services

Discrete-Event Simulation (DES) has predominantly been used in healthcare operations management. In this work the authors present an ongoing DES-based study, undertaken together with a local UK NHS health board, which investigates the outpatient capacity and demand for specialist haematology services. These services are delivered in clinics that span across four hospitals and the resources (i.e., consultant haematologists) delivering these services are drawn from a central resource pool (i.e., the Department of Haematology based in Singleton Hospital, Swansea, Wales). In this study we differentiate between the stakeholders objective and the model reusability objective, with the former contributing to simulation practice and the latter to the advancement of simulation theory. The primary stakeholders objective of this study is to test strategies for service consolidation, appointment rescheduling and reduced Referral To Treatment (RTT) waiting time. Regarding reusability the objective is to model the simulation with the granularity that would enable it to be tested for suitability in similar healthcare operations contexts.

Investigating Control Policies to Mitigate Hospital Congestion

SESSION 2 - 2B

Renata Konrad*, Tze Chiam, Lori Pelletier, Mark Lawley, Arunachalam Chockalingam

MON SESSION 2 | GLAMORGAN -1.63 | 15:30 - 16:00

Keywords: Patient Flow, Petri nets, Stochastic Control

Over two-thirds of hospitals in the United States report experiencing hospital overcrowding. Congestion delays medical treatment; comprises care quality; and represents a loss of revenue. This research evaluates the effects of coordinating services, resources, and care providers to relieve hospital congestion at the University of Massachusetts Memorial Healthcare Center. In this talk, we discuss a variety of tools we have been using to address hospital congestion. This includes using Petri net models to observe the proximity to a hospital entering a congested state; reproducing the care paths for patients from transactional data to recreate the work requirements for a hospital; and examining policies regarding geographic cohorting which seek to improve the placement of General Medicine patients from the emergency department (ED) to inpatient units.

A study of the patient assignment problem with gender constraints

SESSION 2 - 2B

Wim Vancroonenburg*, Frits C. R. Spieksma, Greet Vanden Berghe, Patrick De Causmaecker

MON SESSION 2 | GLAMORGAN -1.63 | 16:00 - 16:30

Keywords: Patient assignment, Bed planning, Complexity

The patient assignment (PAS) problem is a combinatorial optimization problem that arises at the operational level of hospital admission offices. The aim is to find an efficient plan for assigning patients to hospital rooms, considering the availability of rooms and equipment, and patients clinical conditions, all the while taking into account hospital policies. Such an efficient plan is relevant considering the increasing pressure on hospitals to meet a high occupancy with fewer means. The PAS problem considers the assignment of a set of patients, with different admission dates and different lengths of stay, to hospital rooms of limited capacity over a given time horizon. Certain given costs are associated with the assignment of patients to rooms. The problem is to find a minimum cost assignment of patients to rooms subject to some side constraints, in particular: no male and female patients should be assigned to the same room at the same time. The present work establishes the problem complexity, and discusses various solution approaches (heuristic, ILP) to the PAS problem.

ABSTRACTS

Hospital-wide flow management of elective patients

SESSION 6 - 6C

Rainer Kolisch*, Daniel Gartner

WED SESSION 6 | GLAMORGAN -1.64 | 09:00 - 09:30

Keywords: Patient flow management, Diagnosis-related groups, Scheduling

We consider the problem of planning the flow of elective patients in a hospital. For each patient the Diagnosis-related group (DRG) and the clinical pathway are given. The DRG and the length of stay determine the revenue the hospital will receive for a patient. The clinical pathway of a patient defines the clinical procedures to be performed and precedence relations between them. Resources such as diagnostic devices, the operating theater, and beds which are required by the procedures within the clinical pathways are limited. This problem is closely related to admission planning but instead of deciding on the number of patients for fixed schedules we decide for a fixed number of patients on the schedule (patient flow) of each patient. To this end we model the problem as a resource-constrained multi-project scheduling problem (RCMPSP) with minimum and maximum time lags. We propose a zero-one programming formulation with the objective to maximize the DRG-based contribution margin taking into account limited resources. In a computational study where we employ data from a midsize hospital we can show that solving the zero-one programming formulation with standard optimization software can be done fast enough for practical applications. Furthermore, we show that the solutions obtained with our approach considerably improve the solutions currently employed in the hospital.

A case study using simplified discrete-event simulation models as a tool to reconfigure health care services

SESSION 6 - 6C

Anthony Virtue*, Thierry Chaussalet, John Kelly

WED SESSION 6 | GLAMORGAN -1.64 | 09:30 - 10:00

Keywords: DES, health care, Emergency

Over the last decade, real spending in the United Kingdom NHS doubled in real terms to meet government targets including moves to increase spending rates to other EU countries and increasing health demands both as a result of increasing population of the elderly and illness related to lifestyle. However, in 2009-10 the impact of the economic and financial crises and the resulting structural deficit prompted fiscal tightening which would impact all areas of public financing including the NHS. There is evidence to suggest that billions could be saved by productivity savings and by service reconfiguration. Simulation modelling could be a powerful tool to help unlock those potential savings and inform service reconfiguration at a strategic level. Although simulation modelling has been around for many years and many health related papers have been produced, arguably there has been lack of real world benefit. Suggested reasons for lack of real world benefit include the scale, complexity and diversity of health care delivery. Other observations point to the fact that academics get rewarded for publishing large complicated models with detailed analysis rather than focusing on the requirements of the environment or the needs of implementation. This case study attempts to address some of the shortcomings of real world modelling contribution by showing that average simulation process times can act as estimators for real length of stay in health care environments. Using A&E data, this case study will illustrate how average process time models could be used to reconfigure emergency services by specific patient groups (pathways). Developed models also illustrate pathway specific information such as the effects of queues and resource utilisation. Average time simulation models have the added value that they help to simplify models, make them more transparent and reduce development time making potentially making valuable contributions towards real world impact.

ABSTRACTS

Optimizing hospital bed allocation based on DES model output

SESSION 6 - 6C

Lene Berge Holm, Fredrik A. Dahl*, Mathias Barra

WED SESSION 6 | GLAMORGAN -1.64 | 10:00 - 10:30

Keywords: DES, hospital, bed, utilization, optimization

We briefly describe a DES model for bed utilization in a Norwegian general hospital, which was presented at ORAHS 2010. The model is well validated, and accurately represents patient flow through the hospital wards. In the present study, we investigate ways of optimizing bed allocation off line from the simulation, based on model output. We assume that a ward will be able to handle all the patients that it is likely to receive, through so-called crowding beds, which means that additional beds are moved into the patient rooms, or even placed in the corridors when needed. Our goal is to minimize the usage of such crowding beds by allocating the regular beds among the wards intelligently. The model output is generated as a matrix M, where M(w,b) gives the frequency with which there were at least b patients in ward w at midnight. We define an algorithm that works by allocating beds in sequence, always choosing a ward where an additional bed is utilized the most. We prove that this greedy algorithm optimizes the use of regular beds, and thereby minimizes the use of crowding beds. Our measure of effectiveness (MOE) can be interpreted as the prevalence of patients in crowding beds at midnight. If, instead, we define the MOE as the incidence of crowding bed usage (i.e. the frequency with which patients are initially placed in a crowding bed), the optimization problem can still be studied off line, but it will then be an NP complete combinatorial problem.

Simlean Healthcare: Using Simulation and Lean to Improve Healthcare Systems

SESSION 6 - 6C

Claire Worthington*, Stewart Robinson

WED SESSION 6 | GLAMORGAN -1.64 | 10:30 - 11:00

Keywords: Simulation, health, lean

Simulation models of healthcare systems have been built for over 50 years, their impact on practice, however, is disappointing. This has been attributed to cost, time, data demands and the lack of stakeholder engagement. Lean thinking has received attention over the last decade as an approach for improving healthcare systems. Although it has had some successes, sustaining its implementation and ideology is a major challenge. Since simulation and lean have a similar motivation, that is to improve processes, we have brought them together in this work in an effort to improve the implementation of simulation and the sustainability of lean. SimLean uses simulation differently in its three modes. SimLean Educate: simulation illustrates key lean principles SimLean Facilitate: rapid development of a dynamic process map during a lean workshop facilitates discussion around process improvements SimLean Evaluate: detailed simulation developed post workshop evaluates proposed process improvements more thoroughly In SimLean Facilitate we build simple simulation models rapidly. These are models of the process maps that the stakeholders themselves have assembled as they apply lean principles to their work. Examples of our experiences of using this approach will be presented. The opportunities provided to engage wider audiences with simulation and lean for sustained improvements will be explored.

ABSTRACTS

Stochastic Structural Policies for solving the Nurse Assignment Problem under Continuity of Care in Home Care

SESSION 7 - 7B

Ettore Lanzarone*, Andrea Matta

THU SESSION 7 | GLAMORGAN -1.63 | 09:00 - 09:30

Keywords: Home Care, Reference nurse, Assignment problem, Continuity of care, Stochastic orders

Home Care (HC) providers are complex organizations that manage a large number of patients, different categories of operators, support staff and material resources in a context affected by high variability. A robust resource planning is crucial for operating in HC organizations; in particular, under continuity of care, one of the main issues is the assignment of the reference nurse to the assisted patients, since this decision has an impact on the nurse workload for the whole duration of stay of the patient. At the same time, this topic is also challenging, since in the literature the high variability of patient demands is still neglected in the assignment. We derive a set of structural policies for solving the assignment problem of the reference nurse under continuity of care, taking into account the randomness of patient demands and nurse workloads. The goal of the policies is the minimization of a stochastic cost function related to the visits that each nurse provides above his/her capacity. This is an innovative approach with respect to the usual practice of HC providers, where each new patient is assigned to the nurse with the highest expected available capacity, as the difference between the capacity and the expected workload. Results from the implementation in a relevant real case show that the assignments proposed by the policies are often discordant with respect to the ones obtained with the expected available capacity. The policies provide a significantly higher workload balancing and a lower cost for patients with high demand variability. Considering the typical classification of HC patients (palliative and non palliative care patients), this refer to non palliative patients. In districts related to palliative patients, the demand is more predictable and, therefore, to consider uncertainty in the nurse assignment by means of the policies does not add significant benefits

What is happening to the special accommodations for elderly persons in Stockholm, Sweden?

SESSION 7 - 7B

Marten Lagergren*

THU SESSION 7 | GLAMORGAN -1.63 | 09:30 - 10:00

Keywords: LTC, accomodations, simulation , dementia , flow

There exists in Sweden two different types of LTC accommodations for persons with dementia and for frail elderly in general. Using data from the SNAC-study collected in the Kungsholmen district, Stockholm, during the period 2002 - 2010, it has been observed that these two types have tended to be more and more similar to each other when it comes to the composition of the care recipients especially with regard to the proportion of persons with dementia. Is this a desirable development? Why is it happening? What can be done to break it? There are several possible explanations for the development in other accommodation Inflow of cognitively disabled persons? More rapid development of cognitive disability? Reduced mortality for cognitively disabled? The development has been analysed by decomposing the development in average cognitive disability into inflow, yearly change and outflow. By simulating alternative distributions of the inflow between dementia accommodatio and othe the effect of the distribution of inflow can be analysed. Conclusions: Mortality is about the same in both forms of accommodation around 30%. Average yearly cognitive decline standardized for degree of disability is somewhat more rapid in dementia accommodation than in othe. People with cognitive disability are moving into othe accommodations to an extent that makes the proportion of cognitively disabled persons gradually increase. Moving into dementia accommodation is subject to dementia assessment and diagnosis. The main reason for the development is that these assessments lag behind. The result is that cognitively disabled person lacking diagnosis are moving in to other accommodatios. The present development seems to be harmful for the demented persons and the staff as well! The obvious remedy is to expand resources for dementia assessment and change the distribution of places.

ABSTRACTS

Modelling the elderly patient's length of stay in hospital using the discrete conditional phase-type distribution in Italy

SESSION 7 - 7B

Adele Marshall*, Mariangela Zenga

THU SESSION 7 | GLAMORGAN -1.63 | 10:00 - 10:30

Keywords: Coxian phase-type distributions, discrete conditional phase-type models, patient length of stay, elderly healthcare

This paper considers the discrete conditional phase-type distribution (DC-Ph) for modelling patient length of stay conditioned on a set of inter-related patient characteristics known on admission to hospital [1]. The DC-Ph comprises of two components. The first component represents the inter-relationships of patient characteristics classifying the patients into different survival groups according to similar characteristics. The second component represents the length of stay for each of the survival groups according to the Coxian phase-type distribution which has previously been considered to give a suitable representation of the skewed patient survival data [2]. This is achieved by representing the patient length of stay as a stochastic process consisting of a series of phases of care through which the patient moves until they eventually leave the system completely. The model is used to represent the length of stay of elderly patients in hospitals in the Lonbardy region of Italy. Patient characteristics include similar information to those variables recorded in the UK system. The resulting model demonstrates how patient characteristics interact to influence patient outcome and length of stay. This is contrasted with a similar model developed for elderly patients in the UK National Health System. With the proportion of elderly increasing in countries across Europe, the demands placed on health care systems continue to increase placing further pressure on hospitals to deliver high quality care for more patients at less cost. Such a model has the potential of being able to predict length of stay on admission of a patient to hospital. This gives hospitals time to prepare in advance for the patient discharge. It is hoped the advantage of forward planning for patient discharges will prevent the future occurrence of bed blocking caused by a lack of social support care at the time of discharge from hospital.

[1] Marshall A H, Burns M L, Shaw B (2007) Patient Activity in Hospital using Discrete Conditional Phase-type (DC-PH) Models, Skiadas (Ed), Recent Advances in Stochastic Modelling & Data Analysis, pp. 154 - 161
[2] MARSHALL , A. H. and MCCLEAN, S. I. (2004). Using Coxian Phase Type Distributions to Identify Patient Characteristics for Duration of Stay in Hospital. Health Care Management Science, 7 (4), pp. 285-89

Modelling Activities at a Neurological Rehabilitation Unit

SESSION 7 - 7B

Richard Wood*, Jeff Griffiths, Janet Williams

THU SESSION 7 | GLAMORGAN -1.63 | 10:30 - 11:00

Keywords: Neuro-rehabilitation, Queuing Theory, Scheduling

A queueing model of a specialist neurological rehabilitation unit is presented. The application is the Neurological Rehabilitation Centre (NRC) at Rookwood hospital (Cardiff, UK). The NRC serves a population of about 1.5 million across South-East Wales and has an estimated annual demand of 375. This significantly exceeds the annual throughput of the centre which, with 21 beds and an average LOS of four months, is just 63. Together with a significant bed-cost per day (£500) this makes the centre an expensive and highly sought-after service; and thus, a prime candidate for mathematical modelling. Central to the queuing model is the concept that the level of treatment intensity has an effect on patient LOS. In particular, it has an effect on the active component of LOS, that is, the length of time for which the patient is subject to purposeful rehabilitation. Conversely, blocked LOS is defined as the length of time from discharge readiness until ultimate discharge. The model is comprised of four stages. First, appropriate patient groups are determined. Second, a purpose-built scheduling program is used to predict the average amount of treatment provision to patients of each group. Third, these predictions are used to estimate the mean LOS for each patient group. Finally, the queuing model is constructed. This consists of a number of disconnected homogeneous server queuing systems; one for each patient group. A computer program has been written to determine analytic and numeric results for each disconnected system. A Coxian phase-type and exponential distribution are used to model active and blocked LOS respectively for each system. Ultimately, steady-state probabilities, performance measures and costs are output for the holistic queueing model. The model is then subject to a number of hypothetical "what if" type scenarios.

ABSTRACTS

Simulation modelling for stroke care delivery in Scotland

SESSION 8 - 8A

Evin Jacobson*, Steffen Bayer, James Barlow

THU SESSION 8 | GLAMORGAN COUNCIL CHAMBER | 13:30 - 14:00

Keywords: Simulation, DES, modelling, stroke, telemedicine

Stroke care delivery consists of multiple stages, namely prevention, hyper-acute, acute, and rehabilitation. We are especially interested in the hyper-acute stage. Fast imaging of the brain is required for the diagnosis of the type of stroke in order to select patients with an infarction for thrombolysis. This clot-busting treatment cannot be administered after a three to four hour time window or to patients with a haemorrhage. We conduct a simulation study considering Scotland as a location where geography can make the access to timely diagnostic of stroke challenging. Our aim is to develop a methodology for improving stroke care delivery in Scotland by means of a quantitative tool that will assist in better allocating a limited budget on interventions. We model the system using discrete-event simulation (DES), focusing on a system-wide overview of stroke care delivery, especially the interactions between the health care resources involved in stroke care and alternative patient pathways. One such pathway uses a teleradiology link between hospitals to increase the number of hours that thrombolysis can be administered, as the CT scans can be interpreted by a radiologist remotely. This intervention provides an alternative method for stroke care delivery, especially to rural regions with under-staffed hospitals. Another pathway using teleradiology is the earlier administration of thrombolysis through the use of an ultrasound device in ambulances. This method would work by equipping ambulances with ultrasound devices that can be used in the field, and then sending the images using wireless internet to radiologists for interpretation. This method would decrease the negative effects of geographical location on a patient, hence providing equality in access to stroke care. We present the DES model and discuss the implications of the preliminary results obtained from the model.

Tactical Resource Allocation and Elective Patient Admission Planning in Care Pathways

SESSION 8 - 8A

Peter J.H. Hulshof, Richard J. Boucherie, Erwin W. Hans*, Johann L. Hurink

THU SESSION 8 | GLAMORGAN COUNCIL CHAMBER | 14:00 - 14:30

Keywords: Care pathways, mathematical programming, resource planning, admission planning, tactical planning

Long access time to hospital resources may cause patients to seek treatment elsewhere. To manage access times, we propose an iterative method involving Integer Linear Programming (ILP) to develop a tactical resource allocation and elective patient admission plan for a planning period. Tactical planning encompasses equitably balancing access times, efficient use of resources, and meeting production quota. Our method uses information on care pathways, waiting lists, expected demand and available capacity, and our results indicate that access times can be effectively managed with tactical planning.

ABSTRACTS

Unit utilization versus care-pathway throughput time: finding a balance.

SESSION 8 - 8A

Sylvia Elkhuizen*, Jan Vissers

THU SESSION 8 | GLAMORGAN COUNCIL CHAMBER | 14:30 - 15:00

Keywords: Patient flow, care pathways, throughput time, Simulation

Hospitals tend to focus in their optimization efforts on unit-performance. Productivity, doing as many as possible patient consultations, examinations, surgical procedures or admissions with the available capacity, is a key parameter in reporting the performance of a unit. However, a patient experiences a care pathway not as a sequence of independent units, but as a chain. Pushing patients through this chain, with waiting times at each step can be suboptimal, for the patients but also for the hospital. In output financed systems, hospitals get paid after completion of the pathways. This focus on unit-productivity hinders the reduction of throughput time in care-pathways. In this study we followed a modeling approach to investigate the effects of capacity-utilization of a care unit on the system performance, measured in terms of throughput-time, waiting times and sojourn times of patients from the first visit to the end of their care-pathway. To investigate the trade-off between unit-optimization and throughput-times in care pathways, we developed a simulation model and applied to the setting of VieCuri, a medium-sized hospital in Venlo, the Netherlands. For the purpose of the study, we demarcated our project to a representative part of the hospital. We chose the MRI as central diagnostic unit and selected six patient groups that consider the MRI as key part of their care-pathway. To include the throughput-time perspective we also take into account care steps before and after visiting the MRI. To investigate the relationship between MRI-utilization and throughput times we simulated a range of MRI-utilizations. To include also the effects of the utilization of other units such as outpatient clinics and operating theatres on this relationship, we repeated this simulation-experiment for different utilizations of these units. The results of these analyses were used to formulate conclusions for the relationship between unit utilization and care-pathway throughput time.

Towards Modelling Patient Pathways through the Perinatal Network System focusing on high dependency cots in the local neonatal unit

SESSION 9 - 9B

Sarah Dalton*, Thierry Chaussalet

THU SESSION 9 | GLAMORGAN -1.63 | 15:30 - 16:00

Keywords: Neonatal network, high dependency cots, forecasting, capacity planning

Each English neonatal network is composed of many more local neonatal units than intensive care centres. Much previous work has looked at intensive care cots in intensive care centres. High dependency cots in a local neonatal unit are important since they represent another node in the middle of the complex perinatal network system. We wish to model the occupancy of such cots in order to better forecast their use. What work you decide to accept today could produce a future high dependency cot block. We would like to predict the probability of cot blocks on a three day time horizon. While there are two routes out for such patients there are many more routes in, which can lead to congestion and has adverse upstream implications for intensive care cots in neonatal intensive care centres. A kind of short-term futures market for high dependency cots could be quite useful. We explore patient pathways through high dependency care in a local neonatal unit.

ABSTRACTS

The dynamics of inter-organizational collaboration: On redesigning obstetric care.

SESSION 9 - 9B

Angele Pieters*, Henk Akkermans, Kim Oorschot, Thierry Dessel, van, Charlotte Oorschot, van

THU SESSION 9 | GLAMORGAN -1.63 | 16:00 - 16:30

Keywords: System dynamics, obstetric care, inter-organizational collaboration

For a long time, Dutch obstetric care is internationally known and often used as an example for other developed countries. However, recently, more and more flaws of the system have been coming up, such as high perinatal and maternal morbidity and mortality rates. Previous research casts doubts on the effectiveness of the organization of Dutch obstetric care, as a health supply network (Pieters et. al., 2010). Obstetric care is organized as a two-tiered system where independent midwifery practices take care of normal pregnancies and obstetric departments in hospitals take care of high-risk pregnancies. As a result, close collaboration between professionals from different organizations is required because a pregnancy can alternate between a normal and a high-risk one, resulting in transfers of the pregnant woman between organizations. This research aims to answer the following: Will a different organizational system provide better outcomes? And if so, under what conditions? Focus lies in particular on the quality of inter-organizational collaboration. Our approach is that of system dynamic simulation. The structure of the system dynamic model is based on a more general model; the SERVQUAL model (Parasuraman et. al., 1985) extended with insights from health care and operations management. In this particular case setting, the model is grounded in data analysis regarding patient flows between organizations (Pieters et. al., 2010), and in group model building sessions with professionals aimed at understanding the dynamics of inter-organizational collaboration in Dutch obstetric care (Pieters et. al., 2011). The model consists of several feedback loops, such as the reinforcing feedback loop of the following variables: wellbeing pregnant women demand on the system work pressure staff competences quality of service delivered wellbeing pregnant women. Different scenarios regarding levels of collaboration and of organizing workflows are simulated in order to come to recommendations on how to improve the system.

ABSTRACTS

PERFORMANCE MEASUREMENT AND EVALUATION

Performance measurement in healthcare: some lessons

SESSION 5 - 5A

Mike Pidd*

TUE SESSION 5 | GLAMORGAN COUNCIL CHAMBER | 13:30 - 14:00

Keywords: Performance measurement, Improvement, Control, Benchmarking, Public interest

How can people be confident that they receive high quality health services in return for their taxes? How can those who provide services compare their performance with others and encourage a culture of continuous improvement? How can governments be sure that public services are effective, efficient and equitably provided? These are big questions and there is nothing that will guarantee high quality health services; people who claim otherwise are peddling snake oil. The day-to-day task of managing and providing health services within tight budgets is difficult, but can be very satisfying. As part of this, performance measurement per se is neither good nor bad. It can be done well or poorly. It can provide useful information and support innovation and development, or it can become part of heavy-handed central control that stifles development. This paper considers the different reasons for measuring the performance of public healthcare providers, using root definitions from Soft Systems Methodology to provide some structure to the discussion. The paper moves on points out the things that can go wrong, so as encourage better practice. It argues that performance measurement is a vital part of any systematic attempt to continually improve public services. It is certainly not the only part, but without it, how can any stakeholders have a reasonable idea of how well these services are provided? It is a mistake to assume that measurement is only appropriate to particular forms of public management. Many have argued that it is a core element of what has become known as the New Public Management. Whether or not this is true, it does not mean that public agencies and programmes need not or should not measure their performance under other regimes. How can agencies know how well they are doing unless they attempt to find out and do so in a systematic way?

Modelling integrated care processes: dementia case study

SESSION 5 - 5A

Tom Bowen, Paul Forte*

TUE SESSION 5 | GLAMORGAN COUNCIL CHAMBER | 14:00 - 14:30

Keywords: Modelling, Integration, dementia, survey

The European Commission FP7 Managed Outcomes project began in 2010 and is running for three years It aims to increase understanding of how the organisation and management of care processes can affect health outcomes for the patient. Its central objective is to explore how healthcare outcomes and cost-benefits are affected by the efficiency with which services are organised, produced and delivered. Better knowledge of these relationships is crucial in order to support more effective use of available resources in the future. Of four care processes being studied, one of the most interesting, from the research methodology perspective, is dementia: in particular, how inpatient hospital processes for patients with dementia are affected by other dementia care processes taking place outside the hospital. The degree to which these are integrated with each other has a crucial impact on how patients are directed into acute care processes and discharged from them. The project is looking at how these processes are organised, interlinked and resourced, and also needs to look at patient outcomes. These will be explored through a survey of local carers of dementia patients who have experienced the hospital care process. Results will be compared with equivalent case study sites in five other research partner countries. There are a number of interesting methodological considerations that this study has had to address and we will outline how we have approached these in the UK case study and report on the state of project to date.

ABSTRACTS

The Price of Anarchy of Healthcare

SESSION 7 - 7A

Vincent Knight*, Paul Harper

THU SESSION 7 | GLAMORGAN COUNCIL CHAMBER | 09:00 - 09:30

Keywords: Patient Choice, Game Theory, Queueing Theory

It is well observed that individual behaviour can have an effect on the efficiency of queueing systems. In this paper we present a routing game model for the choices made by individuals when choosing between healthcare facilities. These choices take in to account travel distance, facility congestion and reputation. Results concerning the price of anarchy, an analytical measure of the inefficiency of choice, are obtained. The work presented is particularly relevant to policy makers when considering the effect of allowing patients to choose between providers in a public health care setting. The theoretical ideas presented are demonstrated by calculating the price of anarchy for a large case study.

Measuring and modelling regional and national health issues - an Eastern European perspective

SESSION 7 - 7A

Marek Lubicz*

THU SESSION 7 | GLAMORGAN COUNCIL CHAMBER | 09:30 - 10:00

Keywords: Measures of health care effectiveness, modelling, application of OR, Eastern Europe

The presentation refers to the issues discussed in fundamental reviews of ORAHS literature, particularly in (Lagergren, 1998), (Brandeau et al., 2005), (Brailsford and Vissers, 2011), as seen from an Eastern European perspective. It elaborates on the results presented in (Lubicz, 2009). The discussion starts from general methodologies of defining, measuring, and categorizing health issues and healthcare interventions at national level, including those specific to low- and middle income countries. Then we look at approaches to modelling processes in healthcare domain, typical for modern OR, in particular - as applied by ORAHS Working Group members in their papers 1975-2010. The issues, health problems, measures, and modelling approaches, especially those applied in the regional or national planning, are analyzed in the context of a country specificity, e.g. income level or healthcare system in use in a country, using ORAHS papers as case studies. The abundance of academic publications and the dramatic increase in attendance at ORAHS meetings, observed by (Brailsford and Vissers, 2011), are discussed in relation to the Eastern European Health Operational Research. Brailsford S., Vissers J. (2011), OR in healthcare: A European perspective, EJOR, 212, 223-234. Brandeau M. Sainfort F. Pierskalla W.P. (2005), Health Care Delivery - Current Problems and Future Challenges, in M.L. Brandeau, F. Sainfort, W.P. Pierskalla, eds, Operations Research and Health Care. A Handbook of Methods and Applications, Kluwer, NewYork. Lagergren M. (1998), What is the role and contribution of models to management and research in the health services? A view from Europe, EJOR, 105, 257-266. Lubicz M. (2009), ORAHS in Action Revisited: A Research Data Base. Outline and Summary Analysis, in Lubicz M., ed., Operational Research Applied to Health Services in Action, OWPW, Wroclaw.

Prioritizing Health Care Interventions: A Multicriteria Resource Allocation Model to Inform the Choice of Community Care Programmes

SESSION 7 - 7A

M.D. Oliveira*, T.C. Rodrigues, C.A.B.E. Costa, A. Brito de Sa

THU SESSION 7 | GLAMORGAN COUNCIL CHAMBER | 10:00 - 10:30

Keywords: Resource Allocation, Portfolio Decision Analysis, Multicriteria Analysis, Primary Care, Portugal

Many countries, and Portugal in particular, are currently dealing with budget cuts and a shortage of resources in the health sector, while the demand for health care services is increasing. Within this context, the Group of Health Centres (GHC) of Northern Lisbon faces the challenge of prioritizing community care programmes so as to decide which programmes should be funded. This article describes the development of a Multi-criteria Model to Allocate Human Resources in Community Care PrOgrammes (MARCCO) with the GHC to appraise the costs and the benefits of the proposed programmes within a multicriteria resource allocation model structure. Building MARCCO followed a socio-technical approach using Multi-Criteria Decision Analysis (MCDA) and decision conferencing. The GHC used the results obtained by MARCCO in the selection of programmes and in the re-design of its information system. MARCCO contributes to the literature by showing how a constructive approach using MCDA methods and decision conferencing is an alternative to conventional approaches used in the prioritization of interventions in the health care sector.

ABSTRACTS

Exploring the use of Data Envelopment Analysis to assess the efficiency of HIV/AIDS prevention around the world

SESSION 7 - 7A

Sergio Santos*, Carla Amado, Mauro Santos

THU SESSION 7 | GLAMORGAN COUNCIL CHAMBER | 10:30 - 11:00

Keywords: DEA, HIV, Prevention

AIDS is currently one of the most significant health care problems worldwide. Due to the difficulty and costs involved in treating HIV, preventing infection is of paramount importance in controlling the AIDS epidemic. In particular, effective prevention measures can reduce new infections, the incidence of the disease and, consequently, the number of people that will require treatment. Whilst appropriate prevention measures can change the course of the epidemic, some figures suggest that these measures have been considerably more equitable, efficient and effective in some countries than in others. Given the limited resources available to healthcare systems in many of the most affected countries, it is fundamental to identify best practices that can be shared to promote improvements. The identification of best practices is not, however, straightforward. Although some international comparisons have been carried out in recent years to assist this purpose, the frameworks adopted have tended to rely on the use of multiple performance indicators detailing different aspects of the prevention programmes. Whilst valuable, it is well known that the use of multiple performance measures or ratios alone present strong limitations in carrying out comparative analyses as some prevention programmes might be better than others according to some indicators, while poorer according to others, making it difficult to derive a single aggregate measure of the overall performance of each of these programmes. The main purpose of this paper is to address these limitations by exploring the potential of using Data Envelopment Analysis (DEA) to establish international comparisons on the efficiency of HIV prevention programmes and to identify whether there are prevention measures more efficient than others.

Paediatric cardiac transplantation a suitable case for renewal theory?

SESSION 8 - 8B

Steve Gallivan*, Sonya Crowe

THU SESSION 8 | GLAMORGAN -1.63 | 13:30 - 14:00

Keywords: Paediatric, Transplantation

A child judged to need cardiac transplantation must wait until a suitable donor heart becomes available. There are certain criteria that must be satisfied for suitable donor hearts which depend on the tissue type and body mass of the recipient and potential donor. Depending on the clinical status of the recipient, so-called bridging therapy may be given which involves admitting the child to an intensive care unit in an effort to ensure that they survive long enough for a suitable donor heart to become available. Such bridging is both distressing for the child and parents and is also very resource intensive. It is useful to have an estimate of how long the child must wait before a suitably match donor heart becomes available. A simple mathematical model has been devised to derive such an estimate.

ABSTRACTS

An optimal bin-packing algorithm to minimize the number of washing cycles in a hospital sterilization service

SESSION 8 - 8B

Onur Ozturk*, Andras Sebo, Marie-Laure Espinouse, Maria Di Mascolo

THU SESSION 8 | GLAMORGAN -1.63 | 14:00 - 14:30

Keywords: Sterilization service, medical device, bin-packing, simulation

The problem we study arises from the washing step of hospital sterilization services. A hospital sterilization service is a reproduction system for medical devices (MDs). Sterilization services are composed of following steps: pre-disinfection, rinsing, washing, verification, packing, sterilization and storage before reuse. In the problem we treat, all MDs are available at the same time. This is typically the case of an external sterilization service, or, if a sterilization service starts the pre-disinfection of MDs after all surgeries have been finished According to a questionnaire carried out among some hospitals of Rhône-Alpes region in France, it is reported that the washing step is generally the bottleneck of the system. In this study, we aim at optimizing the utilization of washing resources by minimizing the number of launched washing cycles. After modeling the washing step as a bin-packing problem, we are inspired by the linear programming model of Gilmore and Gomory (1961). This model consists of a column generation method where each created column in the solution represents the combination of different MD sets to be washed together in our problem. The small number of different item sizes in our problem makes possible to create all columns of the linear model. We developed an algorithm to create all the columns and then we use linear programming to solve the problem optimally. Finally we test the impact of this optimization on the whole sterilization service using a simulation model and compare it to a case where first fit decreasing algorithm is applied to the washing resources. Computational results show that the optimal method helps smoothening the production by decreasing the waiting of MDs between different steps.

Modelling the demand and supply of Long-term Care services under uncertain conditions

SESSION 8 - 8B

Teresa Cardoso*, Mónica Oliveira, Ana Barbosa-Póvoa, Stefan Nickel

THU SESSION 8 | GLAMORGAN -1.63 | 14:30 - 15:00

Keywords: Long-term care demand, Small area level, Simulation, Markov Cycle Tree, Uncertainty

Developing a network of Long-term Care (LTC) services is currently a health policy priority in many countries. In particular, in countries with a National Health Service structure, the development of a network requires proper planning which demands for information regarding future demand and utilization of LTC services. Unfortunately, this information is often not available and the development of methods to properly predict demand and utilization is required. This study develops a simulation model based on a Markov cycle tree to predict year demand and utilization of LTC services, so as to inform the planning of these services at the small area level in coming years. The model is multiservice, allowing to predict yearly the number of individuals requiring different types of LTC services (domiciliary, inpatient and outpatient) and the resources that should be provided for these individuals (inpatient beds, domiciliary visits and consultations). The model was validated and applied at the Lisbon civil parish level in Portugal for the 2010-2015 period. Given imperfections on data and uncertainties related to predicting future demand, uncertainty was modelled through an integrated approach that combines scenario analysis with probabilistic sensitivity analysis using Monte Carlo simulation. Results show that LTC demand in Lisbon is expected to increase in the 2010-2015 period, with this increase being higher for outpatient care. These results provide key information for health care planners to decide on how to plan the LTC network. This study adds to literature by proposing methods based on population needs (with these being estimated and not affected by current delivery of LTC services), by being designed to be applied to the small area level and by proposing an integrated approach to deal with several types of uncertainty.

ABSTRACTS

SPECIAL SESSION ON MODEL IMPLEMENTATION

Policy Strategy and Optimal Implementation

SESSION 6 - 6A

Steven J Burnell*

WED SESSION 6 | GLAMORGAN COUNCIL CHAMBER | 09:00 - 09:30

Keywords: Policy, Strategy, Optimal Implementation

POLICIES: Political Objectives Loosely Integrated Controlled & Informed by Economic Sustainability

Sixty years ago, my National Health Service (NHS) cost 3% of GDP but is now over 7%. In 1997, the NHS in England cost £45Bn but by 2009 it cost £93Bn (2007 Prices). Last year, our Health Policies changed because the Economy had changed and our Government was changed. The NHS is being restructured to deliver a Policy of substantial improvement in "Quality Innovation Productivity Prevention" (the QIPP policy). This means by 2015 £20Bn of efficiency gains to be reinvested to mitigate & cope with rising Costs & rising Demands of a Population that is getting Older & Fatter. Regrettably, this policy has become blunt, short-term cost cutting – simple, easy, quick, & immediate impact (often with bigger negative consequences tomorrow or elsewhere).

Regrettably, the Policy of "Competition" is extrapolated from the quick to adapt & easy to evolve, like a Chemist on the High Street and applied to 1000-Bed Teaching Hospitals. This Policy is flawed. People will not accept the consequences of Failure but it is politically convenient, whereas policies of "Design" and "Intense Co-operation" require Intelligence & bring Accountability.

Thankfully, Policies often generate a supporting Strategy e.g. Dementia focused on removing Stigma & delivering Early Diagnosis and these Strategies tend to be more research evidence based with longer gestation periods, informed by Academics, Medics, and Others.
However, Strategies usually avoid the operational challenges of implementation. This provides us with the scope and opportunity to work with Practitioners to Design, Develop, & Deliver Optimal Care. Here, our work can increase levels of Confidence & Consensus by informing Investment Choices & Resource Allocation Decisions with rapid modelling Solutions.

Small, entrepreneurial companies can best inform Policy by evidencing how it might be optimally Delivered & Sustained.

This house believes that to date, OR academics have failed to make any lasting impact on healthcare practice.

SESSION 6 - 6A

Tom Bowen, Sally Brailsford*, Mike Carter, Martin Pitt, Martin Utley

WED SESSION 6 | GLAMORGAN COUNCIL CHAMBER | 09:30 - 11:00

Keywords: Debate, healthcare practice, model implementation

This session will take the form of a debate on model implementation in healthcare, and the fact that academics and consultants work in different ways, have different incentives and have achieved different levels of success in terms of model acceptance by clients/users. Few would disagree with the statement that OR has been widely applied in healthcare over the past 40 years and that there is a massive academic literature on the topic. ORAHS itself is testimony to this: it has been in existence since 1975 and is still growing. However, review papers on this topic, from Wilson (1981), Jun et al. (1999), Fone et al. (2003) through to Brailsford et al. (2009) all comment that despite a plethora of one-off applications in the academic literature, very few papers report the outcomes of implementation or sustained adoption of these models, and so the value of modelling in health remains an open question. This is the question we shall debate in this session. Contributions from the floor will be encouraged.

ABSTRACTS

WORKFORCE PLANNING

Hybrid algorithms for determining the optimal composition of healthcare teams

SESSION 6 - 6B

Bernardetta Addis, Roberto Aringhieri*, Marco Gribaudo, Andrea Grosso

WED SESSION 6 | GLAMORGAN -1.63 | 09:00 - 09:30

Keywords: Petri nets, metaheuristics, performance models, quality of service, patient flow

The quality of the health care is directly connected to the effectiveness of the service delivered. Usually, the health care is delivered by teams composed of individuals working together sharing knowledge, experiences and skills. Therefore, teams having different individuals can directly affect the effectiveness of the whole system providing the health care service. We can measure the efficiency of the teams and of the members involved using various metrics (such as the number of patient per hours they visits, or the probability of making an incorrect decision), and exploit such measures to forecast the overall performance of the team. The random nature of the problem however, requires the introduction of random variables, and the characterization of the overall team behaviour with some sort of stochastic process. We address the problem of the evaluation of the impact of different team composition through the following case study: we analyse the patient flow of an Emergency Medical Service (EMS) by using a detailed Generalized Stochastic Petri nets (GSPN) model. A GSPN allows a direct mapping from a high level representation of the team and of the EMS, to a Continuous Time Markov Chain (CTMC) that can be analysed to evaluate the performance of a particular choice. With a careful simplification of the EMS process, the solution of the GSPN and the evaluation of the performance metrics can be performed at a speed high enough to consider the model as a black box for an upper level optimization procedure. In this paper, we discuss some hybrid algorithms based on metaheuristics framework (especially Local Search methods) for determining the optimal team composition using GSPN as evaluation tool. Experimental evaluation on a real case study is also reported.

Solving various healthcare staff scheduling problems with one heuristic inspired from mathematical decomposition approaches

SESSION 6 - 6B

Julien Crowe*, Patrick Soriano

WED SESSION 6 | GLAMORGAN -1.63 | 09:30 - 10:00

Keywords: Heuristic, staff scheduling, tour scheduling, healthcare applications

In Canada, as each profession within each department of a healthcare organization typically has unique working conditions, human resources often deal with a quantity of different staff scheduling problems of the order of the number of departments times the number of professions. As resources are however limited, it is typically too time consuming and costly to develop or adapt a specific solution approach structure for every single problem. Hence, although little OR research has been published on this topic, we believe there is a need among practionners for very flexible staff scheduling solution approaches. We propose a heuristic flexible approach with a structure inspired from mathematical decomposition techniques such as column generation. This new approach decomposes a staff scheduling problem into a subproblem solved by creating tours and a master problem solved by selecting which tours to include in the schedule. The main interest of using such an approach is to obtain good solutions quickly. However, since the use of a completely heuristic algorithm limits the accessibility to crucial mathematical information such as reduced costs, a central issue of our research has been to define how to evaluate the quality of a tour in the subproblem. We deal with this issue by using primal information only, and implementing a limited number of well-chosen linking constraints connecting both problems. We have compared our new approach with past research (the SOFA algorithm presented at ORAHS 2010) on more than a hundred theoretical instances with varying constraints and demand, and on two real-life healthcare instances from Canada. Our new approach outperforms SOFA by a slight margin, and opens a path for more research on efficient flexible staff scheduling approaches.

ABSTRACTS

Competing Technological Trajectories and Health Services Organization Paradigms

SESSION 6 - 6B

Sebastiao Loureiro, Erika Aragao*, Bethania Almeida, Fabio Mota, Taris Santana

WED SESSION 6 | GLAMORGAN -1.63 | 10:00 - 10:30

Keywords: Technological Trajectories, Health Services , scientific knowledge, material technologies, social technologies

The objective of this exploratory study is to present evidence of the existence of two competing technological trajectories structuring a paradigm for health care organization. The paradigm model proposes two levels of relevant factors: one related to variables necessary to the production of medical technologies and the other level refers to key variables related to the production of demand for health care. This paper focus on a variable related to the production and diffusion of scientific knowledge, a basic input to technology and innovation in health. One of the trajectories is based on material technologies, focused on curative processes, capital intensive such as pharmaceutical, medical equipment etc. The other, based on social technologies is intensive in human workforce, focusing on preventive and health promotion processes. In the study the number of scientific papers is used as a proxy for the development of the two trajectories. The methodology used a search in the web of Science from the database ISI Web of Knowledge (Thomas Reuters) advanced module using the field (TS) joining title, summary and key words. The search lexical query was composed of key words that referrer to material technologies in the area of imagenology and other descriptors related to social technologies such as family health, community health, preventive care. The search run covered the period from 1990 to 2009. The results show an expressive increase in material technologies compared to social technologies more evident on the last decade. Moreover scientific publications on the material technologies are more frequently the result of institutional network for collaborative investigation point out to a more structured framework for innovation. Further, it suggests the material technologies may become the hegemonic paradigm to structure the health services organization.

Workforce Formation Planning and Workforce Capacity Management using Annualised Hours

SESSION 6 - 6B

Egbert Van de Veen, Bart Veltman*

WED SESSION 6 | GLAMORGAN -1.63 | 10:30 - 11:00

Keywords: Workforce scheduling, annualised hours, nurse rostering, workforce planning, workforce capacity management

Workforce capacity management using annualised hours allows employees to vary in the volume of working hours per period, such as a week, month, quarter or half year. This variation has to respect the constraint that the total volume of working hours per year respects the employee's labor contract. Recent literature addresses the problem of workforce scheduling using annualized hours. We propose an ILP model that extends existing models. We give examples of practical use of this model and its relation to shift scheduling and (nurse) rostering.

POSTERS

POSTERS

Modelling length of stay of elderly patients in hospital in Northern Ireland using the discrete conditional phase-type distribution with a Bayesian network component

Janette McQuillan, Adele Marshall*, Kieran Payne

MON TEA AND POSTER SESSION | GLAMORGAN COMMITTEE ROOMS | 14:30 - 15:30

Keywords: Coxian phase-type, bayesian networks, length of stayelderly patients, length of stay, hospital management

The proportion of the elderly in the population continues to rise placing extreme pressure on already restricted medical resources. One such resource continually under pressure is hospital beds. Elderly patients are often the long stay patients in hospital, consuming resources for a long time. It is therefore of benefit to be able to understand the characteristics that contribute to a patient becoming long-stay. Coxian phase-type distributions are a special type of Markov model that describe duration until an event occurs in terms of a process consisting of a sequence of latent phases [1]. Such a system can accurately represent patient duration of stay as a sequence of phases of stay in hospital. Previous research has developed the family of discrete conditional phase-type models which extend the Coxian phase-type distribution by conditioning it on a second component of inter-related variables. For example, a Bayesian Network (BN) can be conditioned on the Coxian phase-type distribution. This allows the inclusion of a network of inter-related variables and associated probabilities. The model can represent a continuous distribution which is highly skewed while also incorporating causal information from the inter-relationships between explanatory variables [2]. This paper considers the length of stay of all elderly patients staying in hospital in a year across the six key acute hospitals in Northern Ireland. A discrete conditional phase-type model using a Bayesian network component represents the patient length of stay conditional on other inter-related explanatory variables. [1] MARSHALL , A. H. and MCCLEAN, S. I. (2004). Using Coxian Phase Type Distributions to Identify Patient Characteristics for Duration of Stay in Hospital. Health Care Management Science, 7 (4), pp. 285-89. [2] MARSHALL, A.H., VASILAKIS, C. and EL DARZI, ELIA (2005). Length of Stay-Based Patient Flow Models: Recent Developments and Future Directions. Health Care Management Science 8, pp. 213-20.

Integral Multidisciplinary Rehabilitation Treatment Planning

Aleida Braaksma*, Nikky Kortbeek, Post Gerhard, Nollet Frans

MON TEA AND POSTER SESSION | GLAMORGAN COMMITTEE ROOMS | 14:30 - 15:30

Keywords: Rehabilitation treatment planning, Patient flow, Appointment scheduling, Integer linear programming

At a rehabilitation outpatient clinic patients are treated to recover from injury, illness, or disease. To achieve this, patients require a series of treatments by therapists from various disciplines. In current practice, when treatments are planned, a lack of coordination between the different disciplines, and the deficiency to plan the entire treatment plan at once, is often witnessed. This jeopardizes both quality of care and logistical performance. Our integral treatment planning algorithm, that plans the entire treatment plan at once, ensures continuity of the rehabilitation process, while simultaneously controlling other performance indicators such as access times, therapist utilization and combination appointments. Upon a planning request multiple planning proposals are generated by an integer linear program (ILP), based upon the treatment plan and the availability in centrally controlled therapist schedules. From these proposals, the one that is preferred by the patient is actually planned. We apply our approach to the rehabilitation outpatient clinic of the Academic Medical Centre (AMC) Amsterdam. Considering the results for this case, we believe that our approach can be valuable to many rehabilitation outpatient clinics both on an operational and a management level. Indeed, the developed algorithm is currently being implemented in the AMC.

Worldwide resource allocation for tuberculosis

Christine Currie*, Kathryn Hoad

MON TEA AND POSTER SESSION | GLAMORGAN COMMITTEE ROOMS | 14:30 - 15:30

Keywords: Resource allocation, Tuberculosis, Infectious Diseases, Statistics

We describe a methodology for worldwide resource allocation for tuberculosis (TB) prevention and control, drawing on previous work that analysed the TB epidemics of 211 countries, classifying them by how TB case notification rates have evolved over time and by the age distribution of those suffering from active TB disease. Using the classifications devised in this earlier work, we here suggest a number of ways of allocating resources between countries, considering both equity-based allocations and allocations that depend on the epidemiology of TB in the different countries. Factors such as the HIV prevalence, the wealth and the level of development of a country were found to be important in determining which age groups suffer most from TB disease and are likely to impact on the relative effectiveness of different interventions. We describe how these factors could be used to determine the optimal control and prevention strategies in different countries, allowing us to come up with a complete resource allocation strategy for TB, covering the allocation between countries and the allocation between interventions for each country. There has been relatively little research into TB in the OR literature, especially considering it is the second most deadly infectious disease worldwide, behind HIV. We hope that this work will go some way towards addressing that.

Organising Patient Safety systems: comments on the implementation of a safety campaign in an acute general hospital in NW England

David Puga-Bolio*, Michael Pidd, Jeremy Busby, Andrew Smith

MON TEA AND POSTER SESSION | GLAMORGAN COMMITTEE ROOMS | 14:30 - 15:30

Keywords: Patient Safety, Systems, Soft OR

Patient safety is a major area of concern for health providers both private and public, and a significant number of patients in health systems around the world experience some level of unintended harm. Various key studies have argued in favour of strategies that have an effect in generating the necessary conditions within the greater healthcare system to enable, promote and support safe clinical practice with the intent of minimising adverse patient safety incidents, sometimes suggesting a redesign of the system in order to minimise the potential for error. It is also widely suggested that these systemic approaches to creating safety systems within health care organisations should be systematic undertaken following a series of well defined-steps that would eventually lead to improvement that could be demonstrated by sound measures. Our research looked into the factors affecting the implementation of a safety campaign in an acute general hospital in England using elements from Soft OR. We found that in this instance and as a result of a series of organizational factors, the programme has not been successful in greatly increasing awareness of patient safety issues in any systematic way, due in part to a lack of definition and support structures, resulting in delays and resistance to the process and generating an apparent lack of effectiveness and sustainability of patient safety efforts in the long term. We propose that both external agencies and organisational managerial structures as the owners and key actors of the improvement process should concentrate improvement efforts on creating the support structures that allow for strong safety systems to take shape, which does not seem possible unless the greater healthcare system aligns its strategic objectives and policies regarding safety at the same level as finance and productivity.

POSTERS

Simulating logistical changes in a chronic care outpatient department

Helena Hvitfeldt Forsberg*, Daniel Glaser, Hakan Aronsson, Staffan Lindblad

MON TEA AND POSTER SESSION | GLAMORGAN COMMITTEE ROOMS | 14:30 - 15:30

Keywords: Discrete Event Simulation, Chronic care, Logistics, Staffing, Waiting times

Rheumatology care has undergone radical changes during the last decade as new biological drugs have revolutionized treatment possibilities and patient outcomes. However, chronic care processes are unchanged and do not always match patients needs. Still, patients meet with their physician based on planned regular follow up visits, not taking the individual patients fluctuating disease into account. This results in unnecessary visits if the patient visit is scheduled at a time of low disease activity or delays for a patient in need of more urgent care. The Chronic Health Model (CHM) is a simulation model developed for rheumatology built using Discrete Event Simulation to evaluate novel logistics of chronic care processes. The CHM simulates patients with rheumatic diseases and is based on care processes, logistics and validation data from a Swedish rheumatology clinic and the national Swedish Rheumatology Quality register (SRQ). The CHM is governed by logistics according to the Open and Tight clinical concepts (Grigor 2004, Hewlett 2005). Combining these concepts, an Open-Tight clinic guides patients to Open or Tight logistics with regard to their Disease Activity Score (DAS). Patients with a high DAS see a physician frequently at the Tight clinic whereas patients with inactive disease sees a nurse yearly at the Open clinic. Our first simulation results from the CHM shows promising alternative outcomes compared to the chronic care of today: better utilization of resources, lower costs and improved patient access to care. Implementing the Open-Tight concept, we can in the simulation model replace 30-40 percent of the physicians with nurses while maintaining the same overall results. In reality, this could imply that nurses can care for patients with low disease activity allowing physicians to focus more on patients with the greatest need of care.

Towards a decision tool for dialysis patients: a systematic review of prognostic models

Alan Kimber, Chris Maggs, Honora Smith*, Retha Steenkamp, Charlie Tomson

MON TEA AND POSTER SESSION | GLAMORGAN COMMITTEE ROOMS | 14:30 - 15:30

Keywords: Prognostic models, dialysis, renal, disease modelling

Many studies have shown that patients want clinicians to discuss prognosis with them but objective and accurate patient prognostic information is not always available. A validated prognostic model for dialysis patients will support clinical decision-making, help identify patients in different risk groups, and enable individualised patient care. A systematic review has been carried out into the statistical methodologies used in the development of prognostic models for the prediction of mortality in patients on dialysis or on haemodialysis. A search was carried out into literature published in English between 1990 to date using an agreed set of search terms, including in particular whether the prognostic model had been subject to validation. A total of 200 articles were initially identified by the search strategy, but only 23 articles were relevant to predicting mortality for dialysis or haemodialysis patients. The main statistical model used for prediction of mortality was the Cox proportional hazards model, with time-varying prognostic models described in only a few articles. All the articles included in the review applied some method for model performance evaluation, for instance calibration or discrimination. Most papers did not include any account of model validation, but 6 articles did describe a method applied for prognostic model validation, with internal validation as the most common approach. Temporal validation was described in a few studies, but none of the prognostic models was externally validated. The conclusion is that developing and validating a prognostic model to predict outcomes for the dialysis population in the UK would be important research as there are very few prognostic models developed for patients on dialysis or haemodialysis and none have been externally validated to ensure transportability to other renal populations. The use of time-varying prognostic models to predict mortality at more than a year after start of dialysis should be encouraged.

POSTERS

Bed Management in a Critical Care Unit

Izabela Komenda*, Jeff Griffiths, Vincent Knight

MON TEA AND POSTER SESSION | GLAMORGAN COMMITTEE ROOMS | 14:30 - 15:30

Keywords: Queueing theory, Bed occupancy, Critical Care Unit, Time dependency

One of the main problems facing hospital managers is in coping with the variability in demand for the services which the hospital provides. This is particularly the case in the Critical Care Unit (CCU), where inability to provide adequate facilities on demand can lead to serious consequences. Admissions to CCUs may be categorised under two headings: unplanned (emergency), and planned (elective). The length of stay (LoS) in the CCU is heavily dependent on the admission category: unplanned admissions have a much longer LoS on average than elective patients. We propose a mathematical model which shows how improvements in bed management may be achieved by distinguishing between these two categories of patients. The vast majority of previous literature in this field is concerned only with steady-state conditions, whereas in reality activities in virtually all hospital environments are very much time-dependent. Informations included in this poster go some way to address this problem.

Forecasting social care demand in Hampshire

Joe Viana*, Sally Brailsford, Terry Williams, Rachel Dittrich

MON TEA AND POSTER SESSION | GLAMORGAN COMMITTEE ROOMS | 14:30 - 15:30

Keywords: System Dynamics, Simulation, Forecasting, Social Care, Care Life Cycle

The UK population is ageing. This presents a challenge for policymakers given that older people are the major users of health and social care services. In addition the care workforce itself is ageing,which will impact on the supply of care. The Care Life Cycle Project (CLC)is the first to deal comprehensively with the factors affecting both the supply and demand of health and social care. A suite of innovative modelling tools will be developed incorporating these factors and the expert opinions of our stakeholders, to inform social policy. This poster focuses on a project being conducted with Hampshire County Council (HCC) with the aim of improving forecasting of Social Care needs within Hampshire. The project initially involved reviewing and evaluating existing forecasting models and data sources. The project addressed questions that are affected by demographic change such as: the medical factors (e.g. Dementia)and social factors(e.g. Poverty)which have the greatest impact on future social care needs; simple ways in which forecasting can be made more relevant to social care needs within Hampshire; and, the impact of migration for example. A high level System Dynamics (SD) model has been developed in collaboration with HCC across the Adult Services Department with staff including: directors, information managers, data analysts and social workers and drawing on the expertise of the CLC team. This initial first phase model demonstrates the interrelations between the demand and the supply and which many of the existing forecasting models do not adequately take into account. The SD model allows the stakeholder the ability: to run data driven projections; and,to conduct â€œwhat-ifâ€ experiments exploring other possibilities incorporating current and expert opinion.It is likely that this initial project will be followed up with further collaborations between the HCC and the CLC.

POSTERS

Time-dependent stochastic modelling for predicting demand and scheduling of Emergency Medical Services in Wales

Julie Williams*, Paul Harper, Jonathan Gillard, Vincent Knight

MON TEA AND POSTER SESSION | GLAMORGAN COMMITTEE ROOMS | 14:30 - 15:30

Keywords: Ambulance demand, Singular spectrum analysis, Time-dependent queues, EMS capacity planning

In Wales, the government has imposed a target that 65% of immediately life-threatening emergency incidents should be responded to by Emergency Medical Services (EMS) within 8 minutes; and 95% of serious but not life-threatening calls should be responded to within either 14, 18 or 21 minutes depending on the type of area the incident is located in. Failures of the Welsh Ambulance Service Trust (WAST) to meet this target in the past have prompted several reviews of the service, which have suggested various modernisation plans. We investigate modelling techniques that may be adopted by the service to predict future demand levels and allow efficient scheduling of vehicle and crew members. Whilst intensive research has been conducted in the fields of optimal fleet size and vehicle deployment strategies, we note that the literature on forecasting demand levels is sparse, although it is a critical input to the capacity planning models which in general assume this demand is known as a precursor. Our work considers a novel time series approach to forecasting the daily demand exerted upon WAST using the model-free technique of Singular Spectrum Analysis (SSA), and shows that in addition to being more flexible in approach, the predictions generated using this technique compare favourably to forecasts obtained from conventional forecasting methods. We progress to use this technique to predict demand at a regional level, and use both time-dependent and priority queueing theory techniques (including SIPP methodology and a numerical approach) to set future staffing requirements and design ambulance deployment strategies. Ultimately we aim to develop a time-dependent and priority workforce capacity planning tool to generate rosters for crew members.

Resource Planning and Deployment of Welsh Ambulance Services

Leanne Smith*, Paul Harper, Vincent Knight, Israel Vieira, Janet Williams

MON TEA AND POSTER SESSION | GLAMORGAN COMMITTEE ROOMS | 14:30 - 15:30

Keywords: Emergency Medical Services, Location, Simulation

Response time targets for the Welsh Ambulance Service NHS Trust (WAST) are not currently being met. In particular, the more rural areas in South East Wales consistently perform poorly with respect to the target of reaching 65% of the highest priority emergency calls (category A) within 8 minutes, and are amongst the worst in the UK. This research is concerned with developing mathematical models for the ambulance service system, utilising techniques drawn from Operational Research, namely queueing theory, location theory and discrete event simulation, to help WAST make better decisions on locations, capacities and deployments. We will use the findings from a detailed discrete event simulation (incorporating a geographical representation) to suggest suitable capacities for the South East Region (and subsequently for other areas of Wales). This will then be combined with developed location theory models to find optimal allocations of vehicles at stations across the county so that deployed Emergency Medical Service (EMS) vehicles can respond to the largest proportion of the population within the target time i.e. maximising coverage. Finally, we incorporate survival functions into the location theory formulation for different medical conditions in order to maximise the overall expected survival probability of patients. Each of the models will be run under various scenarios of interest to WAST; changes will be made to the demand of calls, number of available vehicles and turnaround time to see the impact on regional response. This will help the Trust identify vehicle capacity needs and station allocations to provide a more efficient and effective ambulance service to their population, helping them achieve the targets as set by the Welsh Assembly Government.

POSTERS

A two- stage probability model for HIV/AIDS infection in the presence of antiretroviral therapy

M. M Kembe*

MON TEA AND POSTER SESSION | GLAMORGAN COMMITTEE ROOMS | 14:30 - 15:30

Keywords: Antiretroviral therapy, human immunodeficiency virus, acquired immunodeficiency syndrome, disease-free, equilibrium state

The use of antiretroviral therapy (ART) for the control of spread of human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS) is on the increase. However, the level of drug resistance and uncertain behaviour of HIV patients is, also, increasing, making the impact of ART on the spread of HIV difficult to predict. In this research work, we have classified the disease in three states. The first state consists of those persons who are diagnosed HIV positive but are not placed on any form of treatment. State two consists of those persons who are diagnosed as HIV positive and are placed on antiretroviral therapy, and finally, the third state consists of those that have developed full blown AIDS. We formulated a probability model to predict the number of persons in any of the states at any given time. In the formulation, we made some assumptions that the rate of discharge is independent of time and that once a person develops full blown AIDS, he or she never recovers. The probability model equation was formulated based on the three states of the disease and was transformed to a system of first order differential equations. The existence of a unique solution of the model was established as well as the existence and stability of the disease-free equilibrium state of the model. The analytical solution of the model was, also, obtained. A good fit was observed between model values and the empirical data. Some t-tests carried out at 0.05 level of significance showed that there is no significant difference between the model values and empirical values, and we concluded that the model developed could be used for the estimation of the number of persons in any of the states of the disease at any given time.

Understanding the effect of individual and organizational factors on patient length of stay: a hierarchical model approach

Maria Guzman Castillo*, Sally Brailsford, Honora Smith

MON TEA AND POSTER SESSION | GLAMORGAN COMMITTEE ROOMS | 14:30 - 15:30

Keywords: Length of stay, modelling, hierarchical models, logistic regresion, classification

According to the National Health Plan 2007 - 2012 the main problem of the Mexican healthcare system in terms of quality and efficiency is the enormous heterogeneity that exists among the main service providers which complicates the development of a common national action plan to improve quality and efficiency of services. In terms of length of stay in hospitals, it is found that the average length of stay for same surgical procedures or diagnosis varies considerably across different healthcare providers: i.e. the average length of stay in a hospital for appendectomies under 60 beds at the IMSS hospitals is 6.5 days against 3 days in hospitals in the State Services. This variation could be explained by the presence of internal and external factors on the organization affecting the service. In the other hand, managers and medical staff at local hospitals have been always interested on the internal factors on individuals which affect their length of stay. In this paper a Hierarchical logistic regression model with two levels is proposed. At level 1, the units are patients, where a logistic regression function classifies them in three categories according to their length of stay (short, medium and long). At level 2, the units are healthcare organizations. The first level would be useful to understand the effects of internal factors on the length of stay of individuals e.g. characteristics of patients: age, sex, diagnosis, the presence of comorbidities, pathological history, pathological family history, etc. Conversely the second level would be helpful to understand how different policies, practices or other hospital characteristics affect patient length of stay. A two-level hierarchical logistic model could bring valuable information for decision making process not just on a local level but on an organizational and national level.

POSTERS

Towards a Full implementation of Collaborative Care Plan

Mohamed Tadjer*, J, Thierry Chaussalet, Farid Fouladinejad, Salma Chahed

MON TEA AND POSTER SESSION | GLAMORGAN COMMITTEE ROOMS | 14:30 - 15:30

Keywords: Clinical pathways, collaborative care plan, Association rules, referrals, lenght of stay

Today, UK healthcare strategy managers face a challenge in developing and implementing an efficient care process in line with preserving a steady care evidence-based practice. This would be possible through the monitoring of time schedule and reduction of unnecessary variability with respect to clinical performances, consequently, to achieve the required quality of service at a contained cost. For this purpose the development of a model requires a firm rational basis to provide clear direction. Therefore, it is necessary to provide a systematic assessment for planning and coordinating healthcare services through which patients needs have to be achieved. This study aims to cover the healthcare process for particular conditions, e.g., COPD, Diabetes, Chronicle Heart Disease etc, modelling together the interaction of all components of Hounslow healthcare system, hence, to track patient flow across the system using spatio-temporal models and to evaluate the variations in length of stay and referral activities from the standardised pathways. Furthermore, we intend to derive indexes to inform the reshaping and the delivery of healthcare system.

Exploring the Effect of Temperature Variations on unplanned admissions for some selected diseases

Muhammad Islam*, Thierry Chaussalet, Nazmiye Ozkan, Eren Demir

MON TEA AND POSTER SESSION | GLAMORGAN COMMITTEE ROOMS | 14:30 - 15:30

Keywords: COPD, Poisson regression model, Zero-Inflated Poisson regression, unplanned admissions, morbidity rate

Global climate change is one of the highest concerns in the scientific, health and environmental arena. Establishing association between weather and health exposures are fundamental to learn about the complex exposure-disease relationship but the link between them are still largely unexplored. The Department of Health in England sees unplanned admissions as an important issue, where the National Health Service hospitals will face financial penalties if patients are readmitted as an emergency within 30 days of being discharged. The continuing annual trend in the number of patient readmissions (5% growth during 2007/08 and 2008/09) is causing a serious concern in terms of high demand for services under severe financial cuts (the NHS is expected to save approximately £20bn over five years). We intend to explore the relationship of temperature variations with the unplanned admissions for some selected diseases (COPD, Asthma, and Pneumonia) on local authority area level. For admission information, Hospital Episode Statistics (HES), England and the temperature (maximum, minimum and mean) data from the Met Office, UK for the year 1997-2004 will be used. We linked the HES with temperature based on local authority level and day of weather observation. We will standardise the morbidity rate of unplanned admissions for the selected disease and region by adopting the respective population estimates to explore the regional differences in morbidity rate. The Poisson regression model and Zero-Inflated Poisson regression model could be used to highlight whether the relationship between temperature variations and the unplanned admission counts are significant for those selected diseases after adjusting the effect of air pollutants, age, sex and the day of the admission. The results could be helpful to understand the impact of temperature fluctuations on the unplanned admissions for the diseases and thereby help to revise the future demand of care due to the weather disparity.

POSTERS

Towards an Optimal Ordering Policy for Nursing Home Placements In Long-Term Care

Philip Worrall*, Thierry Chaussalet

MON TEA AND POSTER SESSION | GLAMORGAN COMMITTEE ROOMS | 14:30 - 15:30

Keywords: Nursing home, demand, length of stay, inventory, contract design

Funding for long-term care (LTC) in the UK represents a substantial fraction of the total NHS non-pay spend. Given potential future shifts in social demographics and population aging, serious questions are raised about its future financial sustainability, both in the UK and abroad. Although LTC can be provided at home, a significant proportion of patients receive their care in a private sector nursing home. While the NHS is responsible for both arranging and funding each individual's care, it must compete with other public sector organisations and privately funded individuals for the limited supply of available nursing home beds. Through procurement exercises the NHS can secure its supply of nursing home beds by entering into contracts with one or more private sector providers. Such contracts are often referred to to as block bed contracts. In practice, these contracts commit the NHS to using a particular nursing home for a period of several years although significant quantity discounts can often be obtained. The NHS faces many challenges when negotiating such contracts due to the fact that; nursing homes differ largely in both capacity, quality of care and expertise; patient preferences must be taken into account; and that once placed it is impractical to move patients even if quality of care is higher or price lower at an alternate provider. These dimensions and the problem itself can be considered analogous the classical inventory problem, where a one-period decision must be made ahead of time regarding how much to purchase for the next year. In this paper, we survey the available literature on inventory models and game theoretic approaches which address these types of inventory problems. Our objective is to help healthcare managers make more efficient long-term decisions regarding optimal ordering quantity for nursing home be

How do medical innovations affect service utilisation and costs?

Tiago Cravo Oliveira*, James Barlow, Steffen Bayer

MON TEA AND POSTER SESSION | GLAMORGAN COMMITTEE ROOMS | 14:30 - 15:30

Keywords: Technological innovation, healthcare costs, services, telemedicine, system dynamics

Medical technologies have played a major role in shaping modern healthcare, with benefits ranging from improved health to better quality of life. However, technological innovation is widely considered the main driver of rising healthcare costs. A puzzling feature of many medical innovations is how they simultaneously have lower unit costs and higher total costs. Treatment expansion and substitution may provide an explanation for this: new technologies tend to be complements rather than substitutes for older technologies. We investigate the mechanisms by which medical innovations affect service utilisation and ultimately healthcare costs by studying the interaction between unit costs, quantity and quality of services, and total expenditure. Our case study is teleconsultation in Alentejo, a region in Portugal. We use the systems dynamics methodology to develop models of current care pathways, partly based on interviews with local healthcare providers. The models depict the organisational restructuring caused by teleconsultations and illustrate how this structure leads to dynamic and potentially conflicting effects with outcomes which are difficult to predict. Early findings indicate that teleconsultation might be useful for dealing with an increasing demand for medical care; however it may raise total costs due to increased service utilisation. Other effects on patient experience and service quality are also investigated. This study may help policy makers better understand the impact of policy initiatives as well as test the effects of current and future interventions. The models can lead to a clearer picture of how innovations affect services and costs, and how we might enrich current methods of evaluating and predicting the impact of technological change and innovation on the healthcare system.

POSTERS

Modeling and forecasting bed utilization for a better hospital capacity management

Valerie Dorval*, Angel Ruiz, Patrick Soriano

MON TEA AND POSTER SESSION | GLAMORGAN COMMITTEE ROOMS | 14:30 - 15:30

Keywords: Length of stay, forecasting, operating theatre, planning and scheduling

Access to specialty and subspecialty services is a fundamental concern for the Health and Social Services Department of the province of Quebec in order to improve the services dispensed to the population. Facing constant increase in the demand for cares,the establishments need to:manage effectively their resources(operating theatres,human resources,beds,,etc.) and analyse and anticipate the needs. In this context,our project focuses on the study of bed management,particularly post-surgical hospitalization time for different surgery groups. Hospitalization beds are often the bottleneck limiting the number of surgeries executed in an operating theatre since most interventions requires a bed to ensure the recovery and monitoring of patient. However, there is no effective bed management applied in our partner establishments. Indeed,there is no planning or forecasting tool available to manage the bed occupancy. Without this type of tool,it is hopeless to anticipate the availability of beds or to manage adequately the resources between elective and emergency cases or between the different specialties. The aim of this research is to model allocation,occupancy and release of hospitalisation beds. The first stage,in which we are currently progressing,consists in identifying and modeling the length of stay based on the surgery type. In order to do this,we first performed a literature review,identifying the various models used for this type of problem. Afterwards,in agreement with the establishment,one specialty,orthopaedic surgery,has been selected to build the preliminary model with data from the previous year. After the validation of the model for this specific specialty,it will be extended to every family of surgery performed in the hospital. Finally,with this tool,we intend to model and simulate different strategies regarding the planning and scheduling of the operating theatre taking into account the beds availability.

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