

INFORMS HEALTHCARE 2011

June 20-22, 2011 Hilton Bonaventure Montreal, Canada



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Requests for papers should be sent to the authors at the addresses shown in the program. Individual issues of this program are available for \$20US per copy. Orders must be prepaid and sent to INFORMS, PO Box 632820, Baltimore, MD 21263.

THANKS TO OUR SPONSOR

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Dear Friends and Colleagues,

On behalf of the Organizing Committee of INFORMS Healthcare 2011, I am delighted to welcome you to Montreal.

Fostered by the aging population and the shortage of physicians and nurses, timely access to health services has become increasingly difficult and the congestion at healthcare facilities has reached unprecedented levels. Coupled with the increasing concerns about patient safety and the growing costs of healthcare, these constitute formidable challenges for health care providers and policy makers. The need to transform healthcare systems is at the forefront of the public agenda in many countries and, in many cases, researchers have been an integral part of the initiatives to improve healthcare delivery process and to assist clinical decision making. Recognizing the significant increase in the research activity in this domain, INFORMS decided to focus on healthcare as its first thematic conference.

Our goal has been to bring researchers from different communities and stakeholders together to share information that can improve the long-term efficiency, effectiveness and quality of healthcare delivery. To this end, we have approached other societies as well as INFORMS subdivisions to seek their involvement at the meeting. CORS, IIE, POMS and ORAHS kindly agreed to sponsor clusters at INFORMS Healthcare 2011, which greatly enrich the conference. Of course, this meeting would not have been a success without the support of the six INFORMS subdivisions in organizing sponsored clusters.

There are more than 400 oral presentations at the conference. Upon reviewing the submissions, we have decided to organize the program around 11 themes: Capacity and Patient Flow Management, Data Mining and Health Informatics, Healthcare OM, Emergency Medical Services, Healthcare Supply Chains, Healthcare Delivery Systems, Medical Decision Making, Modeling and Optimization, OR in Public Health, Pharmaceutical Applications and Transplant Operations. This format enables us to highlight the common themes within the six invited and ten sponsored clusters and, hopefully, it will foster interaction between participants who belong to different societies.

The plenary speaker is Dr. Arthur Porter, CEO of McGill University Health Center, who will highlight the challenges in overseeing the development of a super hospital in Montreal. The conference program also features three tutorials in areas complementary to healthcare OR as well as five panel sessions which will benefit from the contributions of healthcare providers. We also organized a networking lunch, a poster session and a reception on Monday.

I am grateful to the members of the Organizing Committee, Diwakar Gupta, Beste Kucukyazici, Eva Lee and Sergei Savin, for their tireless efforts in organizing this meeting. It has been a pleasure to work closely with the INFORMS staff during this process. Their professionalism and stellar support have made the job of the Organizing Committee much easier.

Thank you all for attending INFORMS Healthcare 2011 and presenting your work. Enjoy the Conference and the beautiful city of Montreal.

Vedat Verter
General Chair

NOTE:

All technical sessions are held at Hilton Bonaventure, Meeting Level. Check the Master Track Schedule on pages 10-11 for specific room locations.

BADGES REQUIRED FOR TECHNICAL SESSIONS

INFORMS Healthcare 2011 badges must be worn to all sessions. Badges will be checked at the entrance to technical session areas. Attendees without badges will be directed to the registration desk to register and pick up their badges. *All attendees, including speakers and session chairs, must register and pay the registration fee.*

BLOGS, TWEETS AND MORE

Check out the INFORMS Healthcare 2011 web page for posts from our talented group of bloggers during and after the meeting. And join the Twitter conversation. Add the hashtag #healthcare11 to your tweets to associate them with the conference. Tweets with #healthcare11 will be displayed in the Attendee Twitter Feed on the homepage. If you haven't yet become a Twitter-ite but would like an introduction, stop by the INFORMS booth for a quick lesson.

Go to the conference web page for all the information:

<http://meetings.informs.org/Healthcare2011>

SUNDAY, JUNE 19

4:00pm-8:00pm Registration Meeting Level Foyer

MONDAY, JUNE 20

7:30am-5:00pm Registration Meeting Level Foyer
 8:30am-10:00am Technical Sessions (MA)
 10:00am-10:30am Coffee Break Fontaine B
 10:30am-12:00pm Technical Sessions (MB)
 12:00pm-1:00pm Networking Lunch Fontaine A & B
 1:00pm-2:00pm Interactive/Poster Session Fontaine B
 2:00pm-3:15pm Plenary Session (MC) Westmount & Outremont
 3:15pm-3:30pm Coffee Break Fontaine B
 3:30pm-5:00pm Technical Sessions (MD)
 6:00pm-7:30pm Reception Westmount & Outremont

TUESDAY, JUNE 21

7:30am-5:00pm Registration Meeting Level Foyer
 8:30am-10:00am Technical Sessions (TA)
 10:00am-10:30am Coffee Break Fontaine B
 10:30am-12:00pm Technical Sessions (TB)
 12:00pm-1:30pm Lunch Break (on your own)
 1:30pm-3:00pm Technical Sessions (TC)
 3:00pm-3:30pm Ice Cream Break Fontaine B
 3:30pm-5:00pm Technical Sessions (TD)

WEDNESDAY, JUNE 22

7:30am-4:00pm Registration Meeting Level Foyer
 8:30am-10:00am Technical Sessions (WA)
 10:00am-10:30am Coffee Break Fontaine B
 10:30am-12:00pm Technical Sessions (WB)
 12:00pm-1:30pm Lunch Break (on your own)
 1:30pm-3:00pm Technical Sessions (WC)
 3:00pm-3:30pm Coffee Break Westmount Foyer
 3:30pm-5:00pm Technical Sessions (WD)

SPEAKER GUIDELINES

Audio-Visual Services

All session rooms will be equipped with LCD (computer) projectors, but please note that you **must provide your own computer** or pre-arrange to share with others in your session. Please note that overhead projectors will NOT be available. Please follow these guidelines to ensure a successful presentation.

- Bring your laptop to your session. We recommend that you pre-arrange with other speakers in your session to ensure that at least one of you brings a laptop from which you can project your talks.
- Bring your power supply cord with you. We recommend that you do not attempt to run your presentation off the laptop battery.
- If your laptop is a Mac, you will need the appropriate adapter for the external video output.
- Arrive at your session at least 15 minutes before it begins. All presenters in a session should set up and test the connection to the projector before the session begins.
- We encourage speakers to put their presentations on a flash drive as a backup.

Presentation Guidelines

The room and location of your session are listed in the Technical Sessions section of this program and in the Master Track Schedule. Please be on time for your session and check in with the session chair.

- Arrive at your session at least 15 minutes early for A/V set-up.
- Presentations are expected to be in English.
- Limit the presentation to key issues with a brief summary.
- Time your presentation to fit within your designated time span (determined by the number of speakers presenting in that session), leaving time for audience questions.
- Bring copies of your paper or other handouts to distribute to the audience.
- No proceedings with complete papers are produced for this meeting. However, you can access extended two-page abstracts of most presentations at the conference website: <http://meetings2.informs.org/healthcare2011/>. For any additional information, please contact the authors directly at the address supplied with each abstract.

Questions about the Program, Last-Minute Presentation Changes or Cancellations

Come to the INFORMS Healthcare Registration Desk if you have general questions about the meeting and/or questions about your own presentation.

For Assistance During Your Session: Session Monitor Desks

Session Monitor Desks are located near session rooms. If you have a problem in your session room (related to AV needs or any other requests), go to the Session Monitor Desk in the area to ask for assistance.

SESSION CHAIR GUIDELINES

The role of the Chair is to coordinate the smooth running of the session. The Chair:

- Begins and ends each session on time. Each session lasts 90 minutes, with the time per presentation determined by the number of papers in the session. Equal time should be given to each paper.
- Introduces each presentation (just the title of the paper and the name of the presenting author).
- Ensures that presentations are made **in the order shown in the program**. This allows for "session jumping." If a speaker cancels or does not attend, the original time schedule should be adhered to rather than sliding every talk forward.
- Completes the session attendance form (forms will be in the room).
- We ask Session Chairs to notify us about any last-minute changes or cancellations; these changes will be posted outside the meeting rooms.

EXTENDED ABSTRACTS AVAILABLE

Two-page extended abstracts for most presentations are at the conference web page. Click on the title of the paper to see the extended abstract. <http://meetings2.informs.org/healthcare2011> and click on "Search the Program."

REGISTRATION & GENERAL INFORMATION

Messages

The best way for people to reach you is to contact you directly at your hotel. Please leave your hotel phone number with your colleagues and family members. Messages can be posted on a message board located near registration; you can contact colleagues attending the meeting using this message board. Please check the board periodically to see if you have received a message.

Badges Required for Technical Sessions

INFORMS Healthcare 2011 badges must be worn to all sessions and events. Attendees without badges will be directed to the registration desk to register and pick up their badges. *All attendees, including speakers and session chairs, must register and pay the registration fee.*

Your registration fee includes admittance to the complete technical program. Also included are the Monday evening reception, networking lunch on Monday, and all morning and afternoon coffee breaks. No other meals are included.

Internet

Free Wireless Internet will be available in the exhibit hall, meeting rooms and guest rooms.

WHERE TO GO FOR LUNCH:

These restaurants are close to the hotel:

Le Marly (international bistro)
1065 Côte du Beaver Hall

Restaurant Julien (French)
1191 Rue Union

Beaver Hall (French bistro)
1073 Côte du Beaver-Hall

Plaisirs coupables (snack bar)
1410, Rue Peel (corner Ste-Catherine)

Les 3 Brasseurs (micro-brewery)
732 Rue Sainte-Catherine Ouest

Keg (steak)
1 Place Ville-Marie

Mr. Ma (Chinese)
1 Place Ville Marie

Guido & Angelina (Italian)
690, Rue Sainte-Catherine Ouest

Bâton Rouge (ribs)
1050 Rue De la Montagne

Dunn's Famous Deli
1249 Rue Metcalfe

MONDAY, JUNE 20

Coffee Break & Exhibits

10:00am-10:30am
Fontaine Ballroom – Salon B

Structured Networking Lunch

With roundtable discussion led by facilitators
12:00pm-1:00pm
Fontaine Ballroom – Salons A-B
Each table will be hosted by a member of the conference committee or an INFORMS leader, who will facilitate discussion around the table. This is an opportunity to meet new people, so don't sit with folks you already know! Following lunch, stop by the Interactive/Poster Session, being held from 1:00-2:00pm in Salon B.

Coffee Break & Exhibits

3:15pm-3:30pm
Fontaine Ballroom – Salon B

Welcome Reception

6:00pm-7:30pm
Westmount-Outremont Ballrooms
The Healthcare 2011 Organizing Committee welcomes you to INFORMS first topical conference on health-care. Meet with colleagues and enjoy selections from our food displays. Cash bar; complimentary soft drinks and bottled water.

Thanks to our sponsor:

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TUESDAY, JUNE 21

Coffee Break & Exhibits

10:00am-10:30am
Fontaine Ballroom – Salon B

Lunch Break on Your Own

12:00pm-1:30pm
See list of restaurants within easy walking distance of the Hilton.

Ice Cream Break

3:00pm-3:30pm
Fontaine Ballroom – Salon B

WEDNESDAY, JUNE 22

Coffee Break & Exhibits

10:00am-10:30am
Fontaine Ballroom – Salon B

Lunch Break on Your Own

12:00pm-1:30pm
See list of restaurants within easy walking distance of the Hilton.

Coffee Break

3:00pm-3:30pm
Westmount Ballroom Foyer

INFORMS INTERNATIONAL MEETING 2012 BEIJING

In conjunction with

THE OPERATIONS RESEARCH SOCIETY OF CHINA

June 24-27, 2012
China National Convention Center
Beijing, China

General Chair:

Jian Chen, Professor and Chair, Department of Management Science
Director, Research Center for Contemporary Management
School of Economics and Management, Tsinghua University

PLENARY

MONDAY

2:00pm-3:15pm
Westmount & Outremont

The New McGill University Health Centre: From Vision to Reality

Arthur T. Porter
Director General and Chief Executive Officer
McGill University Health Center
Professor, McGill University

In 1997, five hospitals affiliated with the Faculty of Medicine of McGill University formed the McGill University Health Centre in what remains as Canada's largest voluntary hospital merger. A major driving force behind the merger was the vision to create a favorable environment for pivotal infrastructure renewal: an imperative for the sustaining and enhancement of world-class academic medicine. In April 2010, construction began on the Glen Campus, a key component of the \$2.25-billion MUHC Redevelopment Project and also the largest public-private partnership in Canada. While one of the world's most significant healthcare infrastructure projects, the MUHC Redevelopment Project is also a catalyst for the complete redesign of our clinical, research and teaching practice. This talk will describe the genesis of the vision, the implementation process and implications for the future.



Arthur T. Porter is Director General and CEO of the McGill University Health Centre. He has an extensive international background, which includes business, medical practice and academic

leadership positions in Canada, Europe, Africa and the United States. He has served as a consultant to the World Health Organization, and has worked to establish a variety of international healthcare programs. He holds a M.B.B.Chir./M.D., Cambridge University School of Clinical Medicine; M.A., Cambridge University; M.B.A., University of Tennessee; and B.A., Cambridge University.

TUTORIALS

MONDAY

10:30am-12:00pm
Fontaine G

Why Healthcare Operations Research Needs Health Informatics

Wojtek Michalowski
University Research Chair in Health Informatics and Decision Support
University of Ottawa

This tutorial will begin with a presentation of the main areas of research in health informatics. Considering that the use of O.R. in healthcare is centered on supporting decision-making (administrative and clinical), special attention will be paid to issues involving decision support and decision support systems. The main challenges faced by both the developers and end-users of decision support systems will be presented and possible solutions discussed. Participants should leave this tutorial with a better appreciation of the important interplay between the art of building O.R. models and the health informatics solutions.

TUESDAY

10:30am-12:00pm
Fontaine E

Designing and Conducting Large-Scale Randomized Experiments to Understand Healthcare Delivery in Developing Countries

Prashant Yadav
Director-Health Care Delivery Research
William Davidson Institute
University of Michigan

Improving healthcare delivery requires operational changes in the processes of care provision and in the supply chain for delivering key healthcare inputs. Operations management researchers have used a combination of analytical models and empirical approaches to answer key design questions in healthcare service delivery. We often find that well-tested operational designs sometimes fail or lose their cost efficiency benefits when transferred to a developing country setting. Lack of data and inability to make the right modeling assumptions for a very different socio-economic setting requires a new "implementation science" toolkit for developing

country healthcare research that is built on field observation and can be understood, used and accepted by researchers in medicine, engineering and business. Although randomized, controlled experiments are the gold standard for testing safety and efficacy of pharmaceuticals and other healthcare interventions, they have not been widely used for operational design problems in healthcare. Using examples of randomized experiments from Zambia and Tanzania, this tutorial will provide an overview of the research tools and pragmatic issues in conducting large-scale randomized experiments in healthcare operations management.

WEDNESDAY

10:30am-12:00pm
Côte St-Luc

Healthcare Reform in the US and Canada

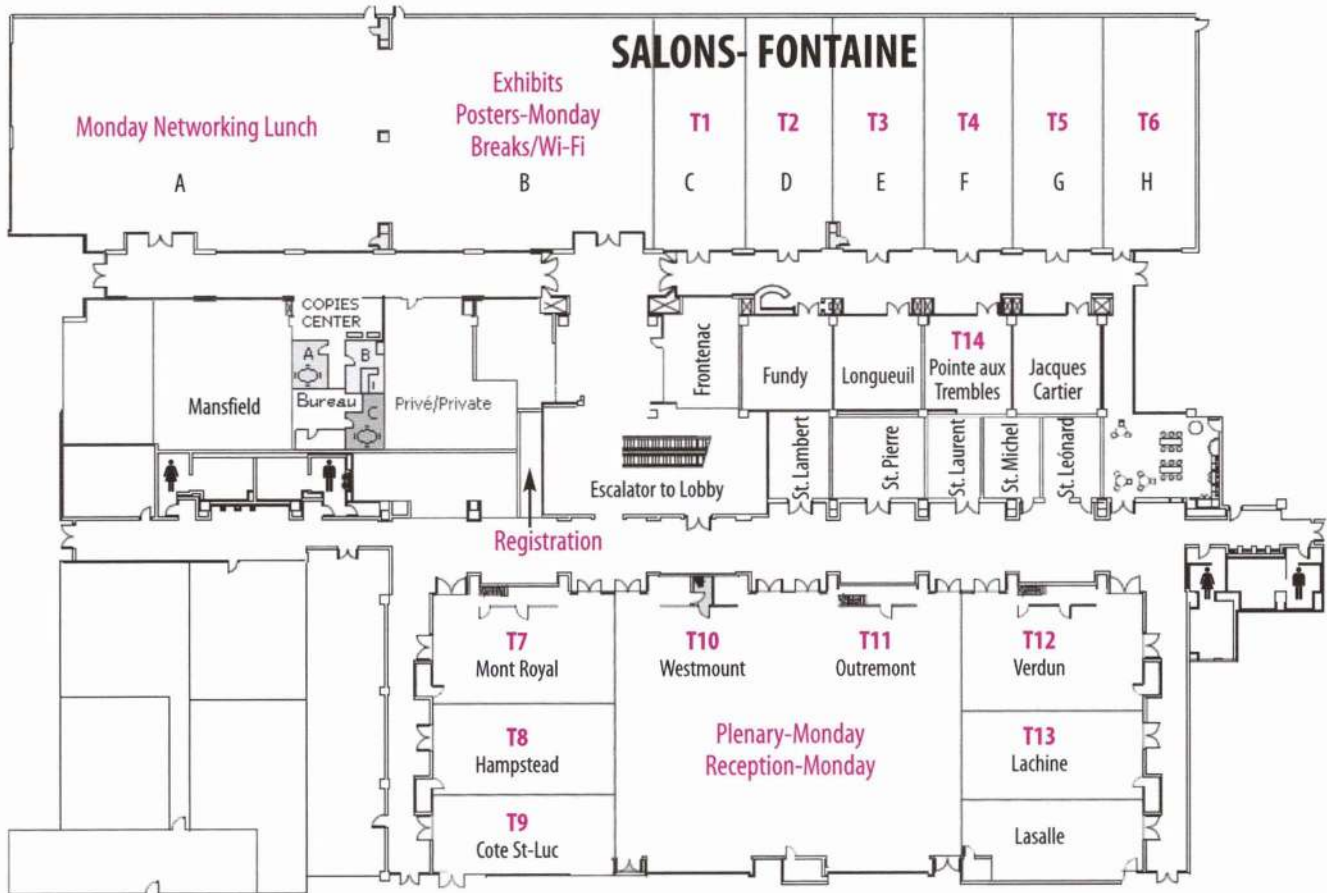
Antonia Maioni
Associate Professor
McGill Institute for the Study of Canada
McGill University

Healthcare reform is an enduring issue on the policy landscapes of both the United States and Canada. This tutorial covers the basic differences in the two healthcare systems, explains the reasons for their convergent development over time, and explores the implications of recent health reform debates in the two countries.

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TRACKS 1-14

Track numbers shown for Technical Session Rooms



Monday, June 20
1:00pm-2:00pm - Fontaine B

Be sure to attend this important and lively session. Interactive Session presentations allow authors to present projects that may be at early stages of development. This is an opportunity for colleagues working in similar areas to critique, make suggestions and provide encouragement.

Abstracts for these presentations on pages 22-26.

- 1 The Impact of Direct-to-Consumer Advertising on Physicians' Prescribing Behavior**
 Franklin Carter, Pennsylvania State University
- 2 A Systems Engineering Agenda to Improve Traumatic Brain Injury in the Military Health System**
 Hande Musdal, Northeastern University
- 3 A Decision-Making Tool Based on Simulation to Improve the Operation of Outpatient Clinics**
 Stéphanie Cartier, Université du Québec à Trois-Rivières
- 4 Understanding the Effect of Patient Diagnosis on its Length of Stay: a Logistic Regression Approach**
 Maria Guzman Castillo, University of Southampton
- 5 Developing a Generic Simulation for Use with Lean to Optimize Wards and Release Nursing Time**
 Claire Cordeaux, SIMUL8 Corporation
- 6 A Generic Framework for Hybrid Simulation in Complex Systems: a Healthcare Example**
 Kirandeep Chahal, Brunel University
- 7 A Model for Forecasting Inpatient Unit Demand Originating from an Emergency Department**
 Jordan Peck, Massachusetts Institute of Technology
- 8 Using a Lagged Model to Study the Learning Curve of Surgeries by Monthly Data**
 Yi Lee, Sichuan University
- 9 Monitoring Abrupt Declines in Surgeon Workloads**
 Danielle Masursky, SUNY
- 10 Applying Genetic Programming for Data Mining in a Large Brazilian Supplemental Health Insurance**
 Silvio Araujo, Universidade Estadual Paulista
- 11 Dynamic Modeling of Service Delivery in Healthcare: the VA Disability Evaluation Process**
 Tom Rust, Worcester Polytechnic Institute
- 12 Optimal Physicians Staffing Policy in a Dynamical Emergency Room System**
 Jerome Ndayishimiye, Binghamton University
- 13 A Combinatorial Approach to Appointment Scheduling and Sequencing**
 Zuozheng Wang, University of Maryland College Park
- 14 Social Network Modularity as a Driver for Complex Epidemic Dynamics**
 Thomas Hladish, University of Texas at Austin
- 15 Estimating Management Policies in an Intensive Care Unit Joining Data and Expert Opinions**
 Fermín Mallor, Public University of Navarre
- 16 Comparison of Data Collection Techniques and Their Effectiveness for Process Improvement in Healthcare**
 Rachael Taylor, University of Ontario Institute of Technology
- 17 Mobile Technology for Patient-Flow Management: An Application for the NEDOCS Score**
 Gilles Reinhardt, DePaul University
- 18 Optimal Location of Medical Devices in Hospitals**
 Mehdi Ardavan, Concordia University
- 19 Cost-Effective Incentive Values to Reduce Diabetes Healthcare Cost**
 Ramy Neamatallah, Concordia University
- 20 An Event-Centric Ontology for Electronic Health Records**
 Jeni Fan, Booz Allen Hamilton
- 21 Skewness Variance Approximation for Dynamic Rate Multi-Server Queues**
 Jamol Pender, Princeton University
- 22 Optimizing Patient Flow at General Site Orthopedic Clinic Using Discrete Event Simulation**
 Ivan Yuen, Hamilton Health

23 Mathematical Optimization Tools at the British Columbia Cancer Agency
Vincent Chow, British Columbia Cancer Agency

24 Improving Orthopedic Surgical Patient Flow Through the Master Surgical Schedule
Daphne Sniekers, Hamilton Health Sciences

25 User-Centered Redesign of BioSense, an Application for National Syndromic Surveillance
Robert Furberg, RTI International

26 Modeling Multidisciplinary Rounding at Intensive Care Unit
Ashish Gupta, Minnesota State University Moorhead

27 Simulation Model to Explore Efficient Patient Flow in an Emergency Department
Felisa Vazquez-Abad, Hunter College CUNY

28 Variances and Probability Distributions in Utility-Based Comparative Effectiveness Analyses
Aysun Taseli, Northeastern University

29 Applying Statistical Process Control and Benchmarking Methods to Specialty Care Process Quality
James Benneyan, Northeastern University-Center for Health Organization Transformation

30 Online Reputation Systems for Improving Operational Efficacy of the Healthcare Marketplace
Haijing Hao, Carnegie Mellon University

31 As the Largest Healthcare Provider in the U.S., Does Medicare Reimburse Hospitals for Outcome?
David Barrett, UWO-Ivey School of Business

32 Policy Mapping the Medical Countermeasure Enterprise: Understanding Complex Policy Environments
Michael Mayer, Booz Allen Hamilton

33 Clinical Information, Communication and Workflow Challenges of Healthcare Professionals in Homecare
Ivana Matic, University of Toronto

34 Analysis of Repeated Measures Data for Glaucoma Progression Classification
Greggory Schell, University of Michigan

35 Constraint Programming and Set Cover Approach to Beam Selection in Total Marrow Irradiation
Chieh-Hsiu J. Lee, University of Toronto

36 Northeastern University Healthcare Systems Engineering Program
Mehmet Erkan Ceyhan, Northeastern University-Healthcare Systems Engineering Centers

37 Creating a Better Delivery System: a New Multidisciplinary Systems Engineering Partnership
Bradley V. Watts, VA Medical Center

38 Current State of Lean and Six Sigma Adoption in Hospitals and Strategies for the Future
Stephanie Triplett, Department of Veterans Affairs

39 Illuminating the Uncertain Future of Healthcare Fraud
David Klubes, Booz Allen Hamilton

40 Approximate Dynamic Programming in Optimal Search with Application to Minimally Invasive Surgery
Yasin Gocgun, University of British Columbia

Abstracts for these presentations on pages 22-26.

Plan Ahead For

INFORMS-SMDM Joint Program 2012

INFORMS in conjunction with the Society for Medical Decision Making

Special Joint Program
on Wednesday, October 17, 2012

INFORMS Annual Meeting
October 14-17

SMDM Annual Meeting
October 17-20

Phoenix, Arizona

Watch for more information
in fall 2011.



MONDAY

Track	Room	MA 8:30-10:00	MB 10:30-12:00	Interactive/ Poster 1:00-2:00	MC Plenary 2:00-3:15	MD 3:30-5:00
1	Fontaine Ballroom C	Canadian Operational Research Society	Theme: Panel Session	Interactive Poster Session Fontaine B	The New McGill University Health Centre: From Vision to Reality Arthur Porter Westmount/ Outremont	Theme: Panel Session
2	Fontaine Ballroom D	Putting Healthcare IE/OR into Practice in the US	Putting Healthcare IE/OR into Practice in the US			INFORMS Health Applications Section
3	Fontaine Ballroom E	Medical Decision Making/ OR for Public Health	Medical Decision Making/ OR for Public Health			Operations Research for Public Health
4	Fontaine Ballroom F	Medical Decision Making	Medical Decision Making			Medical Decision Making
5	Fontaine Ballroom G	INFORMS Data Mining Section/ OR for Public Health	Tutorial: Health Informatics			INFORMS Data Mining Section
6	Fontaine Ballroom H	Theme: Healthcare Operations Mgt.	Canadian Operational Research Society			Canadian Operational Research Society
7	Mont Royal	EURO-ORAHS: OR Applied to Health Services	EURO-ORAHS: OR Applied to Health Services			EURO-ORAHS: OR Applied to Health Services
8	Hampstead	Improving Patient Flow Through Capacity Planning & Scheduling	Improving Patient Flow Through Capacity Planning & Scheduling			Theme: Capacity & Patient Flow Mgt.
9	Cote St. Luc	Medical Decision Making	Canadian Operational Research Society			POMS, College of Healthcare Operations Management
10	Westmount	No Session	No Session			No Session
11	Outremont	No Session	No Session			No Session
12	Verdun	Canadian Operational Research Society	Canadian Operational Research Society			Theme: Modeling & Optimization
13	Lachine	Theme: Modeling & Optimization	Theme: Modeling & Optimization			Theme: Modeling & Optimization
14	Pointe Aux Trembles	No Session	Theme: OR in Public Health			No Session

TUESDAY

Track	Room	TA 8:30-10:00	TB 10:30-12:00	TC 1:30-3:00	TD 3:30-5:00
1	Fontaine Ballroom C	Medical Decision Making	Theme: Panel Session	Theme: Healthcare Delivery Systems	Theme: Healthcare Delivery Systems
2	Fontaine Ballroom D	IIE, Society for Health Systems	INFORMS Health Applications Section	IIE, Health Systems Society	INFORMS Health Applications Section
3	Fontaine Ballroom E	Simulation/OR for Public Health	Tutorial: Designing & Conducting Large-Scale R&omized	OR for Public Health	Operations Research for Public Health
4	Fontaine Ballroom F	Medical Decision Making	Medical Decision Making	Medical Decision Making	Medical Decision Making
5	Fontaine Ballroom G	INFORMS Data Mining Section	Canadian Operational Research Society	INFORMS Computing Society	Theme: Data Mining & Health Informatics
6	Fontaine Ballroom H	Canadian Operational Research Society	Theme: Healthcare Operations Mgt.	INFORMS Health Applications Section	INFORMS Health Applications Section
7	Mont Royal	INFORMS MSOM, Healthcare Operations Mgt.	INFORMS MSOM, Healthcare Operations Mgt.	INFORMS MSOM, Healthcare Operations Mgt.	INFORMS MSOM, Healthcare Operations Mgt.
8	Hampstead	Improving Patient Flow Through Capacity Planning & Scheduling	Improving Patient Flow Through Capacity Planning & Scheduling	Theme: Capacity & Patient Flow Mgt.	Theme: Capacity & Patient Flow Mgt.
9	Cote St. Luc	Pharmacoeconomics	Pharmacoeconomics	Pharmacoeconomics/ OR for Public Health	Pharmacoeconomics
10	Westmount	Transplant Operations	Transplant Operations	Theme: Panel Session	Transplant Operations
11	Outremont	INFORMS MSOM, Healthcare Operations Mgt.	INFORMS MSOM, Healthcare Operations Mgt.	Theme: Health Care Supply Chains	Theme: Health Care Supply Chains
12	Verdun	INFORMS Health Applications Section	INFORMS Health Applications Section	INFORMS Optimization Society	INFORMS Optimization Society
13	Lachine	Theme: Modeling & Optimization	INFORMS Simulation Society	INFORMS Simulation Society	Theme: Modeling & Optimization
14	Pointe Aux Trembles	No Session	No Session	No Session	No Session

WEDNESDAY

Track	Room	WA 8:30-10:00	WB 10:30-12:00	WC 1:30-3:00	WD 3:30-5:00
1	Fontaine Ballroom C	Theme: Healthcare Delivery Systems	Theme: Healthcare Delivery Systems	Theme: Healthcare Delivery Systems	Theme: Healthcare Delivery Systems
2	Fontaine Ballroom D	POMS, College of Healthcare Operations Management	Theme: Healthcare Delivery Systems	Theme: Healthcare Delivery Systems	Theme: Healthcare Delivery Systems
3	Fontaine Ballroom E	INFORMS Health Applications Section/OR for Public Health	OR for Public Health	Putting Healthcare IE/OR into Practice in the US	INFORMS Health Applications Section
4	Fontaine Ballroom F	Canadian Operational Research Society	Canadian Operational Research Society	Theme: Medical Decision Making	Theme: Medical Decision Making
5	Fontaine Ballroom G	Theme: Data Mining & Health Informatics	INFORMS Data Mining Section	Theme: Data Mining & Health Informatics	No Session
6	Fontaine Ballroom H	INFORMS Health Applications Section	IIE, Society for Health Systems	Medical Decision Making	Theme: Healthcare Operations Mgt.
7	Mont Royal	POMS, College of Healthcare Operations Management	POMS, College of Healthcare Operations Management	Theme: Healthcare Operations Mgt.	Theme: Healthcare Operations Mgt.
8	Hampstead	Theme: Capacity & Patient Flow Mgt.	Theme: Capacity & Patient Flow Mgt.	Theme: Capacity & Patient Flow Mgt.	Theme: Capacity & Patient Flow Mgt.
9	Cote St. Luc	Canadian Operational Research Society	Tutorial: Healthcare Reform in Canada & US	Theme: Healthcare Operations Mgt.	No Session
10	Westmount	Canadian Operational Research Society	Canadian Operational Research Society	Canadian Operational Research Society	Canadian Operational Research Society
11	Outremont	INFORMS Computing Society	INFORMS Computing Society	Theme: Health Care Supply Chains	No Session
12	Verdun	Theme: Modeling & Optimization	Theme: Modeling & Optimization	Theme: Modeling & Optimization	Theme: Modeling & Optimization
13	Lachine	Theme: Modeling & Optimization	Theme: Modeling & Optimization	Theme: Modeling & Optimization	No Session
14	Pointe Aux Trembles	No Session	No Session	No Session	No Session



EXHIBITORS

Visit the exhibits in Fontaine B.
All coffee breaks will be held in
the exhibit area.

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Improving Patient Flow through Capacity Planning & Scheduling

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Putting Healthcare IE/OR into Practice in the U.S.

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How to Navigate the Technical Sessions

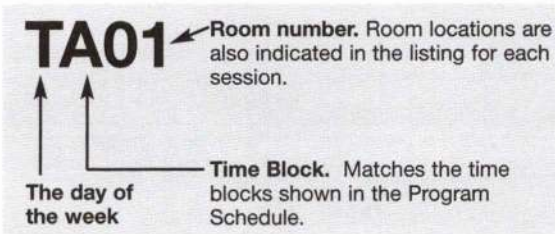
There are four primary resources to help you understand and navigate the Technical Sessions:

- This Technical Session listing, which provides the most detailed information. The listing is presented chronologically by day/time, showing each session and the papers/abstracts/authors within each session.
- The Author and Session indices provide cross-reference assistance (pages 63-68).
- The floor plan on page 7 shows you where technical session tracks are located.
- The Master Track Schedule is on pages 10 & 11.

Quickest Way to Find Your Own Session

Use the Author Index (page 63) — the session code for your presentation will be shown along with the room location. You can also refer to the full session listing for the room location of your session.

The Session Codes



Time Blocks

Monday

- A — 8:30am - 10:00am
- B — 10:30am - 12:00pm
- Poster Session — 1:00pm - 2:00pm
- C — 2:00pm - 3:15pm (Plenary)
- D — 3:30pm - 5:00pm

Tuesday

- A — 8:30am - 10:00am
- B — 10:30am - 12:00pm
- C — 1:30pm - 3:00pm
- D — 3:30pm - 5:00pm

Wednesday

- A — 8:30am - 10:00am
- B — 10:30am - 12:00pm
- C — 1:30pm - 3:00pm
- D — 3:30pm - 5:00pm

Monday, 8:30am - 10:00am

■ MA01

01- Fontaine Ballroom C

Aspects of Congestion in Health Care Systems I

Sponsor: Canadian Operational Research Society

Sponsored Session

Chair: David Stanford, University of Western Ontario, London, ON, Canada, stanford@stats.uwo.ca

1 - How Operations Research Has Influenced Clinical Service Re-design Over a Decade: One Physician's Experience

Donald Campbell, Professor, Monash Medical Centre, Melbourne, Australia, donald.campbell@monash.edu, Keith Stockman, David Stanford, Peter Taylor

The author (a physician) was actively involved in research application of simulation during the early period of emergency access block in Australia (1999-2000). This OR exposure heavily influenced subsequent framing of redesign within the author's own clinical services. Case studies will illustrate the value of exposing clinical leaders to OR.

2 - Practical Application of Discrete Event Simulation to Hospital Clinical Service Planning

Keith Stockman, IRIDIUM for Life - Health and Wellness Centre, Queensland, Australia, keith.stockman@iridium.net.au, Donald Campbell, G Campaign

Southern Health is a large metropolitan health service in Australia which has recently used discrete event simulation to shed light on a number of challenging areas of patient flow including the emergency department and medical inpatients. The models, context and influence on planning are discussed.

3 - Queue Modelling Based Staffing for A&E Departments - Going Beyond Simulation Experimentation

David Worthington, Senior Lecturer, Department of Management Science, Lancaster University Management School, Lancaster, United Kingdom, d.worthington@lancaster.ac.uk, Navid Izady

This study presents and applies a queueing theory based approach to guide use of a simulation model to efficiently investigate alternative staffing profiles for A&E departments failing to achieve the UK's 4 hour target. Application in a particular hospital shows scope for re-allocating existing staff to bring about dramatic improvements in performance. The queueing theory based approach combines time-dependent networks of infinite-server queues with a square root staffing formula.

■ MA02

02- Fontaine Ballroom D

OR in Practice I

Cluster: Putting Healthcare IE/OR into Practice in the US

Invited Session

Chair: Aysun Taseli, Northeastern University, College of Engineering, Boston, MA, 02115, United States of America, ataseli@gmail.com

1 - Benchmarking Healthcare Systems: Data Envelopment Analysis

Mehmet Erkan Ceyhan, Post-Doctoral Associate & Project Manager of VERC, Healthcare Systems Engineering Centers, Northeastern University, 360 Huntington Avenue, Snell Engineering Center, Boston, MA, 02115, United States of America, erkanceyhan@gmail.com

Despite the value of identifying and transferring best practices, many benchmarking approaches are fairly subjective in the manner by which they weight performance metrics and determine top performers. The purpose of this talk is to illustrate the use of data envelopment analysis (DEA), for identifying the most efficient systems at transforming varied resources consumed into varied outcomes produced. VA medical facilities, national healthcare systems using data from the WHO, and state healthcare systems will be summarized to illustrate the application and utility of this method.

2 - Evaluating & Measuring the Clinical Performance of Substance Abuse Centers Using Data Envelopment Analysis

Jon Chilingirian, Associate Professor of Management, Brandeis University, 89 Montrose Street, Newton, MA, 02458, United States of America, chilinge@brandeis.edu, Rafael Corredoira, John Kimberly

Approximately 13,000 substance abuse treatment centers provide services to millions of Americans with alcohol and other drug problems. Although the annual public expenditure for these treatment services is estimated at \$15 billion, plus another \$5 billion for private insurance, more than 20 million Americans in need of substance abuse treatment at a special facility did not receive it (SAMHSA 2007). Treatment center managers are not only trying to cope with myriad social, medical, economic and political demands, they face even more serious accountability and performance challenges. We develop a new performance measure that utilizes clinical performance measures as the output of the treatment provided and, in order to control for the patient mix, a combination of ASAM treatment levels (Mee-Lee, 1996) and severity of the addiction as the inputs. Data were obtained from the State of Maryland's addiction treatment network in 2005 covering 161 clinics offering Level 1 service to over 32,000 patients. The research proceeds in two stages. In the first stage, we identify high performing organizations by conducting an empirical study of Maryland Level I treatment facility performance, taking into account differences in severity of case mix in the sample. In the second stage of DEA, we determine via Tobit regression how environmental, strategic and patient factors are associated with higher performing and more effective facilities, and we assess the extent to which variation in performance can be explained by organizational and environmental factors.

3 - Risk-adjusted Statistical Monitoring and Cluster Detection

Aysun Taseli, Northeastern University, College of Engineering,
Boston, MA, 02115, United States of America, ataseli@gmail.com

Many healthcare processes produce heterogeneous dichotomous events due to nature of the sub-systems in the sense that the data are either homogeneous within but not between sub-populations, or each Bernoulli trial has a unique risk parameter. Examples include mortality rates or surgical site infections among different patient types and success rate of surgeons. We will discuss risk-adjusted statistical monitoring, sequential testing, and spatial cluster detection and compare the performance of conventional methods with risk-adjusted counterparts based on a new distribution of heterogeneity.

■ MA03

03- Fontaine Ballroom E

Joint Session MDM/OR for Public Health: Public Health Emergency Response

Cluster: Medical Decision Making/Operations Research
for Public Health

Invited Session

Chair: David Hutton, University of Michigan,
1415 Washington Heights, SPH II: M3525, Ann Arbor, MI, 48109,
United States of America, dwhutton@umich.edu

1 - Modelling the Response of a Public Health Department to Infectious Disease

Reha Uzsoy, Professor, North Carolina State University, Raleigh,
NC, United States of America, ruzsoy@ncsu.edu, Travis Worth,
Emine Yaylali, Erika Samoff, Anne-Marie Meyer,
Jean-Marie Maillard, Aaron Wendelboe

We present a discrete-event simulation model of the response of the North Carolina public health system to pertussis events. We take a comprehensive view of public health actions related to a pertussis event, beginning with detection of an individual patient, confirmation of the case by physician and lab results, contact tracing and medication of contacts by local health departments. Results suggest that resource availability has significant impacts on the evolution of a disease outbreak, as do information delays at various stages of the process.

2 - Simulation Model of Potential Hospital Response under a Novel Emergency Management Paradigm

Anke Richter, Associate Professor, Naval Postgraduate School,
699 Dyer Rd, Bldg 234, Monterey, CA, 93943,
United States of America, arichter@nps.edu, Joan McInerney

We explore a novel emergency management paradigm - a tiered supervision system in two metropolitan hospitals. We determine their ability to treat the casualties seen in the Madrid bombings under standard procedures or the new paradigm. Implementing a logit model developed to predict physician's competency in the tiered program in a Monte Carlo simulation of staffing, we see that when only ED physicians were used neither hospital could have handled the surge. In the tiered approach, Hospital A could easily accommodate the surge and Hospital B can increase its response from 37% to 74%.

3 - A Two-agent Stochastic Alert Threshold Model For Identifying A Potential Disease Outbreak

Emine Yaylali, Research Assistant, North Carolina State University,
Fitts Dept. of Industrial & Systems Eng, Raleigh, NC, 27695-7906,
United States of America, eyaylal@ncsu.edu, Julie Ivy

Infectious disease outbreaks are one of the major threats to public health and cause human casualties and economic burden. In order to identify an outbreak, issue a timely alert and start mitigation actions, we modeled the public health system as a multi-agent(decentralized) partially observable Markov decision process where local and state health departments are decision makers. While minimizing false and late alerts, the near optimal timing decisions for alerting are obtained using H1N1 and pertussis data of North Carolina. Sensitivity analysis and structural properties are also identified.

■ MA04

04- Fontaine Ballroom F

Modeling for Medical Decision Making

Cluster: Medical Decision Making

Invited Session

Chair: Julie Ivy, Associate Professor, North Carolina State University,
111 Lampe Drive, Raleigh, NC, 27695, United States of America,
jsivy@ncsu.edu

1 - Dynamic State Space Models of Glaucoma

Mariel Lavieri, Assistant Professor, University of Michigan,
1205 Beal Ave, Ann Arbor, MI, United States of America,
lavieri@umich.edu, Jonathan E. Helm, Mark Van Oyen,
Joshua Stein, David Musch

We develop an accurate state space model for the progression of glaucoma. Control decisions of the testing intervals are linked to the dynamic forecasting models created. The model is calibrated using the Collaborative Initial Glaucoma Treatment Study.

2 - Optimal Decisions for Breast Cancer Patients with Spontaneous Disease Regression

Shengfan Zhang, North Carolina State University, Raleigh, NC,
United States of America, szhang5@ncsu.edu, Julie Ivy

In decision modeling, breast cancer is often assumed to be a progressive disease. However some medical studies suggest that breast cancer may regress without treatment. In such cases, screening diagnosis may not be advantageous. We build a partially observable Markov model to incorporate disease regression, allowing transition from in situ cancer to a cancer-free state. This study seeks to quantify the impact of the regression probability on life-time breast cancer mortality with respect to different mammography screening and treatment policies.

3 - The Equity of Pediatric Healthcare Accessibility: Measurement and Inference

Nicoleta Serban, Georgia Institute of Technology, Atlanta, GA,
United States of America, nserban@isye.gatech.edu,
Mallory Nobles, Julie Swann

The objective of this study is to identify systematic disparities in access to pediatric healthcare between different groups of children, identified by location or socioeconomic variables. We provide insights into various measures of geographic accessibility to gain an understanding of the sensitivity of the conclusions to the conceptualization of accessibility. We also develop statistical models for uncovering potential inequities in healthcare access. We use statistical hypothesis testing to make inference on the randomness of the spatial associations to accessibility.

■ MA05

05- Fontaine Ballroom G

Joint Session DM/OR for Public Health: Novel Approaches in Public Health Surveillance I: BioSense Program Redesign, Meaningful Use, and Syndromic Surveillance

Sponsor: INFORMS Data Mining Section/Operations Research
for Public Health

Sponsored Session

Chair: Taha Kass-Hout, Deputy Director for Information Science and
BioSense Program Manager, Division Public Health Surveillance
Program Office, CDC, Div. of Notifiable Diseases and Healthcare,
1600 Clifton Road, NE MS E-97, Atlanta, GA, 30329,
United States of America, kasshout@gmail.com

1 - Redesigning the BioSense Program

Barbara Massoudi, RTI International, P. O. Box 12194,
Research Triangle Park, NC, 27709, United States of America,
bmassoudi@rti.org

In 2010 the CDC started redesigning the BioSense Program based on input and guidance from local, state, and federal stakeholders. The goal is to create a new BioSense, which coordinates and links existing surveillance systems enabling rapid and enhanced interchange of information and improving BioSense's utility through a user-centered design approach. The redesign approach, methods, and results including progress on prototype development will be shared. CDC and its partners will work collaboratively to redesign the BioSense Program meeting objectives set forth by the public health community.

2 - HealthMap: Digital Disease Detection

John Brownstein, Assistant Professor, Harvard Medical School,
1 Autumn Street, Boston, MA, 02115, United States of America,
John.Brownstein@childrens.harvard.edu

The rapid global reach in telecommunications has permitted public health professionals to communicate more effectively. In particular, internet-based resources such as discussion sites and online news sources, accessible through free and unrestricted subscription, are valuable sources of information. I will discuss the current capabilities and future directions in the use of the non-traditional data sources. I will describe Healthmap.org a free and open resource and demonstrate how new surveillance technology is providing early warning and tracking of new and emerging public health threats.

3 - Distribute: A Novel Approach to Rapid Regional and National Sharing of Surveillance Data

David Buckeridge, Associate Professor, McGill University,
1140 Pine Avenue West, Montreal, QC, H3A1A3, Canada,
david.buckeridge@mcgill.ca

The Distribute project was initiated in 2006 to pilot influenza-like illness (ILI) monitoring using data aggregated from syndromic surveillance systems operated by state and local health departments. It was rapidly expanded to enhance ILI surveillance during the 2009 H1N1 influenza pandemic, covering approximately one-third of US emergency department visits.

4 - Enhancing Surveillance with Meaningful Syndromic Surveillance Standards

Charlie Ishikawa, International Society for Disease Surveillance,
26 Lincoln Street, Suite 3, Brighton, MA,
United States of America, cishikawa@syndromic.org

Promoting the effective use of health information technology to improve public health is a pillar of US healthcare reform. Under the HITECH Act, EHR Incentive Programs seek to enhance clinical and public health activities, including public health surveillance, through technology certification based on a policy that supports "Meaningful Use". During this session, participants will learn about the opportunities for public health surveillance, and the syndromic surveillance standards, recommended by the International Society for Disease Surveillance and supported by the CDC's BioSense Program.

MA06

06- Fontaine Ballroom H

Personnel Scheduling

Contributed Session

Chair: Melissa Bowers, Associate Professor, University of Tennessee,
613 Stokely Management Center, Knoxville, TN, 37996,
United States of America, mrbowers@utk.edu

1 - Daily Scheduling of Home Health Care Services in Times of Natural Disasters

Patrick Hirsch, Assistant Professor, BOKU - University of Natural
Resources and Life Sciences, Feistmantelstrasse 4, Vienna, 1180,
Austria, patrick.hirsch@boku.ac.at, Klaus-Dieter Rest,
Andrea Trautsamwieser

In industrialized countries the demand for home health care services is rising enormously. When natural disasters occur it is an important task to maintain these services. The authors developed a model formulation for optimizing the daily scheduling of nurses and a Variable Neighborhood Search based algorithm to solve the problem efficiently. Extensive numerical studies with real life data sets from three districts and a sensitivity analysis are presented. Four flood scenarios for the observed areas are evaluated in detail.

2 - Scheduling and Assignment Medical Staff in a Gyneco Obstetrics Service

Ciro Alberto Amaya, Universidad de los Andes, Carrera 1 Este
19A-40, Bogotá, Colombia, ca.amaya@uniandes.edu.co,
Nubia Velasco, William Barrios

Scheduling and assignment tasks involving physicians from the gyneco-obstetrics area presents special attention because special constraints relating to particular activities emerge. The complexity of dealing with this type of process usually results in a failure to meet minimal requirements, has a detrimental impact on levels of service quality and damages medical and assistant staff labour conditions. This research aims to advance a medical staff multi-stage scheduling and assignment model based on the application of Constraint Programming(CP) and the Variable Neighborhood Search (VNS) metaheuristic. The results meet the hard constraints, as defined in the problem and provide full and rapid solutions, thus decreasing the time and effort spent on an activity usually completed by hand.

3 - An Optimization Model for Physician Scheduling that Incorporates Fairness and Preference

Melissa Bowers, Associate Professor, University of Tennessee,
613 Stokely Management Center, Knoxville, TN, 37996,
United States of America, mrbowers@utk.edu, Charles Noon

An issue faced by physician groups is scheduling shift coverage for hospitals. Traditional scheduling models incorporate shift preference as an absolute measure. We present a unique modeling approach which incorporates individual physician preference so that each physician attains a schedule that is superior to his/her own equality schedule.

MA07

07- Mont Royal

Center for Healthcare Operations Improvement & Research: University of Twente, The Netherlands

Sponsor: EURO - ORAHS, Operational Research Applied to
Health Services

Sponsored Session

Chair: Peter Vanberkel, University of Twente, Ravelijn RA 3123, 7521
PL Enschede, Netherlands, Enschede, Netherlands,
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1 - Panel Sizing in Oncology

Peter Vanberkel, University of Twente, Ravelijn RA 3123, 7521 PL
Enschede, Netherlands, Enschede, Netherlands,
p.t.vanberkel@utwente.nl

Panel size is defined as the number of patients that a single physician can effectively be accountable for. Typically this is studied in general practice settings where general practitioners want to know how 'big' their practice can be before the waiting times for appointments becomes too long or overtime too frequent. We extend the panel size models to reflect a hospital environment where there is a higher turnover rate of patients and multiple patient and appointment types. To account for these differences we model the panel size as the sum of patient type specific random variables.

2 - How to Deal with Emergency Surgeries?

Erwin W. Hans, Associate Professor, Center for Healthcare
Operations Improvement & Research, Department of Operations
Methods for Production & Logistics, School of Management and
Governance, University of Twente, P.O. Box 217, Enschede, ov,
7500 AE, Netherlands, e.w.hans@utwente.nl, Ingrid Vliegen,
Annemaaike Hooijsma

Emergency patients can be dealt with in dedicated emergency rooms, or alternatively in the elective program. The former policy may lead to underutilization of resources or waiting time for emergency patients. The latter may lead to waiting time of elective surgery, as well as elective surgery cancellations or overtime. Using generated instances and historical data from different types of hospitals, through scenario simulation we investigate the trade-off between size of the elective OR-department and whether or not having emergency ORs is more efficient.

3 - Combined Pool Size, Location-allocation, Collect-return Policies for Reusable Items within Hospitals

Ingrid Vliegen, Assistant Professor, University of Twente, P.O. Box
217, Enschede, 7500 AE, Netherlands, i.m.h.vliegen@utwente.nl,
Simme Douwe Flapper, Pieter Wolbers, Rogier van Vliet

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 different location and allocation policies for reusable items in hospitals taking into account these performance measures.

■ MA08

08- Hampstead

Improving Patient Flow Through Optimized Scheduling

Cluster: Improving Patient Flow through Capacity Planning and Scheduling

Invited Session

Chair: Jonathan Patrick, University of Ottawa, Telfer School of Management, Ottawa, ON, Canada, patrick@telfer.uottawa.ca

1 - Assessing Appointment Scheduling Rules: A Policy-based Paradigm

William Millhiser, Assistant Professor, Baruch College, 55 Lexington Ave, New York, NY, 10010, United States of America, william.milhiser@baruch.cuny.edu, Emre Veral, Benedetto Valenti

We model patient waiting times and MD idle/overtime as a stochastic process and analyze appointment schedules (AS) in terms of their probability of exceeding stated targets. Our model incorporates service time variability w/ general distributions, no-shows and heterogeneous populations, and analysis of existing AS rules advocates a paradigm shift in AS design, driven by service-level policy considerations. Current model capabilities enable future research in designing such policy-constrained AS.

2 - Optimization of Online Appointment Scheduling

Brian Denton, Associate Professor, Edward P. Fitts Department of Industrial & Systems Engineering, North Carolina State University, 111 Lampe Drive, Raleigh, NC, United States of America, bdenton@ncsu.edu, Ayca Erdogan

We propose a new stochastic programming model for a single-server online appointment scheduling problem with uncertain service times. We analyze the structure of the model and discuss computationally efficient solution methods. Finally, we present the results of numerical experiments that illustrate the nature of optimal online sequencing and arrival time scheduling.

3 - Allocating Operating Room Time and Scheduling Physicians Across Multiple Facilities at Fraser Health

Navid Dena, Senior Operations Engineer, Fraser Health Authority, Unit 101, 15375 - 102A, Surrey, BC, V3R 7K1, Canada, Navid.Dena@fraserhealth.ca

Fraser Health Authority is building an outpatient care and surgery centre scheduled to open in 2011. The Operations Engineering group supports Operating Room allocation through an integrated physician scheduling model for the centre's ORs, scope diagnostics, and various other clinics. Mixed integer programs resolve resource conflicts by leveling daily staffing requirements and decreasing the need for scope reprocessing. Also, as surgeons will be shared with a nearby hospital, the scheduling platform considers inpatient capacity appropriately, effectively smoothing beds.

■ MA09

09- Cote St. Luc

Capacity Management in Hospitals

Cluster: Medical Decision Making

Invited Session

Chair: Burhaneddin Sandikci, Assistant Professor, University of Chicago Booth School of Business, 5807 S Woodlawn Ave, Chicago, IL, 60613, United States of America, burhan@chicagobooth.edu

1 - Hospital Census Smoothing through Elective Admission Optimization

Mark Van Oyen, Associate Professor, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109-2117, United States of America, vanoyen@umich.edu, Jonathan E. Helm

Hospital care services are subject to significant, unnecessary and detrimental fluctuations in patient census and associated workload. To stabilize hospital census levels, this research models patient flow through the network of hospital wards as a series of queueing networks that are incorporated into an elective scheduling optimization model.

2 - Workload, Absenteeism and Nurse Staffing

Wen-Ya Wang, University of Minnesota, 111 Church Street S.E., Minneapolis, MN, United States of America, wenya@ie.umn.edu, Diwakar Gupta

Many recent articles study the effect of nursing workload on patient safety and quality of care, as well as nurses' health, burnout, and job satisfaction. We test whether nurses' anticipated short-term workload affects their decisions to take unplanned time off. We develop a statistical model that relates nurses' expectation about a future shift's workload to absenteeism in different nursing units, and explore some strategies that can be used to improve staffing decisions.

3 - Managing Inpatient Bed Capacity of a Hospital

Don Eisenstein, University of Chicago Booth School of Business, Chicago, IL, 60637, United States of America, don.eisenstein@chicagobooth.edu, Burhaneddin Sandikci, Thomas Best, David Meltzer

To address adverse effects of limited capacity, the University of Chicago Medical Center (UCMC) received special dispensation from the state of Illinois, through which it partitions its inpatient beds into mini-hospitals or wings. Each wing has a specific designation of the types of patients it can admit, and the number of beds it is allocated. A patient requesting hospital services can be admitted only if a bed is available in the appropriate wing. We model and solve the computationally hard problem of forming wings to near optimality using data from UCMC as well as national databases.

■ MA12

12- Verdun

Applications of Simulation to Health Care

Sponsor: Canadian Operational Research Society

Sponsored Session

Chair: John Blake, Dalhousie University, Halifax, NS, B3H 4R2, Canada, john.blake@dal.ca

1 - Using Simulation to Evaluate a Blood Supply Network in Atlantic Canada

John Blake, Dalhousie University, Halifax, NS, B3H 4R2, Canada, john.blake@dal.ca, Hardy Matthew

In this paper we present the results of a study to evaluate Canadian Blood System's supply network in Atlantic Canada. CBS has announced its intention to consolidate Atlantic, Canadian production facilities in Halifax, Nova Scotia. This decision has raised concerns about the safety and efficacy of the supply network in New Brunswick. To address these issues we have developed simulation models of both the current and the proposed distribution network. These models, along with a physical test, are being used to compare the safety and efficacy of the current and proposed networks.

2 - Simulation for Process and Performance Improvement in Israeli Health Care

Anna Graber-Naidich, Clalit Health Services, HaAliya HaShniya 38 Apt. 1, Haifa, 35011, Israel, annagr26@gmail.com, John Blake

Simulation is a powerful system design tool when applied to health care. Two health care simulation case-studies are presented-a model that examines the effect of different factors (such as the daily demand, doctors' availability, no-show and overbooking rates) on a wait-list-length and a model designed for improving the patient flow process in a medical center by identifying the bottlenecks, reducing waiting and throughput times etc.

3 - Using Simulation to Evaluate a Shorter Shelf Life for Red Blood Cells

Hardy Matthew, Dalhousie University, Halifax, NS, Canada, matt.hardy@dal.ca

We describe the use of simulation modeling to evaluate the effects of a reduced shelf-life for red blood cells.

■ MA13

13- Lachine

Case Studies: Modeling Applications

Contributed Session

Chair: Song-Hee Kim, PhD Student, Columbia University, IEOR Department, New York, NY, 10027, United States of America, sk3116@columbia.edu

1 - To Be or Not To Be (Operated)? A Quantitative Decision Model for a Lung-transplant-candidate

Miron Gross, Senior Lecturer, Academic College of Tel-Aviv and Tel-Aviv University, 3 Belkind Street, Tel-Aviv, 62154, Israel, mg8708@post.tau.ac.il, Mordechai Kremer

The present study analyses the decision making process of a lung-disease-patient facing the dilemma whether to accept or decline a lung-donation and a transplantation surgery, when offered. The authors focus on data regarding an IPF patient and suggest the rational Von-Neumann-Morgenstern decision process as a benchmark both for the transplant-candidate as well as for the medical team involved.

2 - Planning the Transportation of Elderly to a Daycare Center

Viviane Gascon, Professor, Université du Québec - Trois-Rivières, C.P. 500, Trois-Rivières, QC, G9A5H7, Canada, gascon@uqtr.ca, François Meunier, Claude Desjardins

We present the case of a public medical clinic offering activities to users at a daycare center. The problem consists in assigning users to days of the week and in defining routes for buses carrying users. Solutions to a TSP with additional constraints (limited time, frequency, bus capacity, etc.) were found with a greedy algorithm. An interface was developed with an ant colony approach as a solving method.

3 - Managing Hospital Recovery Units: An Empirical Study of Capacity Allocation and Patient Outcomes

Song-Hee Kim, PhD Student, Columbia University, IEOR Department, New York, NY, 10027, United States of America, sk3116@columbia.edu, Gabriel Escobar, Carri Chan, Marcelo Olivares

We look at the impact of occupancy levels on routing from ED or after surgery in a capacity-constrained setting to three types of recovery units with increasing levels of treatment and monitoring. Ideally, the routings should depend only on the patients' medical necessity. However, this work uses empirical data from over 60,000 actual patient flows to show the occupancy levels of recovery rooms also influence them. How these routing patterns further affect patient outcomes is also discussed.

Monday, 10:30am - 12:00pm**■ MB01**

01- Fontaine Ballroom C

Panel Session: Collaboration of Healthcare Systems Academic Programs Through a New Alliance

Cluster: Invited Sessions

Invited Session

Chair: Ronald Rardin, John and Mary Lib White Professor, University of Arkansas, Bell 4207, Fayetteville, AR, 72701, United States of America, rrardin@uark.edu

1 - Healthcare Systems Engineering Alliance of Programs

Moderator: Ronald Rardin, John and Mary Lib White Professor, University of Arkansas, Bell 4207, Fayetteville, AR, 72701, United States of America, rrardin@uark.edu, Panelists: Brian Denton, Dionne Aleman, John Fowler, Ken Musselman

While a few of the academic departments in industrial, systems and related branches of engineering have focused on healthcare for decades, it is only in recent years that healthcare systems engineering (HSE) has become a rapidly growing interest. A group of 34 leaders from 20 of the more prominent HSE academic research and education programs in the US and Canada participated in a workshop at the University of Arkansas in May 2010 to seek ways of collaborating and sharing ideas. One major finding was that a formal alliance of HSE academic programs is needed to sustain collaboration. This panel, which focuses on launching such a Healthcare Systems Engineering Alliance, is one of two following up on the 2010 workshop at the current INFORMS healthcare meeting. It will feature presenters who have been leaders in organizing such an alliance.

■ MB02

02- Fontaine Ballroom D

Successful OR Applications in Health Care Practice

Cluster: Putting Healthcare IE/OR into Practice in the US

Invited Session

Chair: Mehmet Erkan Ceyhan, Post-Doctoral Associate & Project Manager of VERC, Healthcare Systems Engineering Centers, Northeastern University, 360 Huntington Avenue, Snell Engineering Center, Boston, MA, 02115, United States of America, erkanceyhan@gmail.com

1 - A Multi-period Capacitated Location Model for Specialty Care Services across VA Healthcare Systems

Seda Sinangil, Northeastern University, Healthcare Systems Engineering Centers, Boston, MA, United States of America, sinangilseda@gmail.com, Mehmet Erkan Ceyhan, James Benneyan, Hande Musdal, Bradley V. Watts, Brian Shiner

This study describes a certain location-allocation problem within the VA healthcare system. We present a multi-objective integer programming model that

minimizes overall cost by locating additional sleep services over New England area. The relationship between different policies, total cost, and coverage percentage with different number of additional facilities are analyzed to provide a practical decision making tool. Results indicate that there is a tremendous opportunity of cost savings while improving the quality of service.

2 - Operations Research Models for Signature Military Injuries

Hande Musdal, Healthcare Systems Engineering Centers, Northeastern University, 368 Snell Engineering Center, 360 Huntington Ave., Boston, MA, 02115, United States of America, hande.musdal@gmail.com, James Benneyan

There have been dramatic increases in a new class of silent injuries with the modern military conflicts, such as traumatic brain injury, post-traumatic stress disorder, depression, sleep disorders, and mental health issues, in part due to the changing manners by which war is waged and better protective equipment. In this study, operations research models are described to optimize the effectiveness for detecting and treating these injuries, by addressing sequential screening models, multi-state categorical diagnostic methods, Markov capacity prediction models, and location-allocation models.

3 - Systems Modeling and Simulation for Reducing Medication Errors

Niquelle Brown, Georgia Institute of Technology, Atlanta, GA, United States of America, niquelle.brown@gatech.edu, Eva Lee, Emily Kang

This work is joint with Drs. Frank and Davis from the Children's HealthCare of Atlanta. We will present our work focusing on 'High Alert' medications where minor dose variations can produce serious complications on patient health. This work offers a system-decision support framework for analysis of medication work flow and helps in understanding error propagation mechanisms across stages and process interdependencies. It allows users to derive intervention strategies and evaluate their overall mitigation effectiveness.

■ MB03

03- Fontaine Ballroom E

Joint Session MDM/OR for Public Health: Resource Allocation Models for Infectious Disease Control

Cluster: Medical Decision Making/Operations Research for Public Health

Invited Session

Chair: Sabina Alistar, Stanford University, P.O. Box 17244, Stanford, CA, United States of America, ssabina@stanford.edu

Co-Chair: Margaret Brandeau, Stanford University, Stanford, CA, United States of America, brandeau@stanford.edu

1 - Allocating HIV Prevention Funds in the United States

Arielle Lasry, CDC, Atlanta, GA, United States of America, ftn9@cdc.gov, Stephanie Sansom, Katherine Hicks, Vladislav Uzunangelov

The Division of HIV/AIDS Prevention (DHAP) at CDC seeks to improve the allocation of HIV prevention funds by targeting intervention programs to the most appropriate population subgroups. To address the problem we define a nonlinear optimization where the objective function is to select the amounts to be invested in HIV prevention interventions such that new infections are minimized. The optimal funding suggests the amount to allocate to each of the interventions target groups considered; we compare this to DHAP's current allocation of funds.

2 - A Portfolio Approach to HIV Control in South Africa

Elisa Long, Assistant Professor, Yale University, 135 Prospect Street, New Haven, CT, 06520, United States of America, elisa.long@yale.edu

With 5.7 million HIV+ people in South Africa and 500,000 new cases occurring annually, reducing new infections and increasing antiretroviral therapy (ART) access is an urgent national priority. Recent clinical trials indicated partially effective interventions may soon be available. Using a dynamic HIV epidemic model, I evaluated the effectiveness and cost-effectiveness increased HIV screening, ART, male circumcision, vaccination, topical microbicide use, and a combination of the interventions.

3 - Uncertainty in Resource Allocation for Pandemic Influenza

David Hutton, University of Michigan, 1415 Washington Heights, SPH II: M3525, Ann Arbor, MI, 48109, United States of America, dwhutton@umich.edu

Typical methods of using deterministic infectious disease models and simple sensitivity analysis do not work well for analyzing resource allocation decisions for rare, potentially devastating infectious diseases, like pandemic influenza. These analyses must be careful in handling uncertainty. Particular challenges involve uncertainty surrounding multiple parameters together and gathering expert judgments on uncertainties surrounding rare public health events. We use an analysis of pandemic influenza to highlight some of these challenges.

■ MB04

04- Fontaine Ballroom F

Stochastic Models for Medical Decision Making

Cluster: Medical Decision Making

Invited Session

Chair: Brian Denton, Associate Professor, Edward P. Fitts Department of Industrial & Systems Engineering, North Carolina State University, 111 Lampe Drive, Raleigh, NC, United States of America, bdenton@ncsu.edu

1 - Probabilistic Sensitivity Analysis in Patient-level Simulation Models: A Case of HCV Treatment

Jagpreet Chhatwal, Merck Research Laboratories, North Wales, PA, United States of America, jchhatwal@gmail.com, Erik Dasbach, Elamin Elbasha, Shannon Ferrante

Performing probabilistic sensitivity analysis (PSA), which sometimes is a mandatory step in drug reimbursement process, is computationally challenging and often impractical in patient-level simulation models. We develop a patient-level Markov simulation model for evaluating alternative Hepatitis C virus (HCV) treatment programs and propose sampling and approximation methods to efficiently perform PSA. Model parameters are estimated from clinical trials data and medical literature. Results are presented using the cost-effectiveness acceptability curve and partial rank correlation coefficients.

2 - Valuing Prearranged Paired Kidney Exchanges: A Stochastic Game Approach

Murat Kurt, Graduate Student, University of Pittsburgh, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, muk7@pitt.edu, Utku Unver, Mark Roberts, Andrew Schaefer

Paired kidney exchanges (PKE) alleviate the shortage in the supply of kidneys for transplantation. We consider patients' transplant timing decisions in a prearranged PKE and formulate the resulting problem as a non-zero sum noncooperative stochastic game. We present necessary and sufficient conditions to characterize the stationary equilibria of this game. Due to vast number of such equilibria, we consider equilibrium selection and characterize the welfare maximizing equilibrium as an optimal solution to an MIP. We illustrate implications from our model using clinical data.

3 - Optimizing the Societal Benefits of the Annual Influenza Vaccine

Osman Ozaltin, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, ozaltin@yahoo.com, Oleg Prokopyev, Andrew Schaefer, Mark Roberts

Seasonal influenza is a major public health concern. The World Health Organization recommends a new flu shot annually based on surveillance and epidemiological analysis. There are two critical decisions regarding the flu shot design. One is its composition, which influence vaccine effectiveness. The other is the timing of the composition decisions, which affects the flu shot availability. Both of these decisions have to be made under uncertainty many months before the flu season starts. We propose a multi-stage stochastic mixed-integer program to address the optimal annual flu shot design.

■ MB05

05- Fontaine Ballroom G

Tutorial: Health Informatics

Cluster: Tutorials

Invited Session

1 - Why Healthcare Operations Research Needs Health Informatics

Wojtek Michalowski, University Research Chair in Health Informatics and Decision Support, University of Ottawa, Telfer School of Management, Ottawa ON K1N 6N5, Canada, Wojtek@telfer.uottawa.ca

This tutorial will begin with a presentation of the main areas of research in health informatics. Considering that the use of Operations Research (OR) in healthcare is centered on supporting decision-making (administrative and clinical), special attention will be paid to issues involving decision support and decision support systems. The main challenges faced by both the developers and end-users of decision support systems will be presented and possible solutions will be discussed. Participants of this tutorial should leave it with a better appreciation of the important interplay between the art of building OR models and the health informatics solutions.

■ MB06

06- Fontaine Ballroom H

Health Care Operations Management

Sponsor: Canadian Operational Research Society

Sponsored Session

Chair: Reidar Hagtvedt, University of Alberta School of Business, 2-43 Business Bldg, Edmonton, AB, T6G2R6, Canada, hagtvedt@ualberta.ca

1 - Knowledge Management in Healthcare: The Need, Improvements, Barriers and Risks

Aasia Anwar, PhD Student, University of Alberta, Edmonton, AB, T6G 2R3, Canada, aasia@ualberta.ca, John Doucette

Why an efficient KM system is the need of the health care sector today? This session will discuss how KM can help the health care industry to deal with the challenges of the 21st century and will also highlight the barriers and risks in this journey towards a patient-centric health care system.

2 - Habitual Citizenship Behavior in Hand-hygiene Compliance

Reidar Hagtvedt, University of Alberta School of Business, 2-43 Business Bldg, Edmonton, AB, T6G2R6, Canada, hagtvedt@ualberta.ca, Kenneth Schultz, Sarah Forgie

Compliance with hand-hygiene regulations is a crucial component driving the rate of healthcare-acquired infections, yet the behavior is largely unobserved, secondary to the core task of the healthcare worker, and partially a routine. We propose to expand the current model, the Theory of Planned Behavior, to take into account the habitual and dynamic aspects of such behavior, and classify such phenomena as 'habitual citizenship behavior'. Two studies conducted over the course of more than a year, one observational and one survey-based, provide data to test our hypotheses.

3 - Effect of Health on Firm Productivity

Fredrik Odegaard, University of Western Ontario, The Richard Ivey School of Business, London, ON, N6A 3K7, Canada, fodegaard@ivey.uwo.ca, Pontus Roos

In this paper we discuss a model for analyzing the effect of health of the workers on firm productivity. Workers health is analyzed through responses to self-reported questionnaires and modeled as a latent variable. Based on the framework of Item Response Theory, estimates of the underlying individual Health Status are derived. Aggregation of the health values is then used as an input to a Malmquist Index to measure firm productivity. The model is illustrated using data from three large Swedish manufacturing firms over the period 2000-2003.

■ MB07

07- Mont Royal

Resource Allocation and Staff Scheduling

Sponsor: EURO - ORAHS, Operational Research Applied to Health Services

Sponsored Session

Chair: Nikky Kortbeek, MSc., University of Twente/Academic Medical Center Amsterdam, P.O. Box 217, Enschede, 7500 AE, Netherlands, n.kortbeek@utwente.nl

1 - Tactical Resource Allocation and Elective Patient Admission Planning in Care Pathways

Peter J.H. Hulshof, University of Twente, P.O. Box 217, Enschede, 7500 AE, Netherlands, p.j.h.hulshof@utwente.nl, Richard J. Boucherie, Erwin W. Hans, Johann L. Hurink

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.

2 - Flexible Nurse Staffing Based on Forecast of the Hourly Ward Census

Nikky Kortbeek, MSc., University of Twente/Academic Medical Center Amsterdam, P.O. Box 217, Enschede, 7500 AE, Netherlands, n.kortbeek@utwente.nl

Workload on nursing wards depends highly on patient arrivals and patient lengths of stay, which are both inherently variable. Predicting this workload, and staffing nurses accordingly, is essential for guaranteeing quality of care in a cost effective manner. In this presentation we present a stochastic approach to estimate the hourly ward census. This analytical model incorporates operating room planning and emergency patients. Based on the hourly census prediction, flexible nurse staffing methods are proposed.

3 - Nurse Rostering via Decomposition: The Weekend Scheduling Problem

Egbert van der Veen, ORTEC & University of Twente, Groningenweg 6k, Gouda, 2803 PV, Netherlands, Egbert.vanderVeen@ortec.com, Bart Veltman, Erwin W. Hans

This talk introduces a new shift scheduling problem: the weekend scheduling problem (WSP). We consider the WSP as a first phase of the nurse scheduling problem. The WSP addresses the scheduling of weekends only. Other shifts are scheduled afterwards to complete the schedule. The key assumption is that weekend-related employee preferences dominate all other preferences. We discuss the effects of this two-phase approach both on the schedule of the weekend shifts and on the schedule as a whole.

■ MB08

08- Hampstead

Improving Patient Flow for Cancer Treatment

Cluster: Improving Patient Flow through Capacity Planning and Scheduling

Invited Session

Chair: Pablo Santibanez, BC Cancer Agency, 600 West 10th Avenue, Vancouver, BC, V5Z 4E6, Canada, psantibanez@bccancer.bc.ca

1 - Chemotherapy Appointment Scheduling and Nurse Assignment

Ayten Turkcan, Northeastern University, 360 Huntington Ave, 334 SN, Boston, MA, United States of America, A.Turkcan@neu.edu, Mark Lawley, Sara Shashaani

Chemotherapy scheduling is a complex problem due to several factors such as cyclic nature of chemotherapy treatment plans, high variability in resource requirements (nurse, chair, pharmacy) and multiple clinic resources involved. In this study, we propose optimization-based appointment scheduling and nurse assignment methods based on acuity levels for chemotherapy patients. The proposed method has a potential impact on efficient utilization of existing capacity and more effective care delivery to the growing number of cancer patients.

2 - Process Redesign to Improve Chemotherapy Appointment Booking at the BC Cancer Agency

Ruben Aristizabal, BC Cancer Agency, 600 West 10th Ave, Vancouver, BC, V5Z 4E6, Canada, RAristizabal@bccancer.bc.ca, Vincent Chow, Kevin Huang, Martin Puterman, Pablo Santibanez, Nancy Runzer

The Vancouver Centre chemotherapy clinic at the BC Cancer Agency delivers nearly 15,000 outpatient treatments per year. Clinical complexity, scheduling restrictions and outdated manual booking processes led to frequent clerical rework, long wait lists for treatment and late appointment confirmation for patients. We redesigned the booking process and implemented an appointment scheduling tool that reduced confirmations less than a week in advance by 58% and wait list size by 60 to 80%.

3 - An Optimization-based Scheduling Model for Chemotherapy Appointments at the BC Cancer Agency

Pablo Santibanez, BC Cancer Agency, 600 West 10th Avenue, Vancouver, BC, V5Z 4E6, Canada, psantibanez@bccancer.bc.ca, Ruben Aristizabal, Kevin Huang, Vincent Chow, Martin Puterman, Nancy Runzer

We developed an IP model to allocate outpatient chemotherapy appointments to nurses and treatment slots. The model considers clinical constraints and patient treatment preferences while balancing nurse workload, case complexity and drug preparation demand in the pharmacy. The model was implemented as a web-based scheduling tool that allows clerks to efficiently create treatment schedules that have more consistent workload for nurses and improved adherence to pharmacy capacity.

■ MB09

09- Cote St. Luc

Application of Lean Methods to Improve Patient Flow

Sponsor: Canadian Operational Research Society

Sponsored Session

Chair: Lawrence Rosenberg, McGill University- Jewish General Hospital, 3775 Cote Ste Catherine Road, Montreal, QC, Canada, lawrence.rosenberg@mcgill.ca

1 - Voice of the Customer and Lean Implementation of a New Pre-surgical Screening Clinic

Lawrence Rosenberg, McGill University- Jewish General Hospital, 3775 Cote Ste Catherine Road, Montreal, QC, Canada, lawrence.rosenberg@mcgill.ca, Dana Porubska, Nadia Lahrichi, Philip Troy

To improve care, JGH created a Pre-Surgical Screening Clinic. New processes included algorithm-based patient triage; on-site internists; expanded nursing role; and screening, testing & OR scheduling at one location. Simulation was used to analyze space, staff, and scheduling needs. Resistance to change by stakeholders was a challenge. To overcome this we created an urgency for change, developed a communications plan, were inclusive in decision-making, and presented a clear vision of the future state. Attention to the "voice of the customer" was critical to the implementation of the project.

2 - A Peri-operative Process Simulation Model

Philip Troy, Quantitative Process And Decisions Support Analyst, Les Entreprises TROYWARE, 6590 A Kildare, Cote Saint-Luc, QC, H4W 2Z4, Canada, DrPhil@PhilTroy.com, Lawrence Rosenberg

To address a shortage of surgical beds, the Sir Mortimer B. Davis Jewish General Hospital commissioned the development of a peri-operative process simulation model. Historical data was used to derive distributions for patient recovery duration by case type, as well as for each surgeons' case mix, procedure duration by case type, and surgical schedule. This model led to a better initial understanding of the demand for surgical beds, and will be used in the future to analyze other peri-operative patient flow issues and to support the hospital's lean patient flow efforts.

3 - Discharge Process Value Stream Mapping Post Colorectal Surgery: Initiating the Process

Gabriela Ghitulescu, MD, McGill University, 3755 Cote Ste-Catherine, Room A500, Montreal, QC, H3T 1E2, Canada, gabriela.ghitulescu@mcgill.ca, Lawrence Rosenberg, Cania Vincelli

According to NSQIP data, the post-operative length of stay for elective colorectal procedures at our institution is higher than average. This knowledge has prompted us to use the Value Stream Mapping process in order to investigate causes and potential solutions to this issue. Healthcare professionals involved in caring for these patients were trained in Value Stream Mapping, then participated in a workshop where the current and ideal states were mapped, and improvement ideas were developed, with a concrete plan for implementation.

■ MB12

12- Verdun

OR in OA: Osteoarthritis Examined Through OR Models

Sponsor: Canadian Operational Research Society

Sponsored Session

Chair: Sherry Weaver, Haskayne School of Business, University of Calgary, 2500 University Dr. NW, Calgary, AB, T2N1N4, Canada, sherry.weaver@haskayne.ucalgary.ca

1 - Patient Scheduling for Orthopaedic Surgery using DES and Queueing Models

Sherry Weaver, Haskayne School of Business, University of Calgary, 2500 University Dr. NW, Calgary, AB, T2N1N4, Canada, sherry.weaver@haskayne.ucalgary.ca, Michael Carter, Tom Noseworthy

Over the last decade, hip and knee replacements have doubled, resulting in median waits of 42-206 days. The COA endorses 3 urgency-based access targets, leading to our research problem: how many surgical spots should be dedicated to urgent patients in order to ensure that these patients all receive timely care while minimizing the disruption to less urgent patients? Our results show that the M/D/1/N queueing model does the best job of approximating the steady-state urgent queue. A cost function considering the number of elective patients bumped and idle surgical theatre time is used to determine the optimal number or spots to hold for urgent patients and does not require the development of a complex DES.

2 - A Decision Support Tool for Hip and Knee Osteoarthritis Health Service Delivery

Deborah Marshall, Associate Professor, University of Calgary, 3280 Hospital Drive NW, Calgary, AB, Canada, damarsha@ucalgary.ca, Paul Rogers, Tom Noseworthy, Dianne Mosher, Mahmood Zarrabi, Sonia Vanderby, Michael Carter, Thomas Rohleder

The rising prevalence of osteoarthritis is increasing the burden on already strained healthcare resources. Alberta Health Services managers lack tools to help inform difficult resource and process decisions. We present a system dynamics model developed as a decision support tool for the hip and knee osteoarthritis system. Simulating patients from disease onset through both medical and surgical management, the model provides insight into the resources needed to meet current and future demand.

3 - Modelling the Orthopaedic Surgery Workforce in Canada

Sonia Vanderby, University of Toronto, Toronto, Ontario, ON, Canada, sonia@mie.utoronto.ca, Michael Carter

Despite lengthy wait times and increasing demand for orthopaedic surgery, Canada lacks tools which enable co-ordinated planning for the future of the orthopaedic surgeon workforce. A health human resources planning model of the Canadian orthopaedic surgeon workforce developed to address this is presented. The system dynamics model relates resident and surgeon populations with surgeon productivity and surgical demand to determine the surgeons and trainees needed to meet future demand. The model results for the baseline and several scenarios are presented.

■ MB13

13- Lachine

Queueing Models I

Contributed Session

Chair: Ross Anderson, Graduate Student, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, rma350@mit.edu

1 - Strategic Delays in Healthcare Service

Oded Berman, Professor, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, berman@rotman.utoronto.ca, Opher Baron, Dmitry Krass, Jianfu Wang

The policy that minimizes the waiting time or the probability of a long waiting time for single-station systems is non-idling. However, we observed a policy with idleness in a healthcare provider we worked with. Thus, in contrast to the much of the queueing literature, we allow idleness and show that "policies with strategic idleness" may improve the waiting time perceived by customers in a healthcare service network. For example, such policies may reduce the probability of very long waiting times. We demonstrate the advantage of such policies using two single-server queues in tandem.

2 - Analysis and Design of Call Center Operations of a Hospital

Osman Alp, Bilkent University, Industrial Engineering Department, EA204, Ankara, Turkey, osmanalp@bilkent.edu.tr, Ezel Budak

In this talk, call center operations of a private hospital and the a critical portion of the internal call traffic are studied. There are mainly three types of calls received by the call center: Consultancy Calls, Appointment Calls, and Domestic Calls. We collected data to estimate the service times and proportion of calls of different types. We model the system a queueing network which consists of $M/M/s$, $M/M/1$, and several $M/M/1/1$ queues. We analyze different service protocols to maximize the appointments made and minimize the un-answered consultancy calls.

3 - Scheduling Interns at Hospitals: Queueing Models and Fluid Approximations

Ross Anderson, Graduate Student, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, rma350@mit.edu, David Gamarnik

We build a queueing model to compare two schedules for medical interns: one where interns work long shifts on alternating days, and another where interns work short shifts daily. We show that the latter schedule has a greater capacity to handle patient volume. Moreover, under an asymptotic rescaling, we find a threshold on the patient arrival rate determining whether long shifts or daily admitting causes fewer reassignments. This is motivated by empirical work done with Brigham and Women's Hospital.

■ MB14

14- Pointe Aux Trembles

Public Health and Technology Studies

Contributed Session

Chair: Tal Ben-Zvi, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States of America, tbenzvi@stevens.edu

1 - Optimizing Storage Facility Locations for Emergency Response Medical Materiel

Michael Pouy, Research Fellow, LMI, 2000 Corporate Ridge, McLean, VA, 22102, United States of America, mpouy@lmi.org, Jeremy Eckhause

A number of U.S. federal agencies are responsible for providing equipment and supplies to disaster areas within a short time after a disaster occurs. Stockpiles for this purpose include such things as sheltering supplies, medicines and medical equipment, mortuary supplies and personal protective equipment. Given the likely locations of disasters (hurricanes, etc), and various parameters and other requirements, where should this materiel optimally be located? We answer this question with a two-part approach.

2 - The Effective Factors on Transferring Telemedicine Technology in Developing Countries: The Case of Iran

Fariba Latifi, Assistant Professor, Alzahra University, 2619 - 80 Harrison Garden Blvd., Toronto, ON, M2N 7E3, Canada, fariba_latifi@yahoo.com, Somayeh Alizadeh

This research aimed at evaluating the effective factors on telemedicine technology transfer in developing countries. The research explored in Iran as a developing country starting to practice telemedicine in recent years. The findings of the study demonstrate the influence of technical and cultural factors on adopting telemedicine technology in Iran.

3 - Emerging Pandemics: Making Predictions using Partially Observable Markov Decision Processes

Tal Ben-Zvi, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States of America, tbenzvi@stevens.edu, Donald Lombardi, Abraham Grosfeld-Nir

This study considers an infectious disease capable of reaching pandemic proportion, and someone needs to decide what to do. If the potential threat is mild, then harsh courses of action can be costly and deplete resources. If the potential threat is real, then any delays in action are extremely harmful. The model we suggest specifies a way to improve planning for pandemics; that is, how to achieve the optimal cost-beneficial level of health with respect to cost and degree of threat.

Monday, 1:00pm - 2:00pm

Poster Session

Cluster: Poster Papers

Invited Session

1 - The Impact of Direct-to-consumer Advertising on Physicians' Prescribing Behavior

Franklin Carter, William Donan Clinical Professor of Marketing, Pennsylvania State University, Smeal College of Business, 432 Business Bld, University Park, PA, 16801, United States of America, fjc11@psu.edu

The objective of this paper is to present a model that will evaluate the nature of the relationship that exists between DTCA, patients' characteristics and physicians' prescribing behavior. In order to test this relationship we have considered two models: first, we specified a logit model with the outcome of the doctor's visit (whether or not the doctor prescribed a drug) as a dependent variable and various advertising and patients' personal characteristics as independent variables. The estimates show that the interaction between patients' responses to DTCA, their health status and personal characteristics are important factors in determining physicians' prescribing behavior.

2 - A Systems Engineering Agenda to Improve Traumatic Brain Injury in the Military Health System

Hande Musdal, Healthcare Systems Engineering Centers, Northeastern University, 368 Snell Engineering Center, 360 Huntington Ave., Boston, MA, 02115, United States of America, hande.musdal@gmail.com, James Benneyan

Traumatic brain injury (TBI) has been called the "signature injury" of modern military conflicts, with estimates as high as 22% of all servicemen suffering some degree of TBI, at enormous cost. We describe ongoing work to develop systems engineering models to address six integrated needs: identification of at-risk individuals, severity estimation, capacity and resource estimation, disease progression models, treatment optimization, and service location/co-location.

3 - A Decision-making Tool Based on Simulation to Improve the Operation of Outpatient Clinics

Stéphanie Cartier, Student, Université du Québec à Trois-Rivières, C.P. 500, Trois-Rivières, Qc, G9A 5H7, Canada, stephanie.cartier@uqtr.ca, Chantal Baril

Several issues are present in most outpatient clinics. There is little or no preliminary screening of the reasons for the request for consultation with the physician (forms, medications, treatments, etc.) Appointment scheduling is not always based on demand and priorities. Moving the patient from the waiting room to the examination room and to related services (if needed) is difficult. The patient lead time through this process is often long. The flow of patient-related information (medical records) and accessibility to this information are complex. To overcome these difficulties, we propose building a decision-making tool based on simulation to plan and organize the work in outpatient clinics. The simulation model will find optimal solutions for outpatient clinics.

4 - Understanding the Effect of Patient Diagnosis on its Length of Stay: A Logistic Regression Approach

Maria Guzman Castillo, PhD student, University of Southampton, 57 Brickfield Road, Southampton, SO17 1BJ, United Kingdom, mdlgc106@soton.ac.uk, Sally Brailsford, Honora Smith

Managers and medical staff at hospitals have been always interested on identifying the internal factors and patient attributes affecting length of stay (LoS) of individuals. In this context it is a general perception that the diagnosis of the patient is one of the key factors to understand and predict hospital length of stay. In this paper different models from the logistic regression family are used to classify patients in three categories according to their length of stay (short, medium and long) with the aim of measuring the effect of different patient attributes on the LoS, in particular patient diagnosis.

5 - Developing a Generic Simulation for Use with Lean to Optimize Wards and Release Nursing Time

Claire Cordeaux, Lead for Health and Social Care, SIMUL8 Corporation, 29 Cochran Street, Glasgow, G1 1HL, United Kingdom, claire.c@simul8.com

Putting simulation techniques into the hands of healthcare users can be challenging. This interactive poster describes how SIMUL8 Corporation is working with the NHS Institute for Innovation and Improvement to combine simulation and lean methodologies allowing nurses to use simulation models to prove to managers that investment in change is justified.

6 - A Generic Framework for Hybrid Simulation in Complex Systems: A Healthcare Example

Kirandeep Chahal, Lecturer, LIBT (Brunel University), 22 Craneswater, Hayes, UB3 5HP, United Kingdom, kirandeep.chahal@brunel.ac.uk, Tillal Eldabi, Terry Young

This paper proposes a generic framework for hybrid simulation for complex systems. It has been argued that a hybrid approach, wherein system dynamics and discrete event simulation are integrated symbiotically, will provide more realistic picture of complex systems. The proposed framework is evaluated empirically with a healthcare case study.

7 - A Model for Forecasting Inpatient Unit Demand Originating from an Emergency Department

Jordan Peck, Research Assistant, Massachusetts Institute of Technology, 77 Massachusetts Ave, Building E38 - 610, Cambridge, MA, 02139, United States of America, jspeck@mit.edu, James Benneyan, Stephan Gaehde, Deborah Nightingale

This poster focuses on the two steps of the hospital health care delivery chain, an emergency department and a hospital's inpatient units. Past research into this chain has suggested that early prediction of patient need for admission can be used to better align flow between the two departments. Tools for making admission predictions are tested and their possible implications are explored. The results of this exploration show that both expert opinion and a Naïve Bayesian statistical approach have predictive value in this context.

8 - Using a Lagged Model to Study the Learning Curve of Surgeries by Monthly Data

Yi Lee, Sichuan University, Wangjiang Campus of Sichuan University, Chengdu, SC, 610064, China, kobeisthebest@126.com

It is the purpose of this article to analyze the phenomenon of learning for a doctor who operates a surgery through repetition. In this paper, the problems of using aggregate monthly data to estimate learning curves of 23-month period are investigated. This paper presents a lagged model which can fit the data of the duration of the surgery rather accurately and explains the monthly operating times for surgeries whose learning effect could be divided into different stages.

9 - Monitoring Abrupt Declines in Surgeon Workloads

Danielle Masursky, Research Manager, SUNY Upstate, 750 E Adams St, UH 4702, Syracuse, NY, 13210, United States of America, MasurskD@Upstate.edu

Anesthesia departments may benefit from monitoring the workload of surgeons. We modeled the time series of the workloads of individual surgeons to detect abrupt decreases. We also conducted a small survey of OR managers to guide the interpretation of the analytical results. The findings increase confidence in the validity and usefulness of previously described methods for forecasting workloads of groups of surgeons. However, anesthesia groups have little chance of benefiting economically by monitoring its individual surgeons' workloads using billing data.

10 - Applying Genetic Programming for Data Mining in a Large Brazilian Supplemental Health Insurance

Silvio Araujo, Professor, Universidade Estadual Paulista, Rua Cristovao Colombo, 2265, Sao Jose do Rio Preto, 15054000, Brazil, saraujo@ibilce.unesp.br, Ademir Constantino, Everton Barros, Wesley Romeo

Data Mining is a major step in the process of automatic discovery of useful knowledge in large data warehouses. This research presents an approach using genetic programming to solve the classification task in with a focus on data from a health insurance.

11 - Dynamic Modeling of Service Delivery in Health Care: The VA Disability Evaluation Process

Tom Rust, Worcester Polytechnic Institute, Department of Social Science, Worcester, MA, 01609, United States of America, tom.rust@va.gov

Research presents a system dynamics analysis of health care service delivery; specifically the administration of Veterans' disability evaluations. Throughput has declined (increasing service delays) in recent years, despite attempts to improve. Simulations reveal policies developed in isolation have lead to conflicting goals, contributing to intractable system under-performance. Solutions are proposed.

12 - Optimal Physicians Staffing Policy In A Dynamical Emergency Room System

Jerome Ndayishimiye, PhD Student, Binghamton University, 286 Rumbold Ave, North Tonawanda, NY, 14120, United States of America, jndayis1@binghamton.edu

Hospital emergency rooms are difficult to manage because of the complexity of allocating costly clinical resources, mainly physicians, in light of the uncertainty in the arrivals of patients, the increasingly crowded emergency rooms, and the costs of delaying medical treatment. We propose a model using ordinary differential equations to evaluate the perceived natural dynamics of patients and physicians in emergency rooms. From understanding the natural dynamics, we use optimal control theory to determine the optimal dynamics of physicians to increase the benefits of treating more patients while controlling the costs of physicians' utilization. Numerical simulations of our model, using actual hospital data, suggest a continuous physicians' optimal control staffing policy. To implement such continuous policy, we use discretization methods based on the concepts of least square methods and the Riemann sum.

13 - A Combinatorial Approach to Appointment Scheduling and Sequencing

Zuozheng Wang, University of Maryland College Park, 3330E Van Munching Hall, College Park, MD, 20742, United States of America, wangzccc@hotmail.com

This study focuses on sequencing problems in outpatients scheduling with different classes of patients. By using a combinatorial approach, we prove that scheduling patients in increasing variance is better than the reversed sequence for two classes of patients. For N ($N > 2$) classes of patients, we reject the conjecture that scheduling patients in increasing variance of their consultation time is optimal or near optimal.

14 - Social Network Modularity as a Driver for Complex Epidemic Dynamics

Thomas Hladish, University of Texas at Austin, 1 University Station, C0930, Austin, TX, 78712, United States of America, tjhladish@mail.utexas.edu, Lauren Ancel Meyers, John Brownstein, Anne Gatewood Hoen

Using a database of 2.17 million connections to the OeLe Sans Fil public Wi-Fi hotspot network in Montreal, Canada, we reconstructed a social contact network for over 103,000 users distributed across 200 hotspot locations. The resulting network had a heterogeneous degree distribution and strong modularity as determined by a network clustering algorithm. Epidemics simulated on the giant component produced epidemic curves with multiple peaks. The observed epidemic dynamics were driven by the three largest modules in the montreal network, and modules were found to have geographical structure.

15 - Estimating Management Policies in an Intensive Care Unit Joining Data and Expert Opinions

Fermin Mallor, Public University of Navarre, Campus Arrosadia, Pamplona, 31192, Spain, mallor@unavarra.es, Cristina Azcarate, Julio Barado

In a previous work we developed an accurate simulation model of an Intensive Care Unit from which we showed that a validated simulation model needs to incorporate the decisions made by the medical staff. We designed a set of rules that depend on a set of parameters which were estimated by solving an optimization problem. This problem allows us to generate management rules, to be included in the simulation model, producing simulated data as similar as possible to the historical data. In this work we try to improve this approach by including in the optimization problem the medical staff opinions.

16 - Comparison of Data Collection Techniques and Their Effectiveness for Process Improvement in Healthcare

Rachael Taylor, University of Ontario Institute of Technology, 3683 River Trail, Stevensville, ON, L0S 1S0, Canada, rachael.taylor01@gmail.com, Jennifer Percival, Carolyn McGregor

The flow of information through the healthcare system can be made more efficient through a redesign of the patient journey. This research is critical in order to improve the communication process within the patient's journey through the healthcare system. There are various techniques used for process improvement, all with a range of levels of effectiveness. This research compares data collection techniques based on their ability to improve processes in healthcare. A structured approach to assess and compare data collection techniques was developed. Each had strengths and weaknesses, but each method results in the absence of some information, causing generated information to be incomplete.

17 - Mobile Technology for Patient-flow Management: An Application for the NEDOCS Score

Gilles Reinhardt, DePaul University, 1, E. Jackson Blvd, Suite 7000, Chicago, IL, 60604, United States of America, greinhar@condor.depaul.edu

The National Emergency Department (ED) Overcrowding Score (NEDOCS) is an objective measure of hospital crowding calculated using common measures (number of patients & beds, boarding & waiting times, etc) The resulting score maps to a set of thresholds that predicts the short-term state of the ED and improves response and flow times. The complexity of the formula hinders a continuous and effective use of the score. We developed a mobile application allowing users to customize the score system to their EDs, compute it efficiently, and chart trends of the input and score for longer term analysis.

18 - Optimal Location of Medical Devices in Hospitals

Mehdi Ardavan, PhD Candidate, Concordia University, 1455 De Maisonneuve Blvd. W, ECE Dep., Montreal, QC, H3G 1M8, Canada, m_ardav@ece.concordia.ca, Christopher Trueman, Ketra Schmitt

In a critical care unit at a hospital with medical staff carrying wireless devices, the best location of the medical equipment is determined by considering four criteria which account for electromagnetic interference risk and other factors. The risk of exceeding the immunity level of the medical devices is determined by the Sabine method and Ricean distribution. The optimal location is determined by assuming expert judgments for importance of each criterion and using the method of analytic hierarchy process. Also a sensitivity analysis is performed for one of the criteria.

19 - Cost-effective Incentive Values to Reduce Diabetes Healthcare Cost

Ramy Neamatallah, Graduate Student, Concordia University, 1455 de Maisonneuve, Montreal, QC, H3G1M8, Canada, ramy.neamatallah@gmail.com, Gbolahan Olude, Chun Wang, Mashuda Mulk, Ketra Schmitt

Medication noncompliance can be reduced using incentives. We estimate maximum cost-effective incentive values for management of Type II diabetes. The results demonstrate that incentives can be cost-effective over a variety of treatment costs. The value of incentives is most sensitive to emergency room costs. These results can be applied to a wide range of healthcare management problems.

20 - An Event-centric Ontology (ECO) for Electronic Health Records (EHR)

Jeni Fan, Booz Allen Hamilton, 1 Preserve Pkwy, Suite 200, Rockville, MD, 20852, United States of America, fan_jeni@bah.com, Mark Adams, Yugal Sharma, Reechik Chatterjee, William DeSmedt, Michael Keller, Juergen Klenk, Robert Taylor

A better understanding of disease progress and treatment effectiveness is key to reducing the 30-50% mortality rate for patients suffering severe sepsis/septic shock. Here, we present an innovative ontological framework for event-tracking that promises not only the ability to reason on large volumes of patient data, but also to support Meaningful Use of EHRs generally.

21 - Skewness Variance Approximation for Dynamic Rate Multi-server Queues

Jamol Pender, Graduate Student, Princeton University, 5 Lawrence Drive, Princeton, NJ, 08540, United States of America, jpender@princeton.edu, William Massey

A fundamental dynamic rate queueing model for large scale service systems is a multi-server queue with non-homogeneous Poisson arrivals and customer abandonment. By scaling the arrival rates and number of servers of such systems, using the fluid and diffusion limit theorems found in Mandelbaum, Massey, and Reiman, we can approximate the stochastic behavior of this queueing process by one that is Gaussian. Moreover, the approximations to the mean and variance produced by these limiting processes form a two-dimensional dynamical system. Recent work by Gautam and Ko found a modified version of these differential equations and obtained a better estimates of the mean and variance for the original queueing system. In this paper, we introduce a new three-dimensional dynamical system that surpasses these two approaches. Our model is very general and can be used to staff the number of nurses in a hospital while satisfying delay probability constraints.

22 - Optimizing Patient Flow at General Site Orthopedic Clinic using Discrete Event Simulation

Ivan Yuen, Quality Specialist, Hamilton Health Sciences, 688 Concession Street, 2nd Floor, Room 5, Hamilton, ON, L8V 4T1, Canada, yuen@hhsc.ca, Dr. Brian Drew, Patricia Mlekuz, Joanne Wright, Janie Lucas

Numerous discrete event simulation models have been developed in the past as a tool for allocating resources to improve patient flow in health care. However, there is a challenge in ensuring the results are applied. This initiative has been a successful implementation from the patient perspective in reducing patient cycle time at the General Site Orthopedic Clinic. 10 scenarios that varied appointment schedule and clinic resources were developed and tested using the model. An optimal scenario was recommended and implemented. The recommended scenario has reduced patient cycle time by 27%.

23 - Mathematical Optimization Tools at the British Columbia Cancer Agency

Vincent Chow, BC Cancer Agency, 600 West 10th Avenue, Vancouver, BC, V5Z 4E6, Canada, vchow@bccancer.bc.ca, Ruben Aristizabal, Kevin Huang, Travis Nordin, Martin Puterman, Pablo Santibanez, Greg Werker

We showcase two scheduling optimization tools developed and in use at the British Columbia Cancer Agency. The Chemo SmartBook tool schedules daily chemotherapy appointments under clinical, operational and patient constraints. The RT Staff planning tool allocates Radiation Therapists to work areas over a 2-year period under skill development and robustness constraints. We will also share our experiences on converting mathematical models into software tools for use by healthcare employees.

24 - Improving Orthopaedic Surgical Patient Flow through the Master Surgical Schedule

Daphne Sniekers, Quality Specialist, Hamilton Health Sciences, 711 Concession Street, Hamilton, On, Canada, sniekers@hhsc.ca

The Juravinski Hospital is a major orthopaedic surgical centre for the city, specifically for total joint replacements. Despite many initiatives over the years to improve patient flow and reduce delays and cancellations, surgical cancellations due to no bed still occurs regularly, especially in orthopaedic cases. In addition, the Ministry of Health has mandated wait time targets and volume targets for numerous surgical cases, including fractured hips and total joint replacements. A discrete event simulation model was created to study flow of surgical patients from the wait list, to the surgical day through to their stay and discharge from inpatient units. The model was used to study the effect of changes to the master surgical schedule, scheduling of urgent patients and inpatient unit capacity. The aim was to find an alternative schedule and supporting policies and resources that would reduce cancellations, and achieve wait time and volume targets for the orthopaedic surgical service. The solution suggested from the model results was implemented. Evaluation of the schedule demonstrated the accuracy of the model in real life through a reduction in cancellations and inpatient census.

25 - User-centered Redesign of BioSense, an Application for National Syndromic Surveillance

Robert Furberg, Clinical Informaticist / Research Technologist, RTI International, 3040 Cornwallis Rd, RTP, NC, 27709, United States of America, rfurberg@rti.org, Taha Kass-Hout, John Brownstein, Clark Freifeld, Barbara Massoudi, Mahima Ashok

In 2009, the Centers for Disease Control and Prevention began the process of redesigning the BioSense Program to better meet the needs of its diverse user base. Integral to this Redesign process is the re-imagining and development of the BioSense Application. In order to design and build an application with the needs of users in mind, a User-Centered Design (UCD) approach has been adopted to guide the design specifications process. A UCD methodology focuses attention on the end-users of an application, and prioritizes their evolving needs and requirements during the application development process. By using stakeholder's technical input, gathered through an iterative sequence of interactive sessions, recurring themes have emerged that inform the creation of

application prototypes. These prototypes will in turn inform the development of the final application. In this poster, we examine how the UCD approach has guided, and continues to guide, the evolution of the redesigned BioSense application. In a UCD approach, feedback from users informs design specifications in an ongoing and iterative fashion. Thus far, we have collected valuable feedback from users through a variety of venues: user-interviews at the International Society for Disease Surveillance conference in December 2010, roundtable workshops at the Public Health Preparedness Summit in February 2011 and one-on-one interviews at the Public Health and Radiation Emergency Preparedness conference in March 2011. Through this UCD process, we have identified 22 guiding design principles for the BioSense Redesign. These principles are broadly divided into two areas: features that would strengthen currently existing designs and features that would be entirely new, providing added value. These recurring themes informed the design of an interactive prototype which Redesign Team members will demonstrate in this interactive session.

26 - Modeling Multidisciplinary Rounding at Intensive Care Unit
Ashish Gupta, Associate Professor, Minnesota State University Moorhead, 1104 7th Ave South, Moorhead, MN, 56563, United States of America, gupta@mnstate.edu, Ramesh Sharda, Brian Pickering, Ognjen Gajic, Yue Dong

Multidisciplinary rounding is a critical collaborative Intensive care units (ICU) activity done with the objective of providing better patient care and devising a dynamic short term patient-specific treatment plan. In this study, we observe and simulate the complex rounding process within the medical ICUs of a major teaching hospital in US with the aim of understanding their workflow and investigating strategies that could improve ICU performance by curtailing unwarranted interruptions during the rounding process.

27 - Simulation Model to Explore Efficient Patient Flow in an Emergency Department

Felisa Vazquez-Abad, Professor, Hunter College CUNY, 695 Park Avenue, Room HN 1000 E, New York, NY, 10021, United States of America, fvazquez-abad@gc.cuny.edu, Rehana Rasul, Eric Osisek, Peter Gorski

Visits to emergency departments increase every year causing overcrowding, but improvements in staff, technology and space are costly. Our interactive quick simulator allows to make statistical comparisons with and without a fast track treatment area, a low cost alternative. Users can evaluate the impact of important parameters and gain insight about this low cost alternative.

28 - Variances and Probability Distributions in Utility-based Comparative Effectiveness Analyses

Aysun Taseli, Northeastern University, College of Engineering, Boston, MA, 02115, United States of America, ataseli@gmail.com

Comparative effectiveness and utility-based methods are widely used in healthcare research for evaluating alternative medical treatments and interventions. Most such methods usually are based on expected values. We illustrate analytic approaches that address three common types of inherent theoretic and population variability, including use of mean-variance models, utility probability distributions, and stochastic dominance concepts. Examples underscore the impact on treatment decisions and implications when conducting these types of analyses.

29 - Applying Statistical Process Control and Benchmarking Methods to Specialty Care Process Quality

James Benneyan, Professor of Industrial Engineering, Center for Health Organization Transformation New England VA Engineering Resource Center, Northeastern University, 360 Huntington Avenue, Boston, MA, 02115, United States of America, benneyan@coe.neu.edu, Janis Hersh, Mehmet Erkan Ceyhan, Aysun Taseli, Zeynep Karakas

We investigate the performance of a range of different specialty care services of Veterans Affairs Healthcare System over time via univariate and multivariate statistical process control (SPC) and data envelopment analysis (DEA) methods. SPC and DEA are proposed as a framework for testing, measuring, comparing improvement, and determining the relative efficiency of multiple systems both at facility clinics level in the New England Area, and region level nationwide. Future research directions presented.

30 - Online Reputation Systems for Improving Operational Efficacy of the Healthcare Marketplace

Haijing Hao, PhD Student, Carnegie Mellon University, 5000 Forbes Avenue, Heinz College PhD Program, Pittsburgh, PA, 15213, United States of America, haohaijing@cmu.edu, Kai Zheng, Qiaozhu Mei, Tzu-Yu Wu

Online reputation systems, where consumers (patients) rate the performance of their healthcare providers, have the potential to reduce information asymmetry—an inherent flaw of the healthcare marketplace accounting for many of its operational inefficiencies. Through examining a prevalent Chinese website, haodf.com (“good doctors”), we studied the interaction mechanisms among consumers and between consumers and providers and their implications on supporting the consumer-driven healthcare model.

31 - As the Largest Healthcare Provider in the United States, Does Medicare Reimburse Hospitals for Outcome
David Barrett, PhD Student, UWO - Ivey School of Business, 1151 Richmond Street, London, ON, N6A3K7, Canada, dbarrett.phd@ivey.ca

While customer centered approaches continue to evolve in healthcare, other incentives are required beyond simply customer choice to promote quality initiatives. Using the outcome dimension of Donabedian's healthcare quality framework and PLS, I demonstrate that hospitals with higher patient perceptions of care and better clinical outcomes receive lower Medicare reimbursements.

32 - Policy Mapping the Medical Countermeasure Enterprise: understanding Complex Policy Environments

Michael Mayer, Associate, Booz Allen Hamilton, 13200 Woodland Park Rd, Herndon, VA, 20171, United States of America, mayer_michael@bah.com, David Sulek, Julie Hays

Multiple agencies, departments, and centers are involved in MCM development, with significant overlaps in scope and objectives. Generating a visual mapping of a policy landscape provides organizations with a distinctive, holistic perspective of the policies that affect them and their stakeholders. This enables an organization to increase awareness of existing policy while providing a framework for anticipating and adjusting to new legislation that may be developed.

33 - Clinical Information, Communication and Workflow Challenges of Healthcare Professionals In Homecare

Ivana Matic, RN, Master of Nursing Student, University of Toronto, #130 - 155 College Street, Toronto, On, M5T1P8, Canada, ivana.matic@utoronto.ca, Sima Ajami, Diane Doran

This multi-phased qualitative description study aims to identify and prioritize healthcare practitioners' information, communication and workflow challenges in Homecare that would best benefit from novel communication and information system solutions. In order for appropriate solutions to be developed, priority problems must be identified first. Data collection of this study is through focus groups and shadowing. The analysis will serve to define the problems and prioritize them, with findings further to be explored in subsequent workflow studies.

34 - Analysis of Repeated Measures Data for Glaucoma Progression Classification

Gregory Schell, PhD Student, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48105, United States of America, schellg@umich.edu, Joshua Stein, Mariel Lavieri

Glaucoma is a degenerative eye disease which if left untreated can cause irreversible blindness. Motivated by a desire to predict when glaucoma patients will experience disease progression, we construct statistical models via generalized estimating equations to classify patients as experiencing or not experiencing disease progression. Our models were developed and tested on repeated measures data available from the Collaborative Initial Glaucoma Treatment Study.

35 - A Constraint Programming and Set Cover Approach to Beam Selection in Total Marrow Irradiation

Chieh-Hsiu J. Lee, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, chjlee@mie.utoronto.ca, Dionne Aleman, Michael B. Sharpe

Intensity-modulated radiation therapy is a form of radiation therapy used to treat cancer. Using IMRT for total marrow irradiation presents challenges in beam orientation optimization due to large target size. We present a two-step CP-SCP method to prevent clustering of beams to mitigate uncertainty and deliver a quality treatment.

36 - Northeastern University Healthcare Systems Engineering Program

Mehmet Erkan Ceyhan, Post-Doctoral Associate & Project Manager of VERC, Healthcare Systems Engineering Centers, Northeastern University, 360 Huntington Avenue, Snell Engineering Center, Boston, MA, 02115, United States of America, erkanceyhan@gmail.com, James Benneyan

Health care has been identified as one of the “Grand Challenges” facing the U.S. in the upcoming century and as a critical focus for operations research and systems engineering. We describe a large scale effort to develop a comprehensive healthcare systems engineering program that includes two federally-awarded centers, undergraduate through graduate curricula, applied internships, faculty-in-training programs, and partnerships with dozens of hospitals and other healthcare organizations.

37 - Creating a Better Delivery System: A New Multi-disciplinary Systems Engineering Partnership

Bradley V. Watts, VA Medical Center, White River Junction, 215 N. Main Street, White River Junction, VT, 05009, United States of America, bradley.watts@va.gov, Stephanie Triplett, Janis Hersh

Created in 2009, the VERC develops and integrates operational systems engineering methods into the delivery of efficient, effective, and reliable veterans care. This poster will present the barriers, challenges, opportunities and successes in supporting a multi-disciplinary and cross-organizational collaboration to create a self-improving VA that can thrive even in rapidly changing environments.

38 - Current State of Lean and Six Sigma Adoption in Hospitals and the Strategies for the Future

Stephanie Triplett, Department of Veterans Affairs, 150 South Huntington Ave, VERC - Building 9, Rm 309, Boston, MA, 02215, United States of America, stephanie.triplett@va.gov

With ~50% of community hospitals having significant fiscal problems and at risk to close, it is striking less than 10% have fully implemented Lean or Six Sigma. This poster looks at where the industry is and where it should be going to keep up with demands for more effective and efficient delivery of services.

39 - Illuminating the Uncertain Future of Healthcare Fraud

David Klubes, Booz Allen Hamilton, 8283 Greensboro Dr, McLean, VA, 22102, United States of America, klubes_david@bah.com, Jason Hunter, Tonia Bleecher

Healthcare fraud is a complex and growing issue that impacts the government, private actors and tax payers. Futures Analysis provides these groups a structured, qualitative approach to gain insights into how healthcare fraud might evolve and facilitates crafting tailored mitigation strategies.

40 - Approximate Dynamic Programming in Optimal Search with Application to Minimally Invasive Surgery

Yasin Gocgun, Post-doc, University of British Columbia, Operations Logistics Sauder, School of Business 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, gocgun@gmail.com, Steven Shechter

We study a class of optimal search problems where the search region includes a target and an obstacle, each of which has some shape. We formulate these problems as Markov Decision Processes (MDPs), but because of the intractability of the state space, we use Approximate Dynamic Programming (ADP) techniques and compare their performances against heuristic decision rules. We motivate the problem with decision making that takes place during the course of minimally invasive surgery.

Monday, 2:00pm - 3:15pm

MC10

Westmount/Outremont

Plenary

Cluster: Plenary

Invited Session

1 - The New McGill University Health Centre: From Vision to Reality

Arthur Porter, Director General and Chief Executive Officer, McGill University Health Center, Montreal, QC, Canada

In 1997, five hospitals affiliated with the Faculty of Medicine of McGill University formed the McGill University Health Centre in what remains as Canada's largest voluntary hospital merger. A major driving force behind the merger was the vision to create a favourable environment for pivotal infrastructure renewal—an imperative for the sustaining and enhancement of world-class academic medicine. In April 2010, construction began on the Glen Campus, a key component of the \$2.25-billion MUHC Redevelopment Project and also the largest public-private partnership in Canada. While one of the world's most significant healthcare infrastructure projects, the MUHC Redevelopment Project is also a catalyst for the complete redesign of our clinical, research and teaching practice. This talk will describe the genesis of the vision, the implementation process and implications for the future.

Monday, 3:30pm - 5:00pm

MD01

01- Fontaine Ballroom C

Panel Session: Research Funding Opportunities in Healthcare Operations Research

Cluster: Invited Sessions

Invited Session

Chair: Brian Denton, Associate Professor, Edward P. Fitts Department of Industrial & Systems Engineering, North Carolina State University, 111 Lampe Drive, Raleigh, NC, United States of America, bdenton@ncsu.edu

1 - Research Funding Opportunities in Healthcare Operations Research

Moderator: Brian Denton, Associate Professor, Edward P. Fitts Department of Industrial & Systems Engineering, North Carolina State University, 111 Lampe Drive, Raleigh, NC, United States of America, bdenton@ncsu.edu, Panelists: Teresa Zayas Cabán, Russell R. Barton

This panel discussion will include representatives of funding agencies including the U.S. National Science Foundation (NSF), the Agency for Healthcare Research and Quality (AHRQ), and others. Representatives of these agencies will provide a summary of currently funded research related to healthcare OR, and discuss priority funding areas and opportunities for the future.

MD02

02- Fontaine Ballroom D

Healthcare Potpourri

Sponsor: INFORMS Health Applications Section

Sponsored Session

Chair: Hari Balasubramanian, Assistant Professor of Industrial Engineering, University of Massachusetts, College of Engineering, Amherst, MA, 01003, United States of America, hbalasubraman@ecs.umass.edu

1 - The Impact of Case Mix on Timely Access to Appointments for a Primary Care Physician

Asli Ozen, Doctoral Student, University of Massachusetts, Amherst, 160 Governors Drive, Amherst, MA, 01003, United States of America, aozen@engin.umass.edu, Hari Balasubramanian

Using data from a primary care practice, we show empirically using simulation that not only the panel size but also the case mix plays a crucial role in the appointment burden of physicians. To model case-mix, we categorized patients according to their number of comorbidities (simultaneous chronic conditions) and calculated the overflow by finding the percentage of time when the patients' visit requests exceed the capacity of the physician.

2 - The Impact of Flexibility on Capacity Allocation and Performance of Primary Care Practices

Xiaoling Gao, University of Massachusetts, Amherst, 160 Governors Drive, Amherst, MA, 01003, United States of America, xiaoling@engin.umass.edu, Hari Balasubramanian, Ana Muriel, Liang Wang

We adapt ideas of manufacturing process flexibility to the management of continuity and timely access in primary care practices. Timely access focuses on the ability of a patient to get access to a physician. Continuity refers to building a strong relationship between patient and physician by maximizing patient visits. We develop a two-stage stochastic integer program to investigate optimal capacity allocation for prescheduled and same-day patients, and the value of different flexible policies.

3 - A New Approach to Sector Duration Optimization in Perfexion Treatment Planning

Hamid Ghaffari, PhD Candidate, University of Toronto, Mechanical and Industrial Engineering, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, ghaffari@mie.utoronto.ca, Kimia Ghobadi, Dionne Aleman, Mark Ruschin, David Jaffray

In this research we propose a constraint generation interior point (CGIP) approach to solve sector duration optimization (SDO) which arises in Perfexion inverse planning. The problem is to find the optimum time duration for each sector at each size in order to minimize the dose delivered to the critical structures around the target while ensuring the target structure receives sufficient amount of radiation. Our experiment shows a significant improvement in computation time and quality in using CGIP.

■ MD03

03- Fontaine Ballroom E

Public Health, Emergency Response, and Medical Preparedness

Cluster: Operations Research for Public Health

Invited Session

Chair: Eva Lee, Professor & Director, Georgia Institute of Technology, Ctr for OR in Medicine & HealthCare, Industrial and Systems Engineering, Atlanta, GA, 30332, United States of America, evakylee@isye.gatech.edu

1 - Improving Integrated Care After Disasters

Doug Samuelson, President / Chief Scientist, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States of America, samuelsondoug@yahoo.com

Recent disasters, such as 9/11 and Katrina, and certain combat-inflicted ailments, such as traumatic brain and spinal cord injury, demonstrate that long-term health effects are both difficult to diagnose and important. Current diagnostic and treatment protocols are not well suited to finding such connections. Integrated diagnosis and on-site treatment can substantially reduce both the degree of injury and the long-term costs of treatment. On-site treatment options, in turn, influence the resources, planning and preparation required for effective disaster response.

2 - Biosurveillance: Population Protection and Disease Mitigation Strategies

Chien-Hung Chen, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, cchen@isye.gatech.edu, Eva Lee

This work is joint with CDC Strategic National Stockpile. The large influx of individuals to the point-of dispensing (POD) centers to receive vaccinations or prophylactic treatment raises the potential risk of serious intra-facility cross-infections. In this study, we employ a large-scale simulation/optimization decision support system, RealOpt, to analyze the propagation of highly infectious disease within dispensing sites. Strategies for disease mitigation will be described.

3 - A Software Suite for Public Health, Disaster Medicine and Emergency Response

Eva Lee, Professor & Director, Georgia Institute of Technology, Ctr for OR in Medicine & HealthCare, Industrial and Systems Engineering, Atlanta, GA, 30332, United States of America, evakylee@isye.gatech.edu, Chien-Hung Chen

This work is joint with Strategic National Stockpile at CDC. The study is performed to better understand the feasibility and resource requirements to carry out large-scale medical countermeasure dispensing operations in the event of a biologic attack or a pandemic event. We identify existing gaps and challenges in the operational processes, and present a software suite that has been developed for usage in public health medical preparedness and emergency response operations.

■ MD04

04- Fontaine Ballroom F

Predictive Models of Health Outcomes Related to Obesity and Diabetes

Cluster: Medical Decision Making

Invited Session

Chair: Maria Mayorga, Assistant Professor, Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States of America, Mayorga@clemson.edu

1 - Optimal Learning Applied to Glycemic Control in Type 2 Diabetes

Ilya Ryzhov, Princeton University, Princeton, NJ, 08544, United States of America, iryzhov@Princeton.EDU, Warren Powell, Kate Hsieh

Severe cases of type 2 diabetes are subject to uncertainty regarding risk factors and preferred treatment regimens. We model clinical treatment decisions for diabetes patients as a Markov decision process with unknown transition probabilities representing the possible effects of various diabetes drugs. We use models and techniques from optimal learning to incorporate the acquisition of new information about the treatment effects into our glycemic control strategy.

2 - An ADP Approach for Optimal Control of Cardiovascular Risk in Patients with Type 2 Diabetes

Jennifer Mason, PhD Student, North Carolina State University, 400 Daniels Hall, Raleigh, NC, 27695, United States of America, jemason2@ncsu.edu, Brian Denton, Nilay Shah, Steven Smith

We present an MDP model to determine optimal treatment guidelines to manage blood pressure and cholesterol levels for prevention of cardiovascular events in

patients with type 2 diabetes. Due to the large state space we use ADP methods to compute near optimal treatment plans. The model considers the patient's expected quality-adjusted life years and expected discounted costs of treatment. We compare our results to current US treatment guidelines for cholesterol and blood pressure control.

3 - Generational Trends and Impact of the Overweight and Obese Intrauterine Environment

Maria Mayorga, Assistant Professor, Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States of America, Mayorga@clemson.edu, Odette Reifsnider, Mulugeta Gebregziabher, Kelly Hunt

Using both statistical models and simulation, we examine trends in weight-gain over time among white and black women of child-bearing age in the US from 1980 to 2008. We quantify the increase in incidence rate over time and disparities. Furthermore, we predict effects due to the intrauterine environment.

■ MD05

05- Fontaine Ballroom G

Healthcare IT

Sponsor: INFORMS Data Mining Section

Sponsored Session

Chair: Rema Padman, Professor, Carnegie Mellon University, The H. John Heinz III College, Pittsburgh, PA, 15213, United States of America, rpadman@cmu.edu

1 - A Predictive Readmission Model for Patients with Congestive Heart Failure

Indranil Bardhan, Associate Professor, The University of Texas at Dallas, School of Management, SM 41, 800 West Campbell Road, Richardson, TX, 75080, United States of America, bardhan@utdallas.edu, Jeong-ha Oh, Zhiqiang (Eric) Zheng, Kirk Kirksey

Readmission of patients with chronic diseases is a growing burden on the US healthcare system. We develop a predictive model to identify factors that impact readmission for patients with congestive heart failure. Our results suggest that patient demographics, disease co-morbidities, payer type, and hospital/physician characteristics are associated with readmission rates.

2 - The Information Value of Online Physician Ratings

Ritu Agarwal, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, ragar@umd.edu, Brad Greenwood, Guodong (Gordon) Gao

In recent years, online physician ratings have grown rapidly. In this study we examine three fundamental issues related to these online ratings: (1) the bias in selecting physicians to rate; (2) the bias of online ratings compared to offline opinions; and (3) the correlation between online ratings and physician clinical quality. Answers to these questions have important practical value and policy implications. This study also contributes to the research on online word-of-mouth to unveil the complex nature of consumers' rating generation process.

3 - Do Opinion Leaders Affect Information Technology Adoption in Clinical Care? A Structural Model

Haijing Hao, PhD Student, Carnegie Mellon University, 5000 Forbes Avenue, Heinz College PhD Program, Pittsburgh, PA, 15213, United States of America, haohaijing@cmu.edu, Rema Padman, Rahul Telang, Baohong Sun

This study develops a Bayesian learning structural model to investigate information technology (IT) adoption in the healthcare delivery setting. We apply this structural model to estimate the impact of opinion leaders on the learning process by which their peers adopt a new technology application. We employ panel data associated with the usage of a newly implemented wireless Personal Digital Assistant (PDA) enabled clinical information system in a 500-bed community hospital by about 200 physicians over 22 months. Our results indicate that, first, opinion leader effects have a stronger impact on their peers' adoption decision than technology quality itself. Second, the smaller the usage signal variability, the stronger is the impact on the peers' adoption decision.

■ MD06

06- Fontaine Ballroom H

Healthcare Operations Management

Sponsor: Canadian Operational Research Society

Sponsored Session

Chair: Mehmet Begen, University of Western Ontario, Richard Ivey School of Business, London, ON, Canada, mbegen@ivey.uwo.ca

1 - A Mathematical Modeling Framework to Individualize Mammography Screening

Oguzhan Alagoz, University of Wisconsin-Madison, Madison, WI, 53706, United States of America, alagoz@engr.wisc.edu, Turgay Ayer, Natasha Stout

We develop a finite-horizon partially observable Markov decision process (POMDP) model that can be used to personalize mammography screening, the most effective modality for early diagnosis of breast cancer, based on the prior screening history and personal risk characteristics of women. We solve this POMDP model optimally for individual patients using real data and find that our proposed personalized screening schedules outperform the existing guidelines with respect to the total expected quality-adjusted life years, while significantly decreasing the number of mammograms.

2 - Simulation-optimization for Outpatient Appointment-scheduling in Presence of Seasonal Walk-ins

Tugba Cayirli, Assistant Professor, Özyegin University, Kusbakisi Cad. No: 2, Altunizade -sküdar 34662, Istanbul, Turkey, Tugba.Cayirli@ozyegin.edu.tr, Evrim Didem Gunes

This study investigates outpatient scheduling and capacity decisions in an integrated approach. Access rules adjust daily number of patients based on the seasonality of walk-ins, and appointment rules determine which particular slots to overbook or leave open when seasonal rates deviate from the overall walk-in rate. Simulation-optimization is used to derive heuristic solutions for a range of environments with different walk-in rates, and monthly, intra-week and intra-day seasonality levels. Results are compared in terms of the patient waiting time, physician idle time and physician overtime.

3 - Setting Wait Time Targets

Anisa Aubin, MSc Graduate Student, University of Ottawa, 55 Laurier Avenue, Ottawa, ON, K1N 6N5, Canada, rcteam03@aol.com, Jonathan Patrick

Resource limitations mean that though patient often receive the right care, it is often later than the right time. Wait time targets are generally set for clinical purposes but there are also managerial benefits. Our model determines the minimum target for each priority class to maintain average overtime below a threshold. A second model determines the necessary increase in schedule volume to achieve the clinically desirable targets. Finally, a third model attempts to determine the optimal balance between overtime and base capacity in order to meet the targets set in the second model.

■ MD07

07- Mont Royal

Patient Scheduling Methods

Sponsor: EURO - ORAHS, Operational Research Applied to Health Services

Sponsored Session

Chair: Paulien Koeleman, VU University Amsterdam, De Boelelaan 1081a, Amsterdam, Netherlands, paulien@few.vu.nl

1 - Master Surgery Scheduling under Consideration of Multiple Downstream Units

Andreas Fügener, Technische Universität München, München, D-80333, Germany, Andreas.Fuegener@wi.tum.de, Rainer Kolisch

We consider the master surgery scheduling problem (MSS) where operating room (OR) time is assigned to surgery specialities. While most MSS approaches in the literature consider only internal OR resources we enlarge the scope to the downstream resources intensive care unit (ICU) and ward. These are required by the patients once they leave the OR. We first propose an analytical approach which calculates for a given master surgery schedule the demand distribution of patients for the downstream units. Then we discuss heuristic algorithms to level the demand distribution.

2 - Optimizing a Doctor's Time: On the Tradeoff Between Private Practice and Hospital Referrals

Eser Kirkizlar, Assistant Professor, Binghamton University/SUNY, Binghamton, NY, United States of America, eser@binghamton.edu, Demetrios Karides, William Millhiser

How many referrals should a specialist accept at a local hospital given that referrals may take time away from a private practice, may pay well but arrive inconsistently, and may require a follow-up visit? Using a NYC neurologist's data, we develop a Markov decision model that optimizes this and other decisions (e.g., how many hours to staff the hospital as well as the order in which to treat referrals and follow-ups). We will also share a related spreadsheet tool developed for public use.

3 - Simulation Optimization for Appointment Scheduling

Ger Koole, VU University of Amsterdam, Amsterdam, Netherlands, koole@few.vu.nl, Paulien Koeleman

Appointment scheduling is a classical problem in health care operations management. Several papers have focused on finding optimal schedules using numerical approaches. However, this implies that certain unrealistic assumptions have to be made. In this presentation we report on our findings using simulation optimization for a model that includes many features that can be found in practice.

■ MD08

08- Hampstead

Patient Flow Management I

Contributed Session

Chair: Yung-Wen Liu, Assistant Professor, University of Michigan-Dearborn, 4901 Evergreen Rd, 2250 HPEC, Dearborn, MI, 48128, United States of America, ywliu@umich.edu

1 - Stochastic Assignment of Patients in Home Care Services

Ettore Lanzarone, Politecnico di Milano, Dipartimento di Meccanica, Via La Masa 1, Milan, 20156, Italy, etttore.lanzarone@polimi.it, Andrea Matta

The paper deals with the problem of assigning a Home Care (HC) patient to the reference operator preserving the continuity of care and balancing the workload among the operators. We propose a structural analytical policy for solving the assignment problem, that minimizes a stochastic cost function related to the number of visits that each operator provides below his/her capacity using a stochastic ordering. Higher workload balancing and lower cost are obtained with respect to the HC practice, where an approach based on the expected workload is usually adopted.

2 - Appointment Scheduling with No-shows: Structural Results and Priority Rules

Michael Pinedo, Professor, Stern School of Business-NYU, 44 West 4th Street, New York, NY, 10012, United States of America, mpinedo@stern.nyu.edu, Christos Zacharias

Consider the following appointment scheduling problem. A day consists of n identical time slots and m customers have to be assigned to these slots. A customer has a given weight and a certain probability of not showing up. The service provider may assign multiple customers to the same slot. We determine the priority rules that minimize the sum of the total expected costs of slots remaining idle, the total expected overtime costs, and the total weighted expected waiting costs incurred by the customers.

3 - A Game-theoretic Model of Walk-in Clinic Attendance

Yung-Wen Liu, Assistant Professor, University of Michigan-Dearborn, 4901 Evergreen Rd, 2250 HPEC, Dearborn, MI, 48128, United States of America, ywliu@umich.edu, Tilman Borgers

We introduce a game-theoretic model that describes the workings of walk-in clinics when also a system for making appointments in advance exists. We find that in "Bayesian Nash equilibrium" patients whose symptoms are sufficiently severe attend a walk-in clinic. Otherwise, they will call in for an appointment. If the healthcare system could instruct patients to adopt a threshold strategy after observing their own symptoms, it would instruct patients to adopt a higher threshold than they adopt in the Bayesian Nash equilibrium, and thus fewer patients would attend the walk-in clinic.

■ MD09

09- Cote St. Luc

Capacity Management Decisions at Tertiary Hospitals

Sponsor: POMS, College of Healthcare Operations Management
Sponsored Session

Chair: Nadia Lahrichi, Sir Mortimer B. Davis Jewish General Hospital, 3755 Chemin de la Côte-des-Neiges, Montreal, H3T 1E2, Canada, nadia.lahrichi@cirrelt.ca

1 - Scheduling of Staff and Patients for a Pre-surgical Screening Clinic

Dana Porubska, Jewish General Hospital, 3775 Cote Ste. Catherine Road, Montreal, Canada, dporubska@jgh.mcgill.ca, Philip Troy, Nadia Lahrichi, Lawrence Rosenberg

Hospital management at the Sir Mortimer B. Davis Jewish General Hospital decided to develop a new pre-surgical screening (PSS) clinic. We aim to address three objectives for the scheduling: minimize physician idle time, minimize staff over time, and minimize excessive patient waiting time.

2 - Nurse Scheduling: From Theoretical Modeling to Practical Resolution

Hocine Bouarab, École Polytechnique de Montréal, Département MAGI, Montréal, Qc, Canada, hocine.bouarab@polymtl.ca, Martine Dagenais, Sophie Champalle, Mehdi Taobane, Antoine Legrain, Nadia Lahrichi

The aim of this paper is to study and analyze the nurse scheduling process in two hospitals, and propose models and heuristics to improve both the process and the quality of the resulting schedule. Higher quality schedules are obtained in a more efficient manner.

3 - Insights into a General Appointment Scheduling Framework from Simulation-optimization

Kenneth Klassen, Professor of Operations Management, Brock University, Dept of Finance, Operations & IS, St. Catharines, ON, L2S 3A1, Canada, KKlassen@brocku.ca, Reena Yoogalingam

The unique and highly variable characteristics of outpatient clinics makes it challenging to develop general rules for scheduling appointments. The presence of factors such as unpunctuality and interruptions further complicates this process. This study uses a simulation-optimization framework based on empirical data to develop general insights into appointment system design.

■ MD12

12- Verdun

Stochastic Models I

Contributed Session

Chair: Paul Luh, National Chengchi University, Math Dept. National Chengchi University, Taipei, 116, Taiwan - ROC, sl@nccu.edu.tw

1 - Healthcare Queueing System Fuzzy Control Approach for Reducing Sojourn Time

Zafar Zafari, University of British Columbia, 3333 University Way, Kelowna, BC, V1V 1V7, Canada, zafar.zafari@ubc.ca, Javad Tavakoli

Hospital waiting list has always been a very interesting issue for researchers. Controlling the patients waiting time and reducing that has always been considered as an important factor for hospital managers. The objective of this paper is to use fuzzy control methods to reduce sojourn time and consequently decrease the average number of patients in the system, which will cause increasing in patient's satisfaction and decreasing in hospital related costs.

2 - Time Estimation of Occurrence of Diabetes-related Cardiovascular Complications

Paul Luh, National Chengchi University, Math Dept. National Chengchi University, Taipei, 116, Taiwan - ROC, sl@nccu.edu.tw, Ching-Yuan Hu, Jeng-Huei Chen, Chun-Huan Lao, Li-Jen Cheng, Li-Chia Chen

Diabetes, caused by high level of glucose in the blood, could lead to devastating complications. In this study, the disease progression of diabetes, which classifies patients' health conditions in terms of the presence of complications, is considered as a Semi-Markov model. Parameters of the model are estimated based on collected data. Compared with other previous results, this is the first model based on data from Chinese-speaking populations. It will provide a more accurate estimation on the time-to-occurrence and probability of complications for the target populations.

■ MD13

13- Lachine

Queueing Models II

Contributed Session

Chair: Palvannan R. Kannapiran, Operations Research Specialist, National Healthcare Group, 6 Commonwealth Lane, #04-01, GMTI Building, Singapore, 149547, Singapore, palvannan_kannapiran@nhg.com.sg

1 - Queueing Theory Application to Decrease the Number of Patients Waiting

Coleen Wilder, Professor, Valparaiso University, 353 Sheffield Drive, Valparaiso, IN, 46383, United States of America, Coleen.Wilder@valpo.edu

The objective of this research is to produce a simple tool to assist health care management in quantifying the tradeoffs between different queueing structures. In many cases, intuition results in an appropriate selection: the quandary, however, is typically over the magnitude of improvement. The problem addressed herein is limited to two classes of patients and two service providers but could easily be expanded on either front. Queue lengths are derived using linear algebra for a given workload, service time ratio, and patient mix. The queue lengths are then used to compare the different structures.

2 - Intensive Care Unit Patient Flow with Readmissions: A State-dependent Queueing Network

Galit Yom-Tov, Post-doc, Columbia University, IEOR Department, The Fu Foundation School of Engineering, New-York, NY, United States of America, gy2185@columbia.edu, Carri Chan

This work examines the queueing dynamics of an ICU where patients may be readmitted. When patient demand exceeds availability, current ICU patients may be discharged in order to accommodate new, more urgent patients. Such a discharge increases the likelihood of readmission to the ICU. We model such an ICU as a state-dependent Erlang-R queueing network where service times and readmission probabilities depend on whether the ICU is 'full'. We consider how the definition of 'full' affects system behavior and provide insight into capacity management of such systems.

3 - Impact of Fixed Bed Capacity of Stroke Ward using Erlang Loss Model & Modified Stay Distribution

Palvannan R. Kannapiran, Operations Research Specialist, National Healthcare Group, 6 Commonwealth Lane, #04-01, GMTI Building, Singapore, 149547, Singapore, palvannan_kannapiran@nhg.com.sg, Kiok Liang Teow, Thomas W. K. Lew, Seng Lim, Bee Hoon Heng

A dedicated acute stroke ward that admits stroke patients immediately improves patient outcomes. Protocolised care took up to six days but some patients stay longer. Given a fixed bed capacity in an acute hospital, we assessed how long we could keep the long staying patients before transferring them to general ward. We used an Erlang loss model and a modified distribution of the length of the stay for analysis. We also studied the impact of higher average length of stay and inpatient demand. This assured management that the planned capacity was sufficient to provide for current and future demand.

Tuesday, 8:30am - 10:00am

■ TA01

01- Fontaine Ballroom C

Multi-objective Approaches to Policies and Resource Problems in Healthcare

Cluster: Medical Decision Making

Invited Session

Chair: Sanjay Mehrotra, PhD, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, mehrotra@iems.northwestern.edu

1 - Outcome Based State Budget Allocation for Diabetes Prevention Programs

Kibaek Kim, Graduate Student, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, kibaek.kim@u.northwestern.edu, Sanjay Mehrotra

We consider the problem of outcomes based budget allocations to prevention programs across different states to achieve greater geographical healthcare equity. We use Diabetes Prevention and Control Programs (DPCP) by the Center for Disease Control and Prevention (CDC) as an example. We present a robust weighted sum model for outcome adjusted budget allocation. An inverse linear programming technique is presented and used to identify the weights used by decision-makers in such models. Our results show that the CDC budget allocation process for the DPCPs is not likely to be model based. Relative weights for different risk factors and corresponding budgets obtained under different weight regions are discussed. Parametric analysis shows that, when all possible weights are allowed in our robust multi-objective model, frequency of checking HbA1c, risk for limb amputation, diabetes retinopathy or diabetes education can all be used as a surrogate marker for allocating DPCP budgets.

2 - Ameliorating Geographic Disparities in Kidney Transplantation Rates through Optimization Approaches

Ashley Davis, PhD Candidate, Northwestern University, IEMS Department, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, ashleydavis2012@u.northwestern.edu, Sanjay Mehrotra, Daniela Ladner, Mark Daskin, John Friedewald, Anton Skaro, Michael Abecassis

The US Department of Health and Human Services' Final Rule dictated that organ allocation policies should not be biased towards a transplant candidate's place of residence. Since this mandate, little has been done to lessen geographic disparities in kidney transplantation rates. We analyze current kidney allocation and compare present transplantation rates to those of an alternative strategy focused on optimally improving geographic equity. Distribution of 2009 kidney transplant candidates, recipients, and standard criteria donors (SCD) were obtained at Donor Service Area (DSA) precision from United Network of Organ Sharing (UNOS) data. Our kidney sharing strategy utilizes allocating SCD kidneys between DSAs. Via optimization, the optimal DSA sharing levels which minimize the overall variance in transplantation rates are determined. In 2009, less than 25% of SCD kidneys were allocated beyond the DSA of procurement, and DSA SCD kidney transplantation rates varied from 3.0% to 29.9%. Given optimal sharing of SCD kidneys within 600 miles of procurement, DSA SCD kidney transplantation rates vary from 6.5% to 8.8% with an overall variance of less than 0.001%. A national sharing strategy only further decreases this variance by 0.001%. Enhancing the practice of sharing SCD kidneys can increase geographic equity in DSA kidney transplantation rates.

3 - Robust Models for Nurse Staffing

Changhyeok Lee, Graduate Student, Northwestern University, IEMS Department, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, changhyeok.lee@u.northwestern.edu

Hospitals must maintain safe nurse-to-patient ratios to offer consistent patient support. With limited supply of nurses and highly fluctuating patients demand, the providers face the issue of determining the optimal nurse staffing levels. In practice, difficulties arise with estimating the future demand. We present Newsvendor-based optimization models and algorithms for the nurse staffing problem in various distributionally-robust settings including minimax regret framework.

■ TA02

02- Fontaine Ballroom D

Healthcare Delivery Systems

Sponsor: IIE, Society for Health Systems

Sponsored Session

Chair: Teresa Wu, Arizona State University, Tempe, AZ, United States of America, teresa.wu@asu.edu

1 - Ambulance Flow Control through Ambulance Diversion and Destination Policies

John Fowler, Professor, Industrial Engineering, Arizona State University, CIDSE, Tempe, AZ, 85287, United States of America, John.fowler@asu.edu, Adrian Ramirez, Teresa Wu, Esma Gel

Overcrowding episodes in ED's across the United States have caused concern in multiple aspects, including long waiting and boarding times. This research proposes ambulance flow control to allocate patients to the appropriate facility in order to find Pareto improvement in the performance of an emergency care system. The proposed framework based on simulation finds an effective use of the resource pool to receive the appropriate level of care as soon as possible. Genetic algorithms and approximate dynamic programming are discussed to assess the ambulance diversion and destination policies.

2 - Designing, Improving & Efficiently Operating Hospitals with Help from GE's Generic Modeling Toolkit

Onur Dulgeroglu, Systems Simulation Scientist, GE Global Research Center, 1 Research Circle, Niskayuna, NY, 12309, United States of America, dulgerog@research.ge.com, David Toledano

We will introduce a simulation based decisioning toolkit designed by GE's Global Research Center for GE Healthcare's Performance Solutions business. The toolkit is applied alongside GE-HC's advisory services over a wide spectrum of projects, ranging from long term strategic planning such as designing new hospitals, to short term proactive measures such as establishing real-time links with hospital IT systems to take realistic "snapshots" then fast-forward to avoid bottlenecks over the next day.

3 - The Impact of Workload on Hospital Reimbursement: Overworked Servers Generate Lower Income

Sergei Savin, Associate Professor, University of Pennsylvania, The Wharton School, Philadelphia, PA, 19104, United States of America, savin@wharton.upenn.edu, Nicos Savva, Adam Powell

We study the impact of physician workload on hospital reimbursement utilizing a detailed dataset from the trauma department of a major urban hospital. We find that the ratio of patients receiving a high severity status for reimbursement purposes, which maps to a 28% higher payment for the hospital, to be substantially reduced as the workload of the discharging physician increases. This difference persists even after we control for a number of systematic differences in patients, treatment and time of discharge. Furthermore, we show the difference is not caused by selection bias or endogeneity in either discharge timing or discharge allocations. Finally, we find that the impact of workload on the probability that a patient is assigned a high severity is moderated by experience. We attribute this difference to a workload induced neglect of care in paperwork execution. We estimate the loss in revenue to be approximately 0.9% (with a 95% confidence interval of 0.3% and 1.5%) of the department's annual revenue.

■ TA03

03- Fontaine Ballroom E

Joint Session ICS/OR for Public Health: Innovative Global Health Models

Sponsor: INFORMS Simulation Society/Operations Research for Public Health

Sponsored Session

Chair: Stephen Chick, Professor, INSEAD, Technology & Operations Management Area, Boulevard de Constance, Fontainebleau, 77300, France, stephen.chick@insead.edu

1 - SPLASH: A Progress Report on Combining Simulations for Better Health Policy

Peter Haas, Research Staff Member, IBM Almaden Research Center, 650 Harry Road, San Jose, CA, 95120-6099, United States of America, peterh@almaden.ibm.com, Melissa Cefkin, Susanne Glissmann, Cheryl Kieliszewski, Paul Maglio, Ronald Mak, Patricia Selinger, Wang-Chiew Tan

Health is part of a complex system comprising urban planning, medicine, agriculture, economics, social behavior, and more. Decision makers need to predict the health effects of changes in these factors. Typically, experts in different organizations create independent models of the various system

components. We describe our progress in designing the Splash platform for composing multiple heterogeneous models, simulations, and datasets into an integrated picture of health. Splash comprises mechanisms for cataloging, describing, connecting, and executing a set of models together.

2 - Optimal Preventive Care Policies on Type 2 Diabetes Mellitus

Karca Aral, PhD Student, INSEAD, Technology & Operations Management Area, Boulevard de Constance, Fontainebleau, 77300, France, KarcaDuru.ARAL@insead.edu, Alfons Grabosch, Stephen Chick

Type 2 Diabetes Mellitus (T2DM) is a common chronic condition that affects over 285 million people worldwide. The related global cost accounts for USD 326 billion in 2010 despite the fact that T2DM and its related complications are preventable through healthier lifestyle and dietary choices. In this study, we introduce a population level progression model of T2DM. We report on progress to our investigation on optimal preventive policies for resource allocation decisions regarding screening, public awareness and patient education programs for self-management around T2DM.

3 - Determining the Optimal Vaccine Subsidy: An OR Approach

Ruben Proano, Assistant Professor, Rochester Institute of Technology, 81 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, rpmeie@rit.edu, Wenbo Zhang

This study proposes an optimization-based approach to determine the minimum subsidy per vaccine dose that will make an expensive and currently non-affordable vaccine attractive for commercialization in a low-income market segment so that a desired number of children are immunized. The proposed optimization model minimizes, across the vaccine market, the change in the total social surplus that is induced by the subsidy in the given low-income market segment.

■ TA04

04- Fontaine Ballroom F

Integrating Patient Perspectives into Consumer and Clinical Decision-making

Cluster: Medical Decision Making

Invited Session

Chair: Jenna Marquard, University of Massachusetts Amherst, 219 ELab, 160 Governors Drive, Amherst, MA, 01003, United States of America, jmarquard@ecs.umass.edu

1 - Supporting Self-assessment in Healthcare through Exploration of Population-based Patient Data

Leigh Baumgart, University of Virginia, 151 Engineer's Way, Charlottesville, VA, United States of America, lab3h@virginia.edu, Ellen Bass, Jason Lyman, John Voss

The task of making a self-assessment judgment, based on actual practice experience, is important in healthcare. Despite its importance, physicians have shown a limited ability to accurately self-assess. To address this need, an information analysis automation tool is currently under development to integrate and present population-based patient data to health care providers. Providing graphical reports and control over displayed information has aided in self-assessment judgments.

2 - Evaluating Decision-making in Clinical Encounters with Sequential Analysis

Jie Xu, University of Wisconsin-Madison, 3223 Mechanical Engineering Building, 1513 University Ave., Madison, WI, United States of America, jxu29@wisc.edu, Enid Montague

Training programs or technologies might affect doctor-patient communication, which is a critical aspect of shared decision making. In this study, a technique using video coding and lag sequential analysis was used to evaluate the eye gaze patterns in supplement of other verbal measures to evaluate patient participation in a clinical encounter.

3 - Nurses' Behaviors and Eye Fixation Patterns in the Medication Administration Process

Jenna Marquard, University of Massachusetts Amherst, 219 ELab, 160 Governors Drive, Amherst, MA, 01003, United States of America, jmarquard@ecs.umass.edu, Ze He, Philip Henneman

This project aims to determine whether differences in nurses' behaviors and eye fixation patterns during the medication administration process influence their capacities to recognize patient identification errors. Nurse participants who identified patient identification errors in a simulated setting tended to have a higher level of process efficiency, shorter non identification-related discussions, and more fragmented yet systematic eye fixation patterns than nurses who did not catch the error.

■ TA05

05- Fontaine Ballroom G

Data Mining at the Bedside I

Sponsor: INFORMS Data Mining Section

Sponsored Session

Chair: Gilles Clermont, MD,CM, MSc, University of Pittsburgh, Scaife 602A, 3550 Terrace, Pittsburgh, PA, 15261, United States of America, cler@pitt.edu

1 - Data Mining as a Means to Create a Physiologic Severity of Illness Score for Critically Ill Patients

Andrew Kramer, Senior Manager, Critical Care Research, Cerner Corporation, 1953 Gallows Rd., Suite 500, Vienna, VA, 22182, United States of America, akramer@cerner.com

Data mining algorithms do not contain the restrictive assumptions of inferential statistics, and therefore may be useful in exploring the effect of multiple physiologic measures on outcomes for critically ill patients. One particular data mining method, Genetic Algorithms (GA), can effectively search a multi-dimensional response surface and therefore might be successfully applied to analyzing complex data such as a patient's physiology. This talk will demonstrate how GAs can be used to developing a severity of illness score. This score will be optimized towards predicting patient outcomes.

2 - Outlier Detection for Clinical Monitoring and Alerting

Milos Hauskrecht, Associate Professor, University of Pittsburgh, 5329 Sennott Bldg, Computer Science Department, Pittsburgh, PA, 15260, United States of America, milos@pitt.edu, Gregory Cooper, Shyam Visweswaran, Gilles Clermont

We present a new data-driven framework for detecting deviations in clinical care and for outlier-based patient alerting. Our framework works by monitoring a given patient and by identifying those patient-management decisions that are highly unusual with respect to past patients with the same or similar condition(s). We evaluate the framework on data obtained from the electronic health records of 4,486 post-cardiac surgical patients. We show that decisions that deviate more from expected decisions are more likely to be associated with clinically important alerts.

3 - Building Predictive Models using Physiologic Data

Pierre Alexandre Fournier, President, Carré Technologies Inc., 5795, ave de Gaspé, Suite 218, Montreal, QC, H2S2X3, Canada, fourmier@carretechnologies.com, Jean-François Roy

Medical devices and computerized medical records now generate a massive amount of data that has to be harnessed to improve to the quality of health care and medical research and lower their costs. We describe different approaches in building predictive models for health conditions using small and large databases, using the latest results in data mining and machine learning. We also explain how mobile devices can be used by patients to help them keep a health journal and better communicate with health professionals.

■ TA06

06- Fontaine Ballroom H

The Use of Lean Management Techniques in the Hospital Sector

Sponsor: Canadian Operational Research Society

Sponsored Session

Chair: Irwin Kuzmarov, Director of Professional and Hospital Services, Santa Cabrini Hospital, 5655 St. Zotique, Montreal, QC, H1T1P7, Canada, Irwin.Kuzmarov@ssss.gouv.qc.ca

1 - Lean Management in the Healthcare Sector: A Case Study on Performance Improvement

Kudret Demirli, PhD, Concordia University, Department of Mechanical and Industrial, Montreal, QC, H3G 1M8, Canada, demirli@encs.concordia.ca, Jonathan Rodriguez, Irwin Kuzmarov, Sandra Remer

The radiology department at a Community Hospital in Quebec currently has a waiting list of up to 12+ months. The current state was analyzed according to Lean principles and a future state is developed with the goal to minimize patient waiting times and create a smoother flow of patients through the system.

2 - First-line Family Physician Manpower Needs in Hospitals and the Health-care Network- The Essential Ingredient to Quality Care

Mark Roper, Director of Primary Care, McGill University Health Centre, 2100 Marlowe Avenue, Montreal, QC, H4A 3L5, Canada, mark.roper@mcgill.ca

The assessment of Need in medical manpower is a complex and misunderstood process. The analysis of family medicine manpower and needs should be based on the best indicators available. A comprehensive analysis of variables affecting future need will also be discussed.

3 - The Improvement in the Average Length of Stay in a Community Hospital-The Broad use of Lean Management Principles

Irwin Kuzmarov, Director of Professional and Hospital Services, Santa Cabrini Hospital, 5655 St. Zotique, Montreal, QC, H1T1P7, Canada, Irwin.Kuzmarov@ssss.gouv.qc.ca, Sandra Remer

The presentation will describe the entire operation and focus on the state maps both initial and "lean" model, as well as the multidisciplinary approach used both to evaluate and correct the patient production. The data over several periods will be presented.

TA07

07- Mont Royal

Healthcare Operations Management I

Sponsor: MSOM, Healthcare Operations Management

Sponsored Session

Chair: Bruce Golden, The France-Merrick Chair in Management Science Decision, Operations & Information Technologies, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States of America, bgolden@rhsmith.umd.edu

1 - The Impact of Batching on Throughput and Flow Time in an Emergency Department

Gregory Dobson, Associate Professor, University of Rochester, Simon Graduate School of Business, Rochester, NY, United States of America, greg.dobson@simon.rochester.edu, Hsiao-hui Lee, Arvind Sainathan, Vera Tilson

In an ER at a teaching hospital we use queuing to analyze the patient exam by a resident, the subsequent conference with the attending, and the attending visit with the patient and observe throughput and flow time of patients. We prove the throughput optimal policy, with preemptions. Without preemptions, we demonstrate numerically that a throughput optimal policy involves batching patients at the conference and residents waiting for the attending to start a conference. Constraining batch sizes or reducing the number of beds, reduces throughput slightly but has a large impact on flow time.

2 - Effects of Residents on Efficiency in an Emergency Department

David Anderson, University of Maryland, R.H. Smith School of Business, College Park, MD, United States of America, danderson@rhsmith.umd.edu, John Silberholz, Bruce Golden, Mike Harrington, Jon Mark Hirshon

The residency teaching model is often cited as a source of inefficiency in the healthcare system. We build a simulation model of an emergency department (ED) at a large urban academic hospital. Using historical data and a natural experiment involving residents in the ED, we show that residents in fact increase throughput and lower service and waiting times.

3 - A Dynamic Patient Network Model of Hospital-acquired Infections

Sean Barnes, University of Maryland, College Park, MD, United States of America, sbarnes@math.umd.edu, Bruce Golden, Edward Wasil

Hospital patients who share a healthcare worker are inherently connected to each other. These connections form a network through which transmission of infectious diseases can occur. The structure of this network is a strong determinant of the extent and rate of transmission. We examine how the density of this network and the behavior of healthcare workers, who often share patients and interact with each other, can affect transmission using a dynamic, agent-based model.

TA08

08- Hampstead

Optimal Resource Allocation

Cluster: Improving Patient Flow through Capacity Planning and Scheduling

Invited Session

Chair: Jonathan Patrick, University of Ottawa, Telfer School of Management, Ottawa, ON, Canada, patrick@telfer.uottawa.ca

1 - Effective ER Physician Scheduling to Balance Patient Service & Staffing Costs

Subhamoy Ganguly, University of Colorado at Boulder, 419 UCB, Boulder, CO, 80309, United States of America, subhamoy.ganguly@colorado.edu, Stephen Lawrence

Using historical patient arrival and service data, we develop an integer goal-programming model to provide an effective staffing schedule for emergency rooms. A unique aspect of our approach is that we aggregate patient demand into discrete time buckets during a clinic day and model the stochastic distribution of aggregate patient demand within these buckets. This reduces the complexity of the ER scheduling problem without significantly reducing model fidelity. Our model helps balance staffing costs and service levels, and facilitates sensitivity analysis of different staffing policies.

2 - Mass-casualty Triage: Distribution of Victims to Multiple Hospitals using the SAVE Model

Matthew D. Dean, Assistant Professor, University of Southern Maine, School of Business, Portland, ME, United States of America, matthew.dean1@maine.edu, Suresh K. Nair

During a mass casualty incident (MCI), to which one of several area hospitals should each victim be sent? These decisions depend on resource availability (both transport and care) and the survival probabilities of patients. This paper focuses on the critical time period immediately following the onset of an MCI and is concerned with how to effectively evacuate victims to the different area hospitals in order to provide the greatest good to the greatest number of patients while not overwhelming any single hospital. This resource-constrained triage problem is formulated as a mixed-integer program. It is compared with a model in the extant literature and also against several current policies commonly used by the so-called incident commander. The experiments indicate that the proposed model provides a marked improvement over the commonly used ad-hoc policies. It also has an average improvement of 36.5% and 69.0% in the expected number of survivors over the existing model, depending on how it is implemented. A discussion surrounding the circumstances in which it would be advantageous to have more transport resources available versus more hospital capacity provides guidelines for implementation of the proposed model to incident commanders of mass casualty incidents.

3 - Sharing the Blocks: A Win-win Strategy for Surgeons and Hospital Operation Room Utilization

Robert Day, Assistant Professor, University of Connecticut, School of Business, Storrs, CT, 06269, United States of America, Bob.day@business.uconn.edu, Robert Garfinkel, Steven Thompson

We develop a mechanism that enables hospitals to allocate surgical block time to physicians that improves OR suite utilization while maintaining or improving accessibility. Implementation results at a local hospital show that the mechanism is effective.

TA09

09- Cote St. Luc

Disease Modeling

Cluster: Pharmacoeconomics

Invited Session

Chair: Lauren Cipriano, Stanford University, Dept. of Management Science & Engineering, Huang Engineering Center, Stanford, CA, United States of America, cipriano@stanford.edu

1 - Incorporating New Evidence into an Existing Microsimulation Model: A Case Study

Pamela McMahon, Associate Director, MGH Institute for Technology Assessment, 101 Merrimac St., Boston, MA, United States of America, pamela@mgh-ita.org, Kathryn Lowry, G. Scott Gazelle, Chung Yin Kong

We describe how we approach current clinical questions by incorporating new data into an existing microsimulation model, the Lung Cancer Policy Model (LCPM), previously used to evaluate lung cancer screening programs and tobacco control. The model is one of a group of lung cancer models in the NCI's Cancer Intervention and Surveillance Modeling Network (CISNET) consortium that will be used to interpret and extend findings from the National Lung Screening Trial.

2 - Cost-effectiveness of a 21-gene Recurrence Score Assay for Breast Cancer using Administrative Data

Malek Bassam Hannouf, PhD, University of Western Ontario, Schulich School of Medicine & Dentistry, London, ON, N5X 2N4, Canada, Malek.Bassam@schulich.uwo.ca, Bin Xie, Muriel Brackstone, Greg Zanic

We developed a Markov model to evaluate the cost effectiveness of a 21-gene recurrence score assay versus current Canadian clinical practice in women with early stage breast cancer. The model was parameterized using 7 year follow up data from the Manitoba Cancer Registry and cost data from the Manitoba Health and Healthy Living.

3 - Applying Multi-objective Optimization to Cancer Screening Models

Chung Yin Kong, Senior Scientist, Massachusetts General Hospital, 101 Merrimac St., 10th FL, Boston, MA, 02114, United States of America, joey@mgh-ita.org, Pamela McMahon, G. Scott Gazelle, Janie Lee

Simulation modeling has become an important tool in the economic and policy evaluation of cancer prevention and control. To ensure the accuracy of the model's predictive ability, a disease simulation model must calibrate to the existing clinical and epidemiologic data. In this study, we applied a Pareto optimal frontier method to calibrate disease simulation models with multiple calibration targets. The Pareto optimal frontier method creates a repository of optimal model parameters which allows users to select the most suitable solution(s) for their applications.

■ TA10

10- Westmount

Models in Organ Transplantation

Cluster: Transplant Operations

Invited Session

Chair: Stefanos Zenios, Charles A. Holloway Professor, Stanford University, Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305-5015, United States of America, stefzen@GSB.stanford.edu

1 - OrganJet: Overcoming Geographical Disparities in Access to Deceased Donor Kidneys

Baris Ata, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States of America, b-ata@kellogg.northwestern.edu, Sridhar Tayur, Anton Skaro

There are over 80,000 patients in the US waiting for a kidney transplant. Under the current allocation policy, deceased organs are first allocated locally. This causes significant disparities across different geographical regions. We propose an operational solution that offers affordable jet services (OrganJet) to patients on the transplant waiting list, which allows them to multiple-list in different locations (OPOs) of their choosing. OrganJet helps remedy current disparities provided a small fraction choose to multiple list, resulting in uniform waiting times to transplant in the US.

2 - Ontology and Decision Tree Approaches to understand Attribute Relations in Bone Marrow Transplants

Pouya Raeiszadeh, University of Toronto, 5 King's College Road, Room 304, Toronto, ON, Canada, praeis@mie.utoronto.ca, Dionne Aleman, Ardeshir Ghavamzadeh

Bone marrow transplantation (BMT) is commonly used to treat patients with cancer and immunodeficiency diseases. Several criteria should be considered when choosing a BMT donor. We present an ontology approach to provide an unambiguous understanding of the BMT donor selection process, and a decision tree approach to explore the significance of these criteria on patient survival.

3 - Recipient Choice in a Scoring-based Kidney Allocation Policy

Yichuan Ding, Stanford University, 14 Comstock Circle, Apt 106, Stanford, CA, 94305, United States of America, y7ding@stanford.edu, Stefanos Zenios

This article studies typical scoring-based kidney allocation policies, and the related problems about patients' incentive in accepting/rejecting a kidney. We derive an incentive compatible condition under which the new scoring system proposed in the RFI can potentially encourage patients to accept kidneys at an earlier time. Our research was the first attempt to analytically model the waitlist under a scoring-based policy. Our results may not be obtained from simulation tests.

■ TA11

11- Outremont

Healthcare-Product Supply-Chain Management I

Sponsor: MSOM, Healthcare Operations Management

Sponsored Session

Chair: Leroy Schwarz, Louis A. Weil, Jr., Professor of Management, Purdue University, Krannert School, 401 W State Street, West Lafayette, IN, 47907, United States of America, lschwarz@purdue.edu

1 - Supply Chains and Surgical Suite Performance

Vicki Smith-Daniels, Professor, Arizona State University, Tempe, AZ, United States of America, Vicki.Smith-Daniels@asu.edu

Drawing on coordinating mechanisms research, this study examines the effects of supply chain coordination on surgical suite operational performance, as well as the complementary performance effects of integrated information systems capability on inter-functional and inter-organizational supply chain coordination. Operational performance has been conceptualized as a composite construct made up of several performance indicators.

2 - Centralized Distribution Strategies in Healthcare

Sylvain Landry, Professor PhD, HEC Montréal, Montreal, QC, Canada, sylvain.landry@hec.ca, Jacques Roy, Martin Beaulieu

For some 15 years, North America has been witness to a movement to better integrate and consolidate local and regional logistics resources. However, this movement has not produced a given single solution. A variety of factors must be considered in order to succeed in this type of initiative: leadership, governance, performance measurement, internal logistics expertise or access to external expertise, recruitment, risk management and financial factors, IT platform, change management, and more. This presentation will examine a number of centralized distribution models and strategies.

3 - The Impact of Group Purchasing Organizations on Healthcare-product Supply Chains

Leroy Schwarz, Louis A. Weil, Jr., Professor of Management, Purdue University, Krannert School, 401 W State Street, West Lafayette, IN, 47907, United States of America, lschwarz@purdue.edu, Joice Hu, Nelson Uhan

This paper examines the impact of group purchasing organizations (GPOs) on healthcare-product supply chains. The supply chain we examine consists of a profit-maximizing manufacturer with a quantity-discount schedule that is nonincreasing in quantity and ensures nondecreasing revenue, a profit-maximizing GPO, a competitive source selling at a fixed unit price, and n providers (e.g., hospitals) with fixed demands for a single product. Each provider seeks to minimize its total purchasing cost (i.e., the cost of the goods plus the provider's own fixed transaction cost). Buying through the GPO provides possible cost reductions, but may involve a membership fee. Selling through the GPO provides the manufacturer possibly higher volumes, but requires that the manufacturer pay the GPO a contract administration fee (CAF); i.e., a percentage of all revenue contracted through it. Using a game-theoretic model, we examine questions about this supply chain, including how the presence of a GPO affects the providers' total purchasing costs. We also address the controversy about whether Congress should amend the Social Security Act, which, under current law, permits CAFs. Among other things, we conclude that although CAFs affect the distribution of profits between manufacturers and GPOs, they do not affect the providers' total purchasing costs.

■ TA12

12- Verdun

Optimization of Radiation Therapy Treatment Plans

Sponsor: INFORMS Health Applications Section

Sponsored Session

Chair: Edwin Romeijn, Professor, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, romeijn@umich.edu

1 - Handling of Conflicting Goals and Uncertainty in External Beam Therapy

Anders Forsgren, KTH Royal Institute of Technology, Stockholm, SE-100 44, Sweden, andersf@kth.se, Rasmus Bokrantz, Albin Fredriksson, Bjorn Hardemark

We consider two fundamental problems arising in external beam therapy. The first is the problem of efficiently approximating the set of Pareto optimal solutions arising in multi-criteria intensity-modulated radiation therapy. We describe a dual sandwich method for approximating the Pareto set. The second problem is the handling of uncertainty in intensity-modulated proton therapy by robust optimization. We describe a method for handling uncertainty in range and setup.

2 - Dynamic Robust Optimization for Fractionated IMRT Treatment Planning

Velibor Mistic, University of Toronto, Toronto, ON, Canada, velibor.mistic@utoronto.ca, Timothy C. Y. Chan

The traditional approach to robust IMRT treatment planning involves defining an uncertainty set, solving a single planning problem and using the solution in all treatment sessions. In this talk, we describe a dynamic robust optimization approach to IMRT treatment planning, where information gathered in each treatment session is used to update the uncertainty set and improve subsequent treatment sessions. We present computational results for a lung cancer patient case and show that this method significantly improves upon the non-dynamic robust approach in both tumor coverage and organ sparing.

3 - Sensitivity Analysis for Lexicographic Optimization in Radiation Therapy Treatment Planning

Troy Long, University of Michigan, 1745 Broadview Ln., Apt 510, Ann Arbor, MI, 48105, United States of America, troylong@umich.edu, Edwin Romeijn

We study the problem of quantifying clinically relevant tradeoffs between and within different stages in lexicographic optimization for IMRT treatment planning. We propose methods to identify and construct Pareto frontiers that coherently present beneficial information to physicians. We apply our approach to a clinical case of prostate cancer.

■ TA13

13- Lachine

Modeling in Healthcare I

Contributed Session

Chair: David Lane, Reader in Management Science, London School of Economics, LSE NAB 3.33, Houghton Street, London, WC2A 2AE, United Kingdom, d.c.lane@lse.ac.uk

1 - A Multi-method Equation-based Approach for Healthcare Modeling

Jim Duggan, NUI Galway, University Road, Galway, Ireland, jim.duggan@nuigalway.ie

System Dynamics (SD) and Agent-Based Modelling (ABM) are particularly effective modelling methods for gaining insight into the dynamics of disease transmission. Both approaches differ in terms of their underlying worldview and technical constraints. In domains such as epidemiology, ABM code-based models can often lack the transparency of equation-based models. This model building approach proposes an integrated framework for SD and ABM, based solely on mathematical equations. A case study is presented, and possible healthcare applications discussed.

2 - An Ontology Modeling to Enhance Clinical Diagnosis Process Via Patient-Physician GTP Communication

Zahra Maslavi, Tarbiat Modares University, Jalal-e Al-e Ahmad Highway, Tehran, Iran, zahra_paint@yahoo.com, Mohammad Mehdi Sepehri

Clinical diagnosis is usually affected by two types of problems. First, inaccurate diagnosis which is often the result of an incomplete transformation of necessary information for diagnosis by the patient to the physician and second is the waste of time that is due to assertion of unnecessary information by the patient that leads to increasing the waiting time for other patients. In this paper we suggest a more profound solution for these two problems in the context of an ontology-based questionnaire system which helps the physician to "get to the point" (GTP) communication.

3 - Clostridium Difficile: System Dynamics Modeling of Hospital Infection Outbreaks

David Lane, Reader in Management Science, London School of Economics, LSE NAB 3.33, Houghton Street, London, WC2A 2AE, United Kingdom, d.c.lane@lse.ac.uk

London School of Economics and UK National Audit Office staff constructed a simulation model to understand and control Clostridium difficile outbreaks. Different contamination stages, various transmission mechanisms and bed, toilet and staff hand cleaning were represented. The model synthesises information from a range of sources. It allows users to understand the consequences of the interaction of a number of transmission vectors and to explore policy interventions aimed at combating outbreaks.

Tuesday, 10:30am - 12:00pm

■ TB01

01- Fontaine Ballroom C

Panel Session: Emerging Teaching and Degree Options in Healthcare Systems Engineering

Cluster: Invited Sessions

Invited Session

Chair: Nebil Buyurgan, Associate Professor, University of Arkansas, 4207 Bell Engineering, Fayetteville, AR, 72701, United States of America, nebilb@uark.edu

1 - Healthcare Systems Engineering Education Programs

Moderator: Nebil Buyurgan, Associate Professor, University of Arkansas, 4207 Bell Engineering, Fayetteville, AR, 72701, United States of America, nebilb@uark.edu, Panelists: Oguzhan Alagoz, Julie Swann, Steve Roberts, Hisham Abu-Nabaa

While a few of the academic departments in industrial, systems and related branches of engineering have focused on healthcare for decades, it is only in recent years that healthcare systems engineering (HSE) has become a rapidly growing interest. A group of 34 leaders from 20 of the more prominent HSE academic research and education programs in the US and Canada participated in a workshop at the University of Arkansas in May 2010 to seek ways of collaborating and sharing ideas. One major finding was that more sharing of educational offerings, and degree/track designs is an urgent need. This panel, which focuses on such education issues, is one of two following up on the 2010 workshop at the current INFORMS healthcare meeting. It will feature presenters from both established and emerging HSE education programs.

■ TB02

02- Fontaine Ballroom D

Quantitative Decision Making in Long Term Care

Sponsor: INFORMS Health Applications Section

Sponsored Session

Chair: Nan Kong, Assistant Professor, Purdue University, 206 S. Martin Jischke Dr., West Lafayette, IN, United States of America, nkong@purdue.edu

1 - Investment Reaction Model

Ali Vahit Esensoy, PhD Student, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, ali.esensoy@utoronto.ca, Michael Carter

This work involves the development of a system dynamics simulation model of a Local Health Integration Network to assess the effects of major investments into seniors' home and community care services on patient flows between health system sectors. Primary focus of the model is to determine the extent to which hospital discharge rates to home and long-term care, and emergency department use were influenced by Ontario's \$1.1bn Aging At Home Strategy.

2 - Optimal Financing Structure Design for Traumatic Brain Injury (TBI) Patients

Zhen Zhu, Purdue University, West Lafayette, IN, United States of America, zzhu@purdue.edu, Andrew Liu, Nan Kong

While it is unfair to blame the high healthcare expenditure in the U.S. on the lack of a universal healthcare system, it would be important to examine the structure cost which does not contribute to the wellness of the patients and study new financing structures that minimize such cost. In this paper, we establish a leader-follower game involving two players, public and private insurers to study three types of structure costs (i.e. administration, over-insurance and moral hazard cost) for a potential TBI cohort. An optimal financing scheme is proposed.

3 - Planning Long Term Care Capacity with Complex Patient Pathways for the Fraser Health Authority

Yurik Sandino, STT/Managing Consultant-Ops Engineering, Fraser Health Authority, 5th Floor, 625 Agnes Street, New Westminster, BC, V3M 5Y4, Canada, Yurik.Sandino@fraserhealth.ca, Eduardo Garza, Tim Lane, Derek Atkins

The Fraser Health Authority provides services for over 1.5 million residents across the continuum of care. In order to inform Residential Care (RC) capacity planning efforts, its leadership team was interested in developing a 'desktop' decision support tool that would allow the quick analysis of various capacity configurations for existing and possibly new services and/or different patient pathways. This was achieved through collaboration between the Operations Engineering and RC groups at FHA and the Centre for Operations Excellence (COE) at the Sauder School of Business, UBC.

■ TB03

03- Fontaine Ballroom E

Tutorial: Designing and Conducting Large-scale Randomized Experiments to Understand Health Care Delivery in Developing Countries

Cluster: Tutorials

Invited Session

Chair: Prashant Yadav, Zaragoza Logistics Center, Edificio N-yade 5, C/ Bari 55 PLAZA, Zaragoza, Spain, pyadav@zlc.edu.es

1- Designing and Conducting Large-scale Randomized Experiments to Understand Health Care Delivery in Developing Countries

Prashant Yadav, Director-Health Care Delivery Research, William Davidson Institute at the University of Michigan, 724 E. University Ave, Ann Arbor MI 48109, United States of America, pyadav@mit.edu

Improving healthcare delivery requires operational changes in the processes of care provision and in the supply chain for delivering key healthcare inputs. Operations management researchers have used a combination of analytical models and empirical approaches to answer key design questions in healthcare service delivery. We often find that well tested operational designs sometimes fail or lose their cost efficiency benefits when transferred to a developing country setting. Lack of data and inability to make the right modeling assumptions for a very different socio-economic setting requires a new "implementation science" toolkit for developing country health care research that is built on field observation and can be understood, used and accepted by researchers in medicine, engineering, and business. Although randomized, controlled experiments are the gold standard for testing safety and efficacy of pharmaceuticals and other healthcare interventions, they have not been widely used for operational design problems in healthcare. Using examples of randomized experiments from Zambia and Tanzania, this tutorial will provide an overview of the research tools and pragmatic issues in conducting large scale randomized experiments in healthcare operations management.

■ TB04

04- Fontaine Ballroom F

Population Analysis for Individualized Medical Decision Support

Cluster: Medical Decision Making

Invited Session

Chair: Jianying Hu, IBM T. J. Watson Research Center, 19 Skyline Drive, Hawthorne, NY, 10532, United States of America, jyhu@us.ibm.com

1 - Supervised Patient Similarity of Heterogeneous Patient Records

Jimeng Sun, IBM TJ Watson Research Center, Healthcare Transformation, NY, United States of America, jimeng@us.ibm.com, Jianying Hu, Shahram Ebadollahi, Fei Wang

Due to the growing use of Electronic Health Records (EHR), various sources of information become available about patients. A key challenge is to identify the appropriate and effective secondary uses of EHR data for improving patient outcome without incurring additional effort from physicians. To achieve the goal of the meaningful reuse of EHR data, patient similarity becomes an important concept. The objective of patient similarity is to derive a similarity measure between a pair of patients based on their EHR data. With right patient similarity in place, many applications can be enabled: 1) case-based retrieval of similar patients for a target patient; 2) treatment comparison among the cohort of similar patients to a target patient; 3) cohort comparison and comparative effectiveness research. One of the key challenges to derive meaningful similarity measure is how to leverage physician input. In this work, we present a set of approaches about how to encode physician input as supervised information to guide the similarity measure to address the following questions: 1) How to adjust the similarity measure according to physician feedback? 2) How to combine different similarity measures from multiple physicians? 3) How to interactively update the existing similarity measure efficiently based on new feedback?

2 - Identifying Patients at Risk: Methods and Application

Michal Ozery-Flato, Research Staff Member, IBM Research, Mount Carmel, Haifa, 31905, Israel, ozery@il.ibm.com, Hani Neuvirth, Jonathan Laserson, Michal Rosen-Zvi, Jianying Hu, Martin S. Kohn, Shahram Ebadollahi

Currently, healthcare data management systems record vast amounts of information about patients. We analyze this information and develop a model for identifying chronic patients at risk for disease aggravation. For this purpose, we explore the use of various classic machine learning techniques and common statistical methods to achieve the most accurate assessment of the risk. Finally, we demonstrate an application of this model for improving care delivery.

3 - Using Modeling and Simulation on Personalized Medical Decision Support

Chih-Lin Chi, Harvard University, Boston, MA, United States of America, Chih-Lin_Chi@hms.harvard.edu, Vincent Fusaro, Prasad Patil, Peter Tonellato

Drugs with narrow therapeutic window, such as warfarin, require intensive individualized care. Treatment protocols are designed to reduce the risks of treatment for the population. We proposed a novel modeling-and-simulation method that integrate published treatment protocols and intelligently determine a low-risk protocol based on an individual's clinical and genetic factors.

■ TB05

05- Fontaine Ballroom G

Where Health Informatics and Operations Research Meet

Sponsor: Canadian Operational Research Society

Sponsored Session

Chair: Wojtek Michalowski, University of Ottawa, Telfer School of Management, Ottawa, ON, K1N 6N5, Canada, Wojtek@telfer.uottawa.ca

1 - A Methodology for Modeling Healthcare Teams and its use in Database Design and Simulation Modeling

Craig Kuziemsky, Assistant Professor, University of Ottawa, Telfer School of Management, 55 Laurier Ave. E., Ottawa, ON, K1N6N5, Canada, kuziemsky@telfer.uottawa.ca

To date there is little research looking at how different team structures will impact information and communication needs within healthcare teams. This presentation will describe a methodology for modeling healthcare teams. We then use the model to develop a database schema that represents the data needs of healthcare teams and we develop a database of simulated team data. Finally we use the database to develop and implement different simulation scenarios that provide insight for the design of information and communication infrastructures to support different team structures.

2 - Deriving a Value Function to Model Physicians' Preferences Regarding Rank-ordered Medical Documents

Dympna O'Sullivan, Aston University, School of Engineering, Aston Triangle, Birmingham, B4 7ET, United Kingdom, d.m.osullivan@aston.ac.uk, Roman Slowinski, Roland Thomas, Szymon Wilk, Wojtek Michalowski, Ken Farion

The practice of evidence-based medicine involves consulting clinical practice guidelines as well as accessing documents from electronic repositories (e.g. Scopus, Pubmed, or the Cochrane Library). The most common approach for presenting retrieved documents is in the form of a list, with the assumption that the higher a document is on a list, the more relevant it is. Despite this common list-based presentation, it is seldom studied how users (in this case, physicians), perceive the importance of the order of elements presented in a list. This paper describes an empirical study that elicited and modeled physician's preferences with regard to list-based results. Preferences were analyzed using a novel GRIP method that evaluated pairwise comparisons of selected subsets of possible rank-ordered lists composed of 3 elements. The results allow us to draw conclusions regarding physicians' attitudes towards the importance of having documents ranked correctly on a result list, versus the importance of retrieving relevant but misplaced documents. Findings should be used by developers of clinical information retrieval applications when deciding how retrieved documents should be presented.

3 - Representing Concurrent Clinical Practice Guidelines as a CLP Model

Martin Michalowski, Adventium Labs, 111 Third Ave. S, Suite 100, Minneapolis, MN, 55401, United States of America, martin.michalowski@adventiumlabs.org, Marisela Mainegra Hing, Wojtek Michalowski, Szymon Wilk, Ken Farion

This talk describes a novel methodological approach to identifying inconsistencies when combining multiple clinical practice guidelines. The need to address these inconsistencies arises when a patient with co-morbidity (i.e. multiple diseases affecting multiple body systems) has to be managed according to different treatment regimens. We discuss how to represent a formal guideline model using Constraint Logic Programming (CLP), chosen for its ability to handle relationships between patient's state, diagnosis, and treatments. We present methods to identify conflicting actions that are manifested by treatment-treatment and treatment-disease interactions that are associated with co-morbidity. Using an open source constraint programming system (ECLiPSe), we demonstrate our approach's ability to identify medically contradictory actions and to present them to a physician for use in generating treatment plans. We apply our approach to various scenarios where a patient has concurrently asthma exacerbation and a peptic ulcer, correctly identifying inconsistencies and finding valid solutions when present.

■ TB06

06- Fontaine Ballroom H

Healthcare Operation

Cluster: Invited Sessions

Invited Session

Chair: Lijie Song, Zaragoza Logistics Center, Edificio Nayade - Portal 5, C/Bari 55, Zaragoza, 50197, Spain, lsong@zlc.edu.es

1 - Admission Policies in a Neurological Hospital Ward

Saied Samiedaluie, PhD Candidate, McGill University, 1001 Sherbrooke West, Bronfman Building, Montreal, QC, H3A 1G5, Canada, saied.samiedaluie@mail.mcgill.ca, Vedat Verter, Beste Kucukyazici, Dan Zhang

In this paper, we study patient admission policies in a neurological hospital ward, where there are multiple patient types with different medical characteristics. The patients need to wait in ED or ICU until a hospital bed is assigned to them. Each type of patient has different arrival rate, average length of stay and waiting cost. The problem is formulated as an average cost dynamic program over infinite horizon. Structural properties of the problem will be discussed.

2 - A Multi-agent Supply and Demand Model for Providing Health Care to a Marginalized Population

Greg Werker, Sauder School of Business, University of British Columbia, 3869 W 18th Avenue, Vancouver, BC, V6S 1B4, Canada, greg.werker@sauder.ubc.ca, Martin Puterman

Motivated by Vancouver's Downtown Eastside—a small geographic area with many health agencies operating independently—we propose individual models to represent provision of mental health, addictions treatment, and primary care services. These models are linked at the system level by a multi-agent model containing both competitive and cooperative elements. We present mechanisms to encourage cooperative actions that benefit the clients.

3 - Reducing Length of Stay in Hospital Emergency Rooms through Process Redesign

Lijie Song, Zaragoza Logistics Center, Edificio Nayade - Portal 5, C/Bari 55, Zaragoza, 50197, Spain, lsong@zlc.edu.es, Nicole DeHoratius, Thomas Lee

Point of care (POC) testing is becoming increasingly popular in US hospitals as a way to speed up testing processes, reduce patient length of stay, and improve patient satisfaction. This study uses propensity score matching (PSM) to test the impact of POC versus central lab testing on patient length of stay, using two years of patient data collected at an American hospital. Our analysis shows a significant reduction in length of stay for patients that underwent POC testing.

■ TB07

07- Mont Royal

Healthcare Operations Management II

Sponsor: MSOM, Healthcare Operations Management

Sponsored Session

Chair: Bruce Golden, The France-Merrick Chair in Management Science Decision, Operations & Information Technologies, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States of America, bgolden@rhsmith.umd.edu

1 - Optimal Booking Strategies for Outpatient Procedure Centers

Bjorn Berg, North Carolina State University, Raleigh, NC, 27607, United States of America, bpberg@ncsu.edu, Brian Denton, S. Ayca Erdogan, Thomas Rohleder, Todd Huschka

Patient appointment booking, sequencing, and scheduling decisions are challenging for outpatient procedure centers due to uncertainty in procedure times and patient attendance. We formulate a model based on a two-stage stochastic mixed-integer program for optimizing booking and appointment times in the presence of uncertainty. Analytical insights are reported for special cases and experimental results show they provide useful rules of thumb for more general problems. A case study based on an endoscopy suite is used to draw useful insights for procedure center managers.

2 - An Assessment of Six Sigma in Healthcare Delivery

Matthew Liberatore, Director, Analytics Strategic Initiative Group, John F. Connelly Chair in Management, Department of Management and Operations, Villanova School of Business, Villanova University, Villanova, PA, United States of America, Matthew.liberatore@villanova.edu

This paper reviews and assesses the extant literature on the application of six sigma in health care delivery, focusing on the areas of application, process changes initiated and outcomes, including improvements in process metrics, cost, and revenue. The findings suggest that although six sigma has been effective in improving health care delivery, more emphasis needs to be placed on improving the process of identifying and evaluating alternatives, and verifying that the changes implemented offer significant and sustainable improvements.

3 - Optimal Sequencing and Scheduling with Potential Call-in Patients

Lawrence Robinson, Associate Professor, Johnson Cornell University, Ithaca, NY, 14853, United States of America, lwr2@cornell.edu, Rachel Chen

We consider a hybrid appointment scheduling system which accommodates both traditional patients who book well in advance and same-day patients with acute needs who call that morning for an appointment. Our model determines which appointment times should be reserved for these potential same-day patients, and which times should be reserved for traditional patients be booked. Our model includes random service times, no-shows, overtime, and auxiliary physician tasks.

■ TB08

08- Hampstead

Using Approximation Methods to Improve Patient Flow

Cluster: Improving Patient Flow through Capacity Planning and Scheduling

Invited Session

Chair: Antoine Sauré, PhD Student, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, antoine.saure@sauder.ubc.ca

1 - Scheduling Long Term Care with Supportive Housing using Approximate Dynamic Programming

Marisela Mainegra Hing, Telfer School of Management, University of Ottawa, Ottawa, Canada, mainegrahing@gmail.com, Jonathan Patrick

Insufficient long term care (LTC) capacity is a problem causing long waiting times and congestion in hospitals. Here we analyze scheduling policies to maintain the hospital census below a reasonable threshold and community wait times below the current wait time target of 90 days, considering the introduction of supportive housing. A semi-MDP model is presented to determine the access policy to available capacity at LTC and supportive housing. The semi-MDP is solved with Approximate Dynamic Programming using Q-learning.

2 - Four-hour Targets in Emergency Departments: Markov Decision Models for Optimizing Tail Probabilities

Paulien Koeleman, VU University Amsterdam, De Boelelaan 1081a, Amsterdam, Netherlands, paulien@few.vu.nl, Sandjai Bhulai

We develop a Markov decision model to optimize tail probabilities of the waiting times of patients in emergency departments where a four-hour target is enforced. We combine two techniques to derive an efficient solution method: we use multiples of the dynamic programming uniformization constant to keep track of the waiting time of the patient longest in the system, and we augment the state space with estimates of the quantiles of the waiting-time distribution that can be updated in a Markovian way. Numerical examples show that the model gives a good approximation to the optimal policy.

3 - Dynamic Multi-appointment Patient Scheduling for Radiation Therapy

Antoine Sauré, PhD Student, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, antoine.saure@sauder.ubc.ca, Scott Tyldesley, Jonathan Patrick, Martin Puterman

Seeking to reduce the potential impact of delays on radiation therapy cancer patients such as psychological distress, deterioration in quality of life and decreased cancer control and survival, and motivated by inefficiencies in the use of expensive resources, we formulate and solve a discounted infinite-horizon Markov decision process for scheduling treatments in radiation therapy units. The main purpose of this model is to identify good policies for allocating available treatment capacity to incoming demand, while reducing wait times in a cost-effective manner.

■ TB09

09- Cote St. Luc

Joint Session Pharm/OR for Public Health: Economic Evaluation of HIV Interventions

Cluster: Pharmacoeconomics/Operations Research for Public Health

Invited Session

Chair: Arielle Lasry, CDC, Atlanta, GA, United States of America, ftn9@cdc.gov

1 - REACH (Resource Allocation for Control of HIV): A Practical Tool for Decision Makers

Sabina Alistar, Stanford University, P.O. Box 17244, Stanford, CA, United States of America, ssabina@stanford.edu, Margaret Brandeau, Eduard Beck

Decision makers responsible for HIV resource allocation have little guidance and can benefit significantly from practical models that can inform the process. We developed the REACH (Resource Allocation for Control of HIV) model, a customizable user-friendly tool that can perform portfolio analyses and recommend optimal resource allocations to control HIV. We performed example analyses in three settings (Uganda, Ukraine, and St. Petersburg, Russia).

2 - The Cost-effectiveness of Pre-exposure Prophylaxis Among Men who have Sex with Men

Robert Koppenhaver, Centers for Disease Control and Prevention, Corporate Square, Atlanta, GA, 30329, United States of America, RKoppenhaver@cdc.gov, Stephen Sorensen, Stephanie Sansom

Pre-exposure Prophylaxis (PrEP) has been shown to reduce HIV incidence among men who have sex with men (MSM) according to a recent study. While PrEP's efficacy has been demonstrated, its cost-effectiveness remains unknown. Given the high cost of PrEP, it is unclear whether or not public health dollars should be invested in PrEP programs. We have developed an epidemic model of HIV among a population of MSM. We compare the cost-effectiveness of current practice (testing, antiretroviral treatment, etc.) to scenarios in which some or all MSM are given PrEP.

3 - Cost Effectiveness of Screening for HIV and HCV Infection in Injection Drug Users

Lauren Cipriano, Stanford University, Dept. of Management Science & Engineering, Huang Engineering Center, Stanford, CA, United States of America, cipriano@stanford.edu

The injection drug user (IDU) population continues to experience epidemic rates of new HIV and hepatitis C (HCV) infections. Detection of new infections during the acute phases of these diseases may provide an opportunity to improve patient outcomes and change the course of these epidemics. We aimed to compare the effectiveness and cost effectiveness of various screening protocols and frequencies of screening for acute and chronic HIV and HCV infection among IDUs in opioid replacement therapy (ORT) using a dynamic compartmental model of the HIV and HCV co-epidemic.

■ TB10

10- Westmount

Organ Transplant Models

Cluster: Transplant Operations

Invited Session

Chair: Steven Shechter, University of British Columbia, 2053 Main Mall, Vancouver, Canada, steven.shechter@sauder.ubc.ca

1 - A Self-promoting Priority Model for Transplant Queues

Steve Dreikic, Associate Professor, Dept. of Statistics & Actuarial Sciences, University of Waterloo, Waterloo, ON, N2L 3G1, Canada, sdreikic@math.uwaterloo.ca, David Stanford, Douglas Woolford

In many jurisdictions, organ allocation is done on the basis of the health status of the patient, either explicitly or implicitly. This presentation presents a self-promoting priority model which takes into account changes in health status over time. In the first variant, all patients arrive as "regular" customers to the queue, but as the health of a patient degrades, their status is promoted to "priority" to reflect the increased urgency of the transplant. Performance measures such as the mean and distribution of the time until transplant are obtained.

2 - Fairness, Efficiency and Flexibility in Renal Transplantation

Nikolaos Trichakis, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Building E40-133, Cambridge, MA, 02139, United States of America, nitric@mit.edu, Dimitris Bertsimas, Vivek Farias

The allocation of deceased-donor kidneys to patients on waitlists is carried out by ranking them according to a point system. We propose a method for designing point systems that allows policymakers to balance efficiency and fairness, taking

as input fairness constraints from a broad class of allowable constraints. Using the method, we design a point system that has the same fairness properties and achieves an 8% increase in life years gains compared to the one recently proposed by policymakers. Performance is evaluated using the same data and simulation tools as the policymakers use.

3 - Optimal Screening Strategies of Patients on the Kidney Transplant Waiting List

Alireza Sabouri, University of British Columbia, Vancouver, BC, Canada, alireza.sabouri@sauder.ubc.ca, Steven Shechter, Tim Huh

The health condition of patients on the kidney transplant waiting list deteriorates while they are waiting for an organ arrival and hence they may no longer be suitable for transplant. Therefore, transplant centers screen waiting patients at various intervals to identify ineligible patients. We propose a model for finding screening strategies that minimizes the expected screening cost and the expected penalty cost associated with transplanting an organ to an ineligible patient.

■ TB11

11- Outremont

Healthcare-Product Supply-Chain Management II

Sponsor: MSOM, Healthcare Operations Management

Sponsored Session

Chair: Leroy Schwarz, Louis A. Weil, Jr., Professor of Management, Purdue University, Krannert School, 401 W State Street, West Lafayette, IN, 47907, United States of America, lschwarz@purdue.edu

1 - A Scenario Planning Process to Prepare U.S. Healthcare System for an Uncertain and Different Future

Shardul Phadnis, Massachusetts Institute of Technology, Cambridge, MA, United States of America, shardul@mit.edu, Mahender Singh, Yossi Sheffi

The US healthcare sector is witnessing fundamental shifts on the demand side (focus on chronic care, home care, etc), supply side (shift from blockbuster drugs to generic and biologic), and in regulations (pedigree, drug diversion, etc). This will change healthcare sector dramatically, but how and how fast it will change is unpredictable. One method to prepare for an unpredictable future is scenario planning. In this paper, we describe the findings from an action research study of developing the supply chain strategy for a firm in the US healthcare sector by creating and using scenarios.

2 - Meaningful Use of Information Technologies in the Health Care Supply Chain: An Empirical Analysis

Kingshuk Sinha, University of Minnesota, Minneapolis, MN, United States of America, ksinha@umn.edu, Asoke Dey, Sriram Thirumalai

An array of information technologies available today promises to improve the performance of organizations and the supply chains within which they are embedded. However, the "meaningful use" of technologies requires an understanding of how organizations select the appropriate technologies, how they develop their technology capability, and leverage such capability to realize performance gains. This paper is an attempt to shed light on issues related to "meaningful use" of health information technologies. The empirical setting of this research is the health care supply chain and the technology capability of interest is the electronic medical record (EMR) capability of health care providers-i.e., the ability to acquire, deploy, and leverage health information technologies to enable and link the clinical processes and support decision making for effective delivery of care. In recent years, there has been a proliferation of health information technologies that promise to improve the delivery of care. However, health care providers often find the development of EMR capability and the subsequent realization of the concomitant benefits to be challenging. To that end, this research builds on the recent literature to identify and conceptualize the various stages of EMR capability development. Based on a synthesis of the relevant theoretical perspectives, we posit hypotheses that (i) relate the stages of EMR capability to the operational performance of health care providers; (ii) relate the choice of the stage of EMR capability to the technological, organizational, and environmental (TOE) factors of health care providers; and (iii) highlight the implications of selection into a stage of EMR capability by health care providers. The empirical analysis in the study is based on data from 1011 acute care providers in the U.S. The study findings indicate that the operational performance of health care providers, measured as discharges per licensed bed, is positively related to the stage of EMR capability. We find that the choice of the stage of EMR capability is significantly influenced by the TOE factors of a provider. Further, the study findings indicate that while operational performance may be higher at higher stages of EMR capability, some providers nevertheless select into the lower stages, i.e., providers systematically self-select into different stages of EMR capability. Contrary to expectations, we find that when health care providers are assigned to a higher stage of EMR capability (that is not self-selected), they fail to realize the potential operational performance benefits of that stage of EMR capability. Implications of the study findings, contributions, and directions for future research are identified.

3 - The Diffusion of Supply Chain Information Technology in U.S. Hospitals and Hospital Systems

Bushra Rahman, Research Administrator, Arizona State University, 519 W Encinas St., Gilbert, AZ, 85233, United States of America, Bushra.Rahman@asu.edu, Eugene Schneller, Michael Furukawa

This research scrutinizes HIMMS data to better understand the diffusion of supply chain technology in U.S. hospitals and hospital systems. We consider key variables including the centralization of governance, hospital size, system ownership, system age, geographical location and hospital surgical intensity. Technologies considered include both supply chain and other technologies.

■ TB12

12- Verdun

Successful OR Applications in Inpatient Healthcare

Sponsor: INFORMS Health Applications Section

Sponsored Session

Chair: Murray Côté, Associate Professor, Texas A&M Health Science Center, Health Policy & Management, School of Rural Public Health, College Station, TX, 77843, United States of America, cote@srph.tamhsc.edu

1 - Decreasing Environmental Services Response Times

Murray Côté, Associate Professor, Texas A&M Health Science Center, Health Policy & Management, School of Rural Public Health, College Station, TX, 77843, United States of America, cote@srph.tamhsc.edu, Zach Robison

In order to enhance throughput and patient flow at University of Colorado Hospital, a statistical staffing model for environmental services was developed. The model, which balances appropriate staffing levels to predicted bed requests, resulted in significant decreases in response time without compromising quality, safety, or costing additional resources.

2 - A Plea for Help from an ED Physician

David Eitel, Wellspan Health System, 1001 South George St, York, PA, United States of America, daveitel@comcast.net

The need for operations research is even more critical in today's healthcare environment, especially the emergency department. This talk will review the state of affairs in the ED, contrast the reality of this industry with its assumptions, and conclude with suggestions on how to better engage OR/MS professionals.

3 - Multi-Project "Learning" in a Complex University and Health Organizations Research Environment

Nick Edwardson, Assistant Director, Texas A&M Health Science Center, College Station, TX, United States of America, edwardson@srph.tamhsc.edu, Larry Gamm

This presentation addresses opportunities in the context of multi-project work of the Texas A&M Health Science Center's (TAMHSC) Center for Health Organization Transformation, an NSF-funded Industry/University Cooperative Research Center. TAMHSC is joined by 3 university partners and works with multiple health system members. Currently, TAMHSC researchers are working with 6 health systems on different, but related projects. This presentation relies on organizational technologies framework to describe the multi-project learning opportunities emerging within this unique learning environment.

■ TB13

13- Lachine

Applications of M&S in Healthcare Management

Sponsor: INFORMS Simulation Society

Sponsored Session

Chair: Rafael Diaz, Research Assistant Professor, Old Dominion University / VMASC, 1030 University Blvd., Suffolk, VA, 23435, United States of America, RDiaz@odu.edu

1 - A System Dynamics Model for Testing Healthcare Interventions Targeting Treatment Utilization

Joshua G. Behr, Associate Professor, Old Dominion University/VMASC, 1030 University Blvd., Suffolk, VA, 23435, United States of America, jbehr@odu.edu

A System Dynamics approach is employed to capture the complexity of patient flow among treatment venues within the US healthcare system. This project investigates changes in system behavior stemming from deployed interventions as well as interventions that have been developed theoretically but not yet implemented. These efforts lead us to understand the dynamic demand-capacity behavior of the health system over time and empirically demonstrate changes in the behavior of the system that are counterintuitive or would not have been evident if approached with more traditional causal methodologies.

2 - Chronic Disease Management: Analyzing the Impact of Interventions on Patient Health

Rafael Diaz, Research Assistant Professor, Old Dominion University / VMASC, 1030 University Blvd., Suffolk, VA, 23435, United States of America, RDiaz@odu.edu

Chronic diseases are associated with prolonged durations that limit patients' abilities to live without significant medical attention. The proposed model investigates this chronic disease management in the ambulatory care setting. We examine the effects of specific interventions on patients' health and the burden on the ambulatory healthcare system. Addressed are three major groups of chronic patients, including chronic heart failure (CHF), Asthma / Chronic Obstructive Pulmonary Disorder (COPD), and Diabetes.

3 - Simulation Based Optimization for Managing Healthcare Interventions

Mandar Tulpule, Research Assistant, VMASC/Old Dominion University, 1030 University Blvd, Suffolk, VA, 23435, United States of America, mtulp001@odu.edu, Rafael Diaz

Public health interventions are policies intended to influence the related behavior of the target population to produce a more effective healthcare system. Most interventions incur significant organizational and financial costs on one hand and uncertain practical implications on the other. As such, return on investment is difficult to determine. The present study utilizes a system dynamics approach to model the complexities associated with these systems. Further, a simulation based optimization approach utilizing the hill climbing algorithm is used to help assess the involved tradeoffs.

Tuesday, 1:30pm - 3:00pm

■ TC01

01- Fontaine Ballroom C

Models for Healthcare System Improvement - Part I

Cluster: Invited Sessions

Invited Session

Chair: Harriet Black Nembhard, Pennsylvania State University, University Park, PA, United States of America, hbn2@enr.psu.edu

1 - New Models for Emergency Department Management

Marc Afilalo, ED Director, Jewish General Hospital, Montreal, QC, Canada

In this presentation, new conceptual models for ED management will be reviewed, they include: vertical and horizontal patients sections, ultra fast-track and RAZ, ultra rapid triage and MD in triage. Research work using simulation will be presented and linked to value stream mapping of ED processes.

2 - A New Paradigm for Priority Patient Selection

David Stanford, University of Western Ontario, London, ON, Canada, stanford@stats.uwo.ca, Peter Taylor, Ilze Ziedins

Patients arrive, and consume health care resources, independently of the The Key Performance Indicators (KPI) the system is trying to adhere to. The present work presents a new paradigm for priority assignment that enables one to fine-tune the system in order to achieve specified KPI delay targets, assuming sufficient capacity exists.

■ TC02

02- Fontaine Ballroom D

Efficient Delivery of Home Health Care

Sponsor: IIE, Society for Health Systems

Sponsored Session

Chair: Ashlea Bennett, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, ashlea@uark.edu

1 - Home Health Care Scheduling and Routing

Mike Hewitt, Rochester Institute of Technology, 81 Lomb Memorial Drive, Rochester, NY, 14534, United States of America, mrheie@rit.edu, Maciek Nowak, Ashlea Bennett

The success of home health care, in terms of savings and health outcomes, has led to a dramatic increase in use. This increase, combined with cuts in government funding, has stretched resources thin. Thus, the efficiency in how home health care providers are used to care for patients is vital. However, consistency with respect to the nurse and time of day associated with a patient visit can be just as important as efficiency. We conduct a qualitative study of the impact of these consistency metrics, and propose an algorithm for producing schedules and routes that considers all objectives concurrently.

2 - Patient Assignment to Nurses in Homecare Delivery

Nadia Lahrichi, Sir Mortimer B. Davis Jewish General Hospital,
3755 Chemin de la Côte-des-Neiges, Montreal, H3T 1E2, Canada,
nadia.lahrichi@cirrelt.ca

We approach assigning patients to nurses in homecare by distributing and balancing the workload among nurses. We propose a new approach combining territorial approach and workload measure to better achieve nurses' satisfaction. We model the problem as a multi-resource generalized assignment problem where the objective is to minimize the gap between workloads.

3 - Estimating the Value of Remote Health Monitoring Systems

Ashlea Bennett, Assistant Professor, University of Arkansas,
4207 Bell Engineering Center, Fayetteville, AR, 72701,
United States of America, ashlea@uark.edu

Caring for patients with chronic illnesses accounts for 75% of U.S. healthcare spending. Technological advances in remote monitoring systems may provide a more cost-effective and less labor-intensive way to manage the care of patients with chronic illnesses by focusing on preventive measures and continuous monitoring instead of emergency care and hospital admissions. We develop a model that estimates the value of providing remote monitoring devices to chronically ill persons. The model considers how capacity constraints and fairness concerns should impact device allocation to target populations. A computational study is presented for a subset of the most common chronic diseases.

TC03

03- Fontaine Ballroom E

Improving Public Health Supply Chains in Low Income Countries

Cluster: Invited Sessions

Invited Session

Chair: Prashant Yadav, MIT-Zaragoza International Logistics Program,
Zaragoza Logistics Center, Zaragoza, MA, Spain, pyadav@mit.edu

1 - Improvements to the Public Distribution of Essential Medicines in Africa: The Case of Zambia

Ngai-Hang Leung, Massachusetts Institute of Technology,
77 Massachusetts Avenue Bldg. E40-149, Cambridge, MA, 02139,
United States of America, zacleung@mit.edu, Anastasia Chen,
Jérémie Gallien, Romain Davroux, Prashant Yadav

Remarkable and successful recent improvements efforts by the government and its partners have improved the access to essential drugs in Zambia. However, through changes in the inventory control system the improved public distribution system could still be enhanced to reach higher standards of availability. We present a possible alternative system design involving mobile devices and optimization and evaluate this proposal via a simulation model built with field data. Our results suggest that this proposal would improve drug availability at the clinics and reduce inventory and drug expiry costs.

2 - Decentralization of Resource-limited Health Care Networks: Optimal Placement of Diagnostic Devices

Sarang Deo, Northwestern University, 2145 Sheridan Road,
Evanston, IL, 60208, United States of America,
s-deo@kellogg.northwestern.edu, Milind Sohoni

Several novel, point-of-care diagnostic devices are being rolled out in developing countries that can eliminate long diagnostic delays. Allocation of limited supply of these devices is based on thumb rules such as clinic size and disease burden. We develop an optimization model to study the impact of network externality on the allocation decision and analytically characterize conditions under which these rules of thumb are optimal. We apply our findings to infant HIV diagnosis network in an East African country.

3 - Subsidizing the Distribution Channel for Products with Positive Externalities

Prashant Yadav, MIT-Zaragoza International Logistics Program,
Zaragoza Logistics Center, Zaragoza, MA, Spain, pyadav@mit.edu,
Terry Taylor

Large populations in low income countries lack access to products, such as essential medicines, whose use confers positive externalities. A key question for a donor is whether it should subsidize the channel's purchases or sales of these products. We find the answer depends on whether consumers are homogeneous or heterogeneous in their valuation of the product. For the case of heterogeneous consumers' valuations, we show that subsidizing sales leads to greater expected donor utility, consumption, and social welfare. When consumers' valuations are homogeneous, we establish the opposite result.

TC04

04- Fontaine Ballroom F

Optimization in Rehabilitation and Orthopaedic Surgery

Cluster: Medical Decision Making

Invited Session

Chair: Kang Li, Assistant Professor, Rutgers University, Industrial & Systems Engineering, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, kl419@rci.rutgers.edu

1 - Trade-off of Clinical Gait Evaluation - Causal Structures through Data Mining

Simon Hsiang, Derr Professor, Texas Tech University, Lubbock, TX, 79409, United States of America, simon.hsiang@ttu.edu,
Tasos Karakostas, Luciano Dias

Clinical gait evaluation reflects a continuous effort for finding the trade-off among multi-objectives, including postural stability, mobility, energy conservation, and impact damping. The proposed data mining procedure is critical in current evidence medicine and universal managed care climate. The causal structures developed based on Bayesian network and the social network clustering based on the patient similarity provides a critical link for communication, visualization, and resources allocation among physicians, patients, and healthcare providers.

2 - Algorithms for Automated Femur Morphometric Analysis

Kang Li, Assistant Professor, Rutgers University, Industrial & Systems Engineering, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, kl419@rci.rutgers.edu

This work proposes a new framework to enable automated analysis of the distal femur articular geometry. The framework consists of three optimization based algorithms and eliminates inter- and intra- operator variability associated with manual analysis. An application of this framework to 90 knee surface models yields several novel findings.

3 - Smart Home for Senior Citizens using Advanced Sensors

Zhihai Zhang, Associate Professor, Tsinghua University, Industrial Engineering, Beijing, 100084, China, zhzhzhang@tsinghua.edu.cn,
Ying Su

The demand of home care for senior citizens in China is growing with ageing of the population. E-health is an emerging field in the intersection of medical informatics, public health and business, referring to health services and related technologies. The aim of our study is to investigate, specify, design, prototype, evaluate and analyze new, state-of-the-art eHealth system specifically tailored to senior citizens with multiple chronic diseases. Then, we can further improve the performance of the system, for example, resource allocation, by optimal technology.

TC05

05- Fontaine Ballroom G

Data Mining in Healthcare

Sponsor: INFORMS Computing Society

Sponsored Session

Chair: Erhun Kundakcioglu, Assistant Professor,
University of Houston, E209 Engineering Bldg. 2, Houston, TX, 77204,
United States of America, erhun@uh.edu

1 - Support Vector Machines for Toxicological Evaluation of Nanoparticles

Erhun Kundakcioglu, Assistant Professor,
University of Houston, E209 Engineering Bldg. 2, Houston, TX,
77204, United States of America, erhun@uh.edu

In the present study, Raman spectroscopy is employed to assess potential toxicity of chemical substances. The database is constructed on healthy cells, Triton-X100, and etoposide exposed cells. Support Vector Machine classifiers and proposed extensions show that titania nanoparticles display cytotoxicity after 36 hours of exposure and heat effect results in apoptotic death. The results were confirmed by MTT assay and are in agreement with existing literature on the matter.

2 - A Minimum Spanning Tree Based Heuristic for Clustering High Throughput Biological Data

Burak Eksioglu, Mississippi State University, P.O. Box 9542, MSU, MS, 39762, United States of America, bekcioglu@ise.msstate.edu, Harun Pirim

A new minimum spanning tree (MST) based heuristic is developed for clustering biological data. The heuristic uses MSTs to generate initial solutions and applies a local search to improve the solutions. MSTs are generated using common distance measures such as Euclidean and Manhattan. To obtain n clusters $n-1$ edges are removed from the MST. Betweenness values (i.e., number of shortest paths going along the edges) determine which edges to remove. Local search transfers a node to the cluster with which it has the most connections, if this transfer improves the objective function value.

3 - Pharmaceutical Inventory Management under Demand and Supply Uncertainty

Samira Saedi, PhD Student, University of Houston, Houston, TX, United States of America, ssaedi@uh.edu, Erhun Kundakcioglu, Andrea Henry

Drug shortages are a challenge for the healthcare community, since they appear without a warning and cost of managing patients increases when supplies for drugs are depleted. In this study, we propose an inventory management framework for pharmaceuticals, where the product's supply is randomly disrupted for a random duration. For operational purposes, current (s,S) policy of a hospital is kept, yet updated safety stock and order-up-to levels demonstrate a significant improvement over conventional tools.

TC06

06- Fontaine Ballroom H

Patient Management

Sponsor: INFORMS Health Applications Section

Sponsored Session

Chair: Dionne Aleman, Assistant Professor, University of Toronto, Director, Medical Operations Research Laboratory (morLAB), Mechanical and Industrial Engineering, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, aleman@mie.utoronto.ca

1 - The Impact of Cross-border Patient Movement on the Delivery of Healthcare Services

Dimitrios Andritsos, UCLA Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90024, United States of America, dimitrios.andritsos.2011@anderson.ucla.edu, Chris Tang

Motivated by a recent legislative discussion in the European Union about providing European patients with the freedom to choose the country they receive treatment, we use a queuing framework to analyze a game-theoretic model that captures the interactions among the patients, the providers, and the healthcare funders. We examine the impact of such "free choice" on the healthcare systems of different countries in equilibrium. We show that cross-border patient movement can increase patient welfare but can have a mixed effect on waiting times and the costs of providing care.

2 - Resource-based START (ReSTART): Mass-Casualty Triage under Resource Limitations

Alex Mills, University of North Carolina-Chapel Hill, Statistics and Operations Research, CB 3260, Hanes Hall, Chapel Hill, NC, 27599, United States of America, amills@unc.edu, Nilay Argon, Serhan Ziya

The most widely used standard for triage, START, relies on a fixed priority ordering among the different classes of patients, and does not explicitly consider resource limitations. We construct a fluid model of patient triage in a mass casualty incident with limited resources and develop a simple dynamic priority policy, Resource-based START (ReSTART). Using simulation, we show that ReSTART significantly outperforms START under realistic conditions.

3 - A Simulation Model for Allocation of Resources in a Cancer Center

Jonathan Woodall, North Carolina State University, 111 Lampe Drive, Raleigh, NC, United States of America, jcwoodal@ncsu.edu, Brian Denton, Tracy Gosselin, Chad Seastrunk

Increased demand in oncology services is causing problems in matching oncology resource supply and patient demand. We discuss the development of a discrete event simulation model based on a cancer center at a large medical center. We discuss how we have used the model to address operational issues such as scheduling of treatment center nurses and using a "fast-track" for patients that complete labs the day before their treatment center visit. Finally, we summarize important managerial insights and future research opportunities.

TC07

07- Mont Royal

Appointment Scheduling with No-Shows

Sponsor: MSOM, Healthcare Operations Management

Sponsored Session

Chair: Rachel Chen, Assistant Professor, University of California-Davis, 3208 Gallagher Hall, Davis, CA, 95616, United States of America, rachen@ucdavis.edu

Co-Chair: Lawrence Robinson, Associate Professor, Johnson Cornell University, Ithaca, NY, 14853, United States of America, lwr2@cornell.edu

1 - Reminder Systems for Reducing No-shows in Office Practices

Leon Cui, University of Rochester, Simon School of Business, Rochester, NY, 14627, United States of America, leon.cui@simon.rochester.edu, Gregory Dobson, Vera Tilson

Personal services businesses such as doctor's offices operate based on an appointment schedule to maximize the utilization of the personnel and equipment. Some businesses deal with a no-show rate of customers that cuts into profits when it is not possible to charge the customer for the full impact of missed appointment. We develop a model to understand the investment and ongoing expense that the firm should put into such systems when customers act strategically. We also consider how reminder systems interact with overbooking policies.

2 - Appointment Scheduling under Patient No-shows and Service Interruptions

Jianzhe Luo, University of North Carolina, Chapel Hill, NC, 27599, United States of America, jzluo@email.unc.edu, Vidyadhar Kulkarni, Serhan Ziya

We consider an appointment-based service system (e.g., outpatient clinic, MRI machine etc.) for which appointments need to be scheduled before the service session starts. Patients with scheduled appointments may or may not show up for their appointments. The service of scheduled patients can be interrupted by emergency requests that have a higher priority. We develop a framework which can be utilized in determining the optimal appointment policies under different assumptions regarding rewards, costs, and the decision variables. We propose two methods that can be used in evaluating the objective function for a given appointment schedule. We specifically consider two different formulations both of which aim to balance the trade-off between the patient waiting times and server utilization and carry out a numerical study to provide insights into optimal policies. We find that policies that ignore interruptions perform quite badly, especially when the number of appointments to be scheduled is also a decision variable. We also find that policies that require equally-spaced appointments perform reasonably well when the interruption rate is constant. However, their performance worsens significantly when the interruption rate is time-dependent.

3 - Controlling Demand and Service Capacity for Appointment-based Services under Patient No-shows

Nan Liu, Columbia University, 600 W 168th St., 6th Floor, New York, NY, 10471, United States of America, nl2320@columbia.edu, Serhan Ziya

We model the appointment scheduling system as a single-server queue where new appointments join from the back of the queue. We assume that patients miss their appointments with probabilities increasing with their waiting time in queue. We consider 2 problems: (1) daily service capacity is fixed and the objective is to maximize throughput by choosing an appropriate panel size (or equivalently demand rate); (2) daily capacity is also a decision variable and the objective is to maximize the long-run average net reward (i.e., reward of serving patients less cost of maintaining service capacity).

TC08

08- Hampstead

Patient Flow Management II

Contributed Session

Chair: Jaehwan Jeong, PhD Student, University of Tennessee, 916 Volunteer Blvd., 331 Stokely Management Center, Knoxville, TN, 37996, United States of America, jjeong3@utk.edu

1 - Improving the Placement Process for the Elderly Patient: Using Lean Method

Liette St-Pierre, Professor, Université du Québec - Trois-Rivières, C.P. 500 Trois-Rivières, Québec, QC, G9A 5H7, Canada, Liette.St-Pierre@UQTR.CA

The proportion of elderly patient waiting in acute care beds is growing. Reducing the number of those patients who are staying in hospital before having a place in CHSLD is a priority for the hospitals. The length of stay in hospital (even when the patient doesn't need acute care) is increasing and resulting in delays for patients in multiple areas of the system and contribute to reduced availability of

inpatient beds for the community. We followed 150 patients on one year period so that we could understand the journey of an elderly patient from the emergency room to his hospital release. The method that we decided to use is based on lean.

- 2 - Improving Patient Flow and Performance within a Polyclinic**
Onur Kuzgunkaya, Assistant Professor, Concordia University,
Mechanical and Industrial Engineering, 1455 De Maisonneuve
Blvd. West EV4.139, Montreal, QC, H3G 1M8, Canada,
onurk@encs.concordia.ca, Robert Shek, Adnan Ali

Ambulatory polyclinics are multiple clinics that share assets and space, minimizing unused resources. Polyclinics are overcrowded and have long wait times. This study focuses on improving patient flow and providing alternative solutions to the polyclinic at Royal Victoria Hospital through simulation modeling and lean techniques. Key findings within this study include the best solution to organize multiple concurrent clinics, and the best practices to maximize quality of patient care and flow.

- 3 - Evaluating and Optimizing a Centralized Hospital Porter System**
Jaehwan Jeong, PhD Student, University of Tennessee, 916
Volunteer Blvd., 331 Stokely Management Center, Knoxville, TN,
37996, United States of America, jjeong3@utk.edu, Charles Noon

Within a hospital, porters play an important role by transporting patients between inpatient units, imaging services and treatment services. The responsiveness of a porter system directly affects the utilization of expensive assets (such as X-ray and MRI) and the efficiency of clinical staff (such as nurses and techs). Poor responsiveness results in idle time for waiting assets and causes clinical staff to be pulled away from direct patient care by having to assume the transportation responsibilities. Hospital transports are characterized by a mix of random and scheduled demands and by highly variable service times. In this work, we simulate the cost and responsiveness of an existing decentralized transport system and compare it to a proposed centralized (pooled server) system. We also determine the minimal staffing profile by hour of day needed to provide a target service level. The analysis is performed using data from a large U.S. hospital.

TC09

09- Cote St. Luc

Joint Session Pharm/OR for Public Health: Infectious Disease Network Models

Cluster: Pharmacoeconomics/Operations Research
for Public Health

Invited Session

Chair: Eva Enns, Stanford University, 117 Encina Commons, Stanford,
CA, 94025, United States of America, evaenns@stanford.edu

- 1 - Optimal Link Removal for Epidemic Control over Networks**
Eva Enns, Stanford University, 117 Encina Commons, Stanford,
CA, 94025, United States of America, evaenns@stanford.edu,
Jeffrey Mounzer, Margaret Brandeau

The control of infectious diseases that spread through close contact often focuses on interrupting the network of contacts. We examine the problem of determining which links should be removed from a contact network in order to maximize infections averted, given a constraint on the maximum number of links that can be removed. We formulate the problem as a non-convex quadratically constrained quadratic program. We evaluate the performance of approximate and heuristic solutions on a variety of network structures and compare against other quarantining metrics.

- 2 - Analytical Results for Network Models of Disease Spread**
Benjamin Armbruster, Northwestern University, Evanston, IL,
United States of America, armbruster@northwestern.edu

We discuss properties of a dynamic Erdos-Renyi model, where each edge follows a 2-state CTMC, turning on and off over time. We show results for the contact process. We describe results for models involving node turnover. In addition, we give analytical results comparing the disease spread under polygamy (when the distribution of the number of partners for men differs from the distribution for women) to a symmetric situation. We find it to spread faster in the asymmetric case.

- 3 - Modeling HIV Prevention, Detection and Treatment Strategies for High-risk Population**

Wonki Kim, Georgia Institute of Technology, Industrial and
Systems Engineering, Atlanta, United States of America,
wkim46@gatech.edu, Eva Lee

This work is joint with Dr. Dawn Smith at CDC. Our tasks include i) Estimate the entire subpopulation according to the awareness of the disease and actual infection, ii) Analyze the size and possibility of potential secondary transmission, and iii) Minimize the overall disease (infection/deaths) in a global and long-term manner. We develop a system model to determine strategies for minimizing overall infectivity and mortality through proper federal and regional investment.

TC10

10- Westmount

Panel Discussion: Challenges and Opportunities in Transplant Operations Research

Cluster: Transplant Operations

Invited Session

Chair: Diwakar Gupta, University of Minnesota, 111 Church Street
S.E., Minneapolis, MN, United States of America, guptad@me.umn.edu

- 1 - Challenges and Opportunities in Transplant Operations Research**
Moderator: Diwakar Gupta, University of Minnesota, 111 Church
Street S.E., Minneapolis, MN, United States of America,
guptad@me.umn.edu, Panelists: Oguzhan Alagoz, Dorry Segev,
Ajay Israni, Stefanos Zenios, Vivek Farias

In the US, the demand for organs far outstrips supply. Organ Procurement and Transplant Network develops policies and procedures for organ recovery and distribution (allocation) to transplant candidates. This panel discussion will focus on challenges and opportunities in helping OPTN achieve one of its primary goals-to increase effectiveness and efficiency of organ sharing and equity in the national system of organ allocation.

TC11

11- Outremont

Health Care Supply Chains

Cluster: Invited Sessions

Invited Session

Chair: Gerardo Pelayo Rubio, PhD Student, Zaragoza Logistics Center,
Edificio N-yade 5, C/ Bari 55, Zaragoza, Spain, gpelayo@zlc.edu.es

- 1 - Screening for Colorectal Cancer: The Case of
Resource Constraints**

Evrin Didem Gunes, Assistant Professor, Koc University, Rumeli
Feneri Yolu, Sariyer 34450, Istanbul, Turkey, EGunes@ku.edu.tr,
Lerzan Ormeci, Derya Kunduzcu

We examine how the allocation of capacity constrained resources for preventive and diagnostic services might affect the health outcomes. Specifically, colonoscopy for screening and diagnosis of colorectal cancer (CRC) is considered. A population dynamics model with resource constraints is introduced. Mortality rates with different priority rules are compared numerically. We show that diagnostic services should obtain priority over screening for CRC case. An alternative approach is allocating a fraction of service capacity for screening.

- 2 - Donor Coordination/Harmonization: Impact of Restriction on the
Health Outcome**

Santiago Kraiselburd, Zaragoza Logistics Center, Zaragoza, Spain,
skraiselburd@zlc.edu.es, Lijie Song, Ananth Iyer, Jorge Barnett

The WHO has identified donor coordination as a key task. Improved coordination across donors may permit significant improvement in outcomes for the same level of resource commitment. We propose the use of a model based approach to assist in this donor coordination effort. The model was applied to the free health care program in Sierra Leone. It shows impact of 4 proposed configurations of the program to the total population health outcome under different demand scenarios.

- 3 - Modeling the Impact of Share Contracts on Pharmaceutical
Companies, Healthpayers and Healthproviders**

Gerardo Pelayo Rubio, PhD Student, Zaragoza Logistics Center,
Edificio Náyade 5, C/ Bari 55, Zaragoza, Spain,
gpelayo@zlc.edu.es, Michael Borowitz, Santiago Kraiselburd,
Prashant Yadav

The pharmaceutical industry faces intense pressures and new drugs for chronic conditions which typically enter the market at very high prices and have highest uncertainty regarding the health outcomes derived from an intervention are pushing towards reimbursement contracts where the risks are optimally shared. We model the relationship between a pharmaceutical company, a health-payer, and a health-provider to analyze different "reimbursement contracts-level of vertical integration" pairs and their effects on profits, coverage, and quality of the coverage.

■ TC12

12- Verdun

Applications of Optimization in Healthcare

Sponsor: INFORMS Optimization Society

Sponsored Session

Chair: Chase Rainwater, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, cer@uark.edu

1 - Evaluating the Capacity of a Proton Therapy Facility

Chase Rainwater, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, cer@uark.edu, Ridvan Gedik, Edwin Romeijn

Due to the effectiveness and limited availability of proton therapy, the demand for this treatment is extremely high in relationship to the available capacity. Therefore, we propose a bicriteria mathematical programming model that maximizes the number of fractions and minimizes the deviations from the patient mix preferences over a finite planning horizon. Our study investigates the impact of various operational limitations faced by medical decision makers, such as: physician availability, operating hours, number of available gantries, gantry specialization and gantry switching flexibility.

2 - Biologically Guided Intensity Modulated Radiation Therapy Optimization with Fraction Constraints

Behlul Saka, PhD Candidate, University of Arkansas, Fayetteville, AR, 72701, United States of America, bsaka@uark.edu, Ronald Rardin, Mark Langer

Although radiation therapy is typically planned as a single overall treatment, it is delivered over 30-50 sessions or "fractions," and both cumulative and per-fraction dose constraints apply. The biological responses of tissues to radiation or "sensitivities" acquired from molecular images over this extended time calls adjusting radiation delivered across the treatment volume in order to yield more effective plans. We propose an optimization approach that adapts IMRT plans in response to the changes in the tumor sensitivity while meeting the dose requirements and present our results.

3 - Emergency Department Patient Flow Redesign

Soroush Saghafian, University of Michigan, Ann Arbor, MI, United States of America, soroush@umich.edu, Wallace Hopp, Mark Van Oyen, Steven Kronick, Jeffery Desmond

We consider a new patient flow design (called patient streaming) to overcome overcrowding in Emergency Departments. We investigate whether streaming can improve performance, where it is effective, and how it should be implemented for maximum performance. We also generate insights into how physicians should choose their next patient.

■ TC13

13- Lachine

Learning and Sequential Decision-making in Medicine

Sponsor: INFORMS Simulation Society

Sponsored Session

Chair: Peter Frazier, Assistant Professor, Cornell University, 232 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States of America, pf98@cornell.edu

1 - Inverse Preference Elicitation for Sequential Decision Making

Dan Lizotte, Postdoctoral Fellow, University of Michigan, West Hall 431, 1085 S University Avenue, Ann Arbor, MI, 48109, United States of America, danjl@umich.edu, Susan Murphy

We present a novel approach for informing clinical sequential decision making that makes use of evidence-based predictions of treatment outcomes and makes room for clinician and patient preferences. We will present the intuition behind our approach, along with preliminary results in constructing a clinical decision support tool using our method.

2 - Towards Safer Retinal Microsurgery: Visualization Via Multispectral Illumination

Raphael Sznitman, Johns Hopkins University, 3400 North Charles St., Baltimore, MD, 21218, United States of America, sznitmanr@gmail.com

One potential side effect of white light exposure during retinal microsurgery is retinal phototoxicity. To address this problem, one can illuminate the retina with a device that alternates between white, and less damaging limited-spectrum light. Using information from previous images, one can automatically color images from limited-spectrum light and provide the surgeon with fully colored video sequences. While trivial illumination policies can be used for retinal surgeries,

the task of finding optimal policies given the safety of patient and the ability of a surgeon is non-trivial. As an initial solution towards this goal we have computed and implemented a greedy policy-one which chooses the best possible illumination to use for the following image. We experimentally show that our methods provides quantitative and qualitative improvements in coloring accuracy over other naive recoloring schemes and generally provides a reduction in estimated phototoxicity.

3 - Optimal Sequential Experimental Design for Stochastic Root-finding in Drug Development

Peter Frazier, Assistant Professor, Cornell University, 232 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States of America, pf98@cornell.edu, Andre Teixeira, Zachary Owen, Rodrigo Bicalho, Thiago Santos

We consider a stochastic root-finding problem appearing in the development of a new bacteriophage-based therapy for bovine mastitis. Experimentalists must find a critical concentration of a bacteriophage that slows a bacterium's growth to a given level. We formulate the problem of finding this critical concentration as accurately as possible with a limited experimental budget as a Markov decision process, and solve the resulting dynamic program exactly. The resulting policy has a natural interpretation as a form of noisy bisection, and has potential application throughout medical research.

Tuesday, 3:30pm - 5:00pm

■ TD01

01- Fontaine Ballroom C

Models for Healthcare System Improvement – Part II

Cluster: Invited Sessions

Invited Session

Chair: James Leaming, HLS Practice Director, InterKnowledge, 1525 Faraday Blvd, Suite 250, Carlsbad, CA, 92008, United States of America, jleaming@interknowledge.com

1 - A Quality Driven Approach for Chronic Care Modeling

Marija Jankovic, Assistant Professor, Écoles Centrales Paris, Grande Voie des Vignes, Chatenay Malabry, 92290, France, marija.jankovic@ecp.fr, Julie Le Cardinal, Sara Ghiassi

Chronic diseases are diseases with long duration, slow progression and estimated more than 60% of overall causes of deaths in the world. Objective of this paper is to explore the possibilities of quality improvement, particularly for type 2 diabetes care. As a first step of this research, we propose a quality driven patient-centric process model for diabetes type 2 delivery services. Future work will consider data gathering and validation of the proposed quality indicators.

2 - Using Information Visualization to Think about Patient Management of Hypertension

Siddharth Prakasam, CIHDS Research Scholar, Pennsylvania State University, University Park, PA, United States of America, svp5228@psu.edu

According to the Center for Disease Control (CDC), 29% of US adults had hypertension in 2008. Given the chronic nature of the disease, it is critical that blood pressure levels are kept under constant surveillance. However, the health status reports given to patients are often misunderstood or ignored. With the focus of increasing understanding of health metrics through interactive visualizations of a patient's status, a better tracking mechanism could improve patient adherence. We propose a glyph-based approach that provides a highly visual and quickly comprehensible assessment of patient information. The glyph is in a shape that approximates the human body and uses color-coding to visually represent 17 key health metrics that pertain to the health status of a hypertensive patient. When created and viewed successively, the glyphs represent the progression in the patient's health over a period of time. Such a tool may improve physician's control over continuous patient monitoring and also help patients to better monitor their own health status between physician visits. From the physician's perspective, the tool would enable decision-making efforts through its representation of large amounts of longitudinal clinical data. Further, this tool has the capability of enhancing collaboration between the patient, nurses, doctors and other caregivers. From a patient's perspective, such an interface would help reinforce the physician recommendations and consequently the chronic condition could be kept under control. In future work, this tool may be developed for other chronic diseases.

3 - NUI Technologies: Improving Patient Access To Health Information

James Leaming, HLS Practice Director, InterKnowledge, 1525 Faraday Blvd, Suite 250, Carlsbad, CA, 92008, United States of America, jleaming@interknowledge.com, Rodney Guzman

Communication is a primary issue in quality of care. Providing the patient access to timely information can improve quality & satisfaction. Disseminating the correct information at the optimal time is challenging. Ensuring that the information is consumable & discoverable can be equally difficult. Recent improvements and affordability have enabled applications powered only by touch. New ability to improve access is possible at the point-of-care. Information can be delivered and managed centrally. The discussion will include technology and hardware discussions, and the future direction of NUI.

TD02

02- Fontaine Ballroom D

Long Term Care Modelling

Sponsor: INFORMS Health Applications Section

Sponsored Session

Chair: Martin Puterman, University of British Columbia, Sauder School of Business, Vancouver, BC, Canada, martin.puterman@sauder.ubc.ca

1 - Scheduling and Capacity Planning for Long Term Care and Supportive Housing

Jonathan Patrick, University of Ottawa, Telfer School of Management, Ottawa, ON, Canada, patrick@telfer.uottawa.ca

There has been plenty of discussion of the aging of our population and its impact on our ability to provide quality care. One must recognize a continuum of care for the elderly with some requiring 24 hour long term care (LTC) while others better served in "supportive housing" (SH). This research determines the necessary capacity plan so that the number of clients waiting for LTC/SH in each hospital in the region remains close to a pre-determined threshold value and clients waiting in the community do not wait more than 90 days for placement.

2 - Long Term Care Capacity Planning

Martin Puterman, University of British Columbia, Sauder School of Business, Vancouver, BC, Canada, martin.puterman@sauder.ubc.ca, Yue Zhang, Derek Atkins

This talk describes several approaches for setting residential care capacity levels over a multi-year planning horizon, to achieve target wait time service levels. This talk describes and compares a simulation optimization approach, a fixed ratio method, the SIPP approach and a simple flow model. It compares and contrasts these methods using data from two practical settings and shows the shortcomings of the SIPP and ratio methods.

3 - Capacity Planning for Publically Funded Community Based Long-Term Care Services

Nan Kong, Assistant Professor, Purdue University, 206 S. Martin Jischke Dr., West Lafayette, IN, United States of America, nkong@purdue.edu, Laura Sands, Mark Lawley, Feng Lin

Long-term care (LTC) provides medical and non-medical services to people with chronic disease or disability. As a large portion of the population receives publicly paid LTC, the public programs paying for LTC are under increasing financial pressure. Although nursing home care is a viable option, it is much more costly than home and community-based service (HCBS). However, little is known on how much infrastructure is needed to provide HCBS. In this research, we formulate an optimal control problem to determine the infrastructure capacity of HCBS from a cost-saving viewpoint.

TD03

03- Fontaine Ballroom E

Academic/Industry Collaboration Panel: Challenges in HealthCare: Marching Forward

Cluster: Operations Research for Public Health

Invited Session

Chair: Eva Lee, Professor & Director, Georgia Institute of Technology, Ctr for OR in Medicine & HealthCare, Industrial and Systems Engineering, Atlanta, GA, 30332, United States of America, evakylee@isye.gatech.edu

1 - Challenges in HealthCare – Marching Forward

Moderator: Eva Lee, Professor & Director, Georgia Institute of Technology, Ctr for OR in Medicine & HealthCare, Industrial and Systems Engineering, Atlanta, GA, 30332, United States of America, evakylee@isye.gatech.edu, Panelists: William Pierskalla, Calvin Thomas, Michael Schrage, Cathy Modaro

This panel includes leaders in healthcare, academia and business who will address challenges in healthcare, and the next generation advances that must be realized to meet those challenges. The panelists will share with us their knowledge and experience in successful industry-academic collaboration, highlight current and future challenges, and provoke debate on proper channels for successful adoption of OR methodologies into practice.

TD04

04- Fontaine Ballroom F

Imaging Based Medical Decisions

Cluster: Medical Decision Making

Invited Session

Chair: Teresa Wu, Arizona State University, Tempe, AZ, United States of America, teresa.wu@asu.edu

1 - Dual Energy CT for Liver Fat Tissue Quantification

William Pavlicek, Mayo Clinic Arizona, Scottsdale, AZ, United States of America, pavlicek.william@mayo.edu, Vivek Nayini

Dual Energy CT (DECT) is a recently re-introduced technology made possible by advances in computers and x-ray designs. Its availability is growing and easily incorporated into widely available CT practices. DECT introduces multiple image presentations or features including energy level from 40keV to 140keV and different material composition. In this research, we implement support vector machine and artificial neural network in Weka to demonstrate the application of data mining tools for liver fat quantification using DECT images.

2 - New Data Mining Framework to Improve Target Localization for Deep Brain Stimulation

W. Art Chaovalitwongse, Assistant Professor, Rutgers University, Director, Rutgers Center for Information Assurance, a NSA National Center of Excellence, Industrial and Systems Engineering, Piscataway, NJ, United States of America, wchaoval@rci.rutgers.edu, Stephen Wong, Kwang Hee Lee, Myon-Kee Jeong, Shabbar Danish, Paveena Chaovalitwongse

Deep brain stimulation of the subthalamic nucleus (STN) is the most commonly used surgical means of treatment for Parkinson's Disease patients. However, state-of-the-art methods for DBS electrode placement in STN can be imprecise. Microelectrode recordings are a useful adjunctive method for STN localization; however, its use has been limited by variability in patient neurophysiology. In this talk, we will present a data mining framework to provide decision support in predicting the STN area.

3 - An Automated DICOM Database for Medical Decisions

Teresa Wu, Arizona State University, Tempe, AZ, United States of America, teresa.wu@asu.edu, William Pavlicek

The US national press has brought to full public discussion concerns regarding the use of medical radiation in diagnosis. We have developed an enterprise system for Mayo Clinic termed "DICOM Index Tracker®" (DIT) which can transparently capture all desired DICOM (Digital Imaging and Communications in Medicine) tags from x-ray and nuclear imaging equipments and other DICOM devices. The system can be used for quality assurance, dosimetry calculation, efficiency and productivity studies.

■ TD05

05- Fontaine Ballroom G

Case Studies: Unlocking the Value of Information

Contributed Session

Chair: John Newman, Professor, Coppin State University, 2500 W. North Avenue, Baltimore, MD, 21216, United States of America, jnewman@coppin.edu

1 - Developing a System for Body Shape Analysis that uses Body Shape Information and Biological Informat

Sekyoung Youm, Professor, Dongguk University, Pil-Dong 3ga, Jung-gu, Seoul, Korea, Republic of, sekyoungyoum@gmail.com, Sung-Ku Cho, Kyungwon Son

To this day, most people, to measure have relied on the BMI (Body mass index) that uses only the ratio of height and weight. However, a measurement system like the BMI is too simple a measure to evaluate a person's body type objectively and accurately. One obvious weakness of BMI would be its inability to distinguish between muscle weight and fat weight (BMI focuses on height and weight only). If people who work out hard mainly rely on the BMI, they will see no change in their BMI ratios even though their body weight composition is changing from fat to muscles. Therefore, a new system is needed for effective body measurement. This very research developed a system that records the front and side of a body for effective analysis of body shape. This system is capable of measuring accurate body shape and suggesting an objective recommendation using database of body shape information. In addition, the research developed a system that can produce a diagnostic program to fix body-shape abnormalities that result from body imbalance. The existing systems lack the capabilities to analyze various bio-information and require manual operation for measuring various body parts. And also, they do not provide any useful measurement to predict imminent illnesses. For these reasons, developing a new system is needed to standardize and analyze automated images showing many dimensions of body parts, and to provide general health diagnosis using various bio-information. This research utilizes methodologies including product design methodology, risk analyses, quality controls, multivariate statistical analysis, and ubiquitous and mobile technology

2 - Adoption of OVA1: A Teaching Case on Decision Making

Vera Tilson, Assistant Professor, University of Rochester, Simon Graduate School of Business, CS-3-349 Carol Simon Hall, Rochester, NY, United States of America, vera.tilson@simon.rochester.edu

Tying classroom material to current business events helps motivate and engage students. It also exposes them to examples of how to apply what they learn in practice. We present an example of how in a course on modeling with spreadsheets, we used a 2010 WSJ article about approval of a medical test for triage of ovarian tumors to create an exercise on conditional probabilities, conflicting objectives, and the value of information. We present the plan of the discussion followed in class and the exercises assigned to students to help them understand the concepts.

3 - A Conceptual Framework for a Clinical Decision Support System for Traumatic Brain Injuries

John Newman, Professor, Coppin State University, 2500 W. North Avenue, Baltimore, MD, 21216, United States of America, jnewman@coppin.edu

Recent research suggests that traumatic brain injury (TBI) is often misdiagnosed or not diagnosed at all. Treatment and follow-up care for TBI have been criticized. Recent prevalence of various degrees of TBI from military combat has given these issues high visibility. This paper presents a conceptual model for the diagnosis, treatment, and follow-up care of TBI. A computerized Military Clinical Decision Support Systems (MCDSS) can help identify the problems and opportunities within the current delivery of medical knowledge and expertise to help design an efficient and effective strategy to address TBI and other conditions for Military and civilian personnel

■ TD06

06- Fontaine Ballroom H

Scheduling Applications

Sponsor: INFORMS Health Applications Section

Sponsored Session

Chair: Michael Carter, University of Toronto, Mechanical & Industrial Engineering, 5 King's College Rd, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca

1 - Medical Tourism: Can Developed Countries Compete on Quality with Developing Countries?

Hossein Abouee Mehrizi, University of Toronto, Canada, H.AboueeMehrizi07@rotman.utoronto.ca, Somayeh Sadat, Michael Carter

We consider a market with two hospitals competing for patients, one perceived to provide higher quality-of-care than the other. Patients select the hospital that provides the highest utility, which is a function of price, the patient's perceived quality-of-life during their life expectancy, and patient characteristics. We provide the existence and uniqueness of the Nash equilibrium by breaking the market down into seven different categories.

2 - Defining Constraint Models in the Real World: A Case Study on Chemotherapy Outpatient Scheduling

Shoshana Hahn, PhD Candidate, University of Toronto, 294 Mullen Drive, Thornhill, ON, L4J 2P2, Canada, shoshanahahn@yahoo.ca, Michael Carter, J. Christopher Beck

In this paper, we address the problem definition stage of solving a real application, the chemotherapy outpatient scheduling problem. We propose a method of evaluating definitions to decide what information from the application to include. The definition should accurately represent the application: solutions are meaningful, yet the model solves in a reasonable time. We create six definitions and develop constraint programming models of those definitions. We use a simulation to evaluate solvability and the quality of the solutions.

3 - Breast Health Clinic Scheduling using Simulation to Promote One-stop-shop Patient Care

Candice Chan, Fraser Health, Surrey, BC, Canada, candice.chan@fraserhealth.ca

The Operations Engineering team at Fraser Health is aiding the design of a new Breast Health Clinic that will be part of an Outpatient Care and Surgery Centre scheduled to open in June 2011. Aligned to the Centre's one-stop-shop care philosophy, clinic patients will be assessed as quickly as possible; seeing a specialist, undergoing tests and receiving most, if not all, of their results on the same day. A simulation model was built to derive integrated schedules between various departments, balancing patient needs & waits against resource utilization for efficiency and effectiveness.

■ TD07

07- Mont Royal

Perspectives on Nurse Staffing

Sponsor: MSOM, Healthcare Operations Management

Sponsored Session

Chair: Edward K. Baker, University of Miami, Department of Management Science, Coral Gables, FL, United States of America, ebaker@miami.edu

1 - In Healthcare, the "Customer" Has Many Faces

Dietrich Chen, University of Miami, The Peppers & Rogers Group, Miami, FL, United States of America, dietrich.chen@1to1.com

In health care, there are multiple customer communities of interest loosely and intimately intertwined. Providers, payors, pharmas, medical device manufacturers and ultimately, customers, are present in this complex and vital industrial network. To be successful, service providers must understand the perspectives and priorities of each player in the complex ecosystem.

2 - Hedging Against Risk to Minimize Budgetary Exposure to Rising Nursing Costs

Deisell Martinez, Florida International University, Decision Sciences and Information System, Miami, FL, United States of America, dmartinez@deivin.com, Edward K. Baker, Murat Erkoc

In this paper, we present "hedging" as an approach to reduce exposure to rising nursing costs. The analysis concluded that nursing services qualify as an underlying asset in a hedging strategy. Using the method, savings of 11% in nursing expenses and a decrease in budget disparity of 14% were achieved.

3 - Nurse Rostering in a Danish Hospital

Jonas Baeklund, Aarhus University, Department of Mathematical Sciences, Denmark, jonas@baeklund.info

Nurse rostering is a well-studied, but complex scheduling problem. The problem we confront is a nurse rostering problem in a ward at a Danish hospital. After a description of the problem, the results obtained by adapting a branch and price / constraint programming solution method to the problem are presented.

TD08

08- Hampstead

Case Studies: Capacity and Patient Flow Management

Contributed Session

Chair: Nubia Velasco, Assistant Professor, Universidad de Los Andes, Carrera 1 Este # 19 A, Bogotá, Colombia, nvelasco@uniandes.edu.co

1 - A Nurse Staffing Analysis at a Large Hospital

Mohamed Louly, King Saud University, P. O. Box 800, Riyadh, 11421, Saudi Arabia, louly@ksu.edu.sa, Abdelghani Bouras, Anis Gharbi, Mohamed Naceur Azaiez

The hospital faces a shortage of 300 Full Time Equivalent (FTE) nurses. The management adopted the policy of substituting these 300 FTE vacancies by allowing additional load to the existing nurses. These extra loads result in an overtime cost at the rate of 1.1 times the regular rate. The overtime allocated budget is 11.5 million U.S.D. The top management of the hospital considers this budget to be excessive. Another potential negative impact of this substitution strategy may be the risk of yielding poor nursing services due to substantial overload caused by the excessive overtime on most of the nurses.

2 - Reducing Waiting Time in a Comprehensive Health Assessment

Opher Baron, Professor, University of Toronto, 105 St. George St., Toronto, ON, M5S3E6, Canada, opher.baron@rotman.utoronto.ca, Oded Berman, Jianfu Wang, Dmitry Krass

Modern healthcare is concerned with preventive, diagnostic, and treatment aspects of health problems. Often, the cost of treatment increases sharply if a problem is diagnosed late. We present a case study of a firm that is a leader in preventive healthcare in North America. Many of the firm's customers are executives who highly value their time and prefer the checkup to have minimal waiting times. A detailed simulation study of the firm allows us to find several surprising reasons for waiting and to recommend on process improvements that would improve the company's service level.

3 - Workforce Scheduling for a Public Health Program

Nubia Velasco, Assistant Professor, Universidad de Los Andes, Carrera 1 Este # 19 A, Bogotá, Colombia, nvelasco@uniandes.edu.co, David Barrera, Ciro Alberto Amaya

This paper deals with the workforce scheduling problem for a public health program in Bogotá. In this, a group of schools demands one or more activities and defines, for each one, a set of desirable schedules to be served. To fulfill this demand, a set of workers is available and must be decided which worker will visit which school and when. Our approach uses a directed graph and to solve it a two-phase algorithm is proposed. With this approach, the population coverage could be increased up to a 68% comparing with the current situation.

TD09

09- Cote St. Luc

Modeling in Pharmaceutical Market

Cluster: Pharmacoeconomics

Invited Session

Chair: Hui Zhang, Lakehead University, 955 Oliver Road, Thunder Bay, Canada, hzhang2@lakeheadu.ca

1 - Dynamic Capacity Expansion for a New Ethical Drug with Partial Outsourcing Options

Hiroko Okajima, PhD Student, The Pennsylvania State University, 467 Business Building, University Park, PA, 16802, United States of America, huol104@psu.edu, Susan H. Xu

We investigate a pharmaceutical manufacturer's jointly optimal in-house capacity and short-term outsourcing policy during the life-span of a new drug to minimize the expected capacity investment costs and capacity overage and underage costs. We formulate the problem as a discrete-time, finite-period stochastic dynamic program and use real options approach. The optimal policy is determined by two state-dependent base-capacity levels. A numerical study shows that short-term outsourcing has both strategic and tactical advantages to mitigate capacity imbalance in uncertain business environment.

2 - The Impact of Order Loss and Shrinkage on a Single-item Pharmaceutical Inventory

Ozden Engin Cakici, University of Rochester, William E Simon Graduate School, Rochester NY, United States of America, engin.cakici@simon.rochester.edu, Harry Groenevelt, Abraham Seidmann

The management of pharmaceuticals inventory in a hospital setting requires some special considerations, and has significant impact on the cost of care. In this paper, we analyze two major drivers of suboptimal inventory management in a hospital setting: (1) order losses and (2) formularies shrinkage. Order loss is a supply disruption caused by the buyer itself. Our empirical observations at a large hospital system show that replenishment orders for pharmaceuticals issued by the radiology department must go through multiple other units for verification, authentication, safety checking, and consolidation, before they are ultimately submitted to a supplier for fulfillment. As a result, a certain portion of the restocking orders is inadvertently lost on the way. Shrinkage, on the other hand, is typically caused by the mandatory disposal of partially used drug packages. Various drugs (e.g., contrast media for medical imaging) are bought by the hospitals in larger packages as a way to cut cost, and they are used intravenously for more than one patient. The typical FDA regulations on these drugs require that, once a vial is opened, any unused portion must be discarded after a short period of time (e.g., 10-24 hours).

3 - Modelling the Dynamics of a Risk Sharing Agreement

Reza Mahjoub, University of Western Ontario, Richard Ivey School of Business, London, ON, N6A 3K7, Canada, rmahjoub@ivey.uwo.ca, Fredrik Odegaard, Greg Zaric

Some new drugs such as oncology drugs are very costly and their effectiveness outside of clinical trial conditions may be unproven. A risk sharing agreement is a contract between the drug manufacturer and a healthcare payer to manage uncertainties regarding the cost and effectiveness of those drugs. We model a risk sharing scheme where the rebate is a percentage of the total sales until an evaluation time. We examine the dynamics of this risk sharing agreement from a pharmaceutical perspective. We fit the model to the data from a clinical trial and perform some specific numerical analysis.

TD10

10- Westmount

Transplant Modeling and Logistics

Cluster: Transplant Operations

Invited Session

Chair: Gordon Hazen, Northwestern University, IEMS Department, McCormick School, Evanston, IL, United States of America, gbh305@lulu.it.northwestern.edu

1 - Analysis of Kidney Transplant Center Locations in the United States

Mark Daskin, PhD, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, msdaskin@umich.edu, Daniela Ladner, John Friedewald, Sanjay Mehrotra, Vadim Lyuksemburg, Ashley Davis, Anton Skaro, Michael Abecassis, Juan Carlos Caicedo

The distance end stage renal disease (ESRD) patients travel to kidney transplant centers (KTCs) is predictive of their listing and receiving a kidney transplant. We analyze the geographic distance traveled by ESRD patients to their closest existing US KTC, and compare the resulting coverage to an optimized model aimed at maximizing geographic access by minimizing the total travel distance faced by ESRD patients to their closest KTC. Findings show that presently, 64% of ESRD patients live within 30 miles of a KTC. Through optimal relocation, 79% of ESRD patients live within 30 miles of a KTC.

2 - The Value of Partially Observable Liver Transplant Waiting List

Burhaneddin Sandikci, Assistant Professor, University of Chicago Booth School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States of America, Burhaneddin.Sandikci@chicagobooth.edu, Lisa Maillart, Mark Roberts, Andrew Schaefer

In the United States, patients in need of a liver transplant receive deceased-donor organ offers through joining a waiting list. Accepting or rejecting an offered organ is largely influenced by the patient's prospects for future offers, which can be ascertained most accurately by knowing the entire composition of the waiting list. We present a model that uses the partially observable waiting list as available in the current system to make optimal accept/reject decisions along with our numerical results investigating the impact of this imperfect information on patients' life expectancies.

3 - The Natural History of MELD

Gordon Hazen, Northwestern University, IEMS Department, McCormick School, Evanston, IL, United States of America, gbh305@lulu.it.northwestern.edu, Zhe Li

The U.S. liver transplant wait list is prioritized by MELD, a combination of laboratory values positively correlated with 90-day mortality. SRTR publishes 30-day MELD transition data appropriate for Markov modeling. However, the data shows some MELDs more likely to improve, odd because listed candidates should on average expect worsening MELDs. We hypothesize this is due to censoring by transplant, and fit a statistical model that allows this using the EM algorithm. The fitted model confirms transplant censoring and produces estimates of the natural history of MELD without transplant.

TD11

11- Outremont

Operational Models of Drug Resistance

Cluster: Invited Sessions

Invited Session

Chair: Eirini Spiliotopoulou, PhD Student at MIT-Zaragoza, Zaragoza Logistics Center, Edificio Náyade 5, C/ Bari 55 - PLAZA, Zaragoza, 50197, Spain, espiliotopoulou@zlc.edu.es

1 - Designing Dynamic Adaptive Clinical Trials

Vishal Ahuja, Graduate Student, University of Chicago, Booth School of Business, 5807 Woodlawn Ave., Chicago, IL, 60637, United States of America, vahuja@chicagobooth.edu, John Birge

We develop dynamic algorithms for clinical trial design. Such algorithms allow for altering treatment during the course of trial by utilizing information learned from the past and considering all future possibilities. We demonstrate that dynamic designs yield better outcomes compared to traditional randomized clinical trials.

2 - Using Multiple First-line Therapies (MFT) to Treat Malaria

Maciej F. Boni, Hospital for Tropical Diseases, Wellcome Trust Major Overseas Programme, Oxford University Clinical Research Unit, Vietnam, mboni@oucr.uo

Despite the availability of many drugs and therapies to treat malaria, many countries' national policies recommend using a single first-line therapy for most clinical malaria cases. To assess whether this is the best strategy for the population as a whole, one can design a mathematical model focusing on the evolutionary epidemiology of malaria. In this modeling framework the benefits of different treatment strategies can be evaluated in the context of resistance evolution. Using several such frameworks, our results show that the population-wide use of multiple first-line therapies (MFT) against malaria yields a better clinical outcome than using a single therapy or a cycling strategy where therapies are rotated, either on a fixed cycling schedule or when resistance levels or treatment failure become too high. MFT strategies also delay the emergence and slow the fixation of resistant strains (phenotypes), and they allow a larger fraction of the population to be treated without trading off future treatment of cases that may be untreatable because of high resistance levels. MFT strategies are also affected by drug type (e.g. artemisinin) and drug half-life, but by and large, they are more effective than current strategies. Effects of drug stocks outs and variation in drug availability will be shown and discussed.

3 - Supply Chain and Resistance Implications of Drug Variety

Eirini Spiliotopoulou, PhD Student at MIT-Zaragoza, Zaragoza Logistics Center, Edificio Náyade 5, C/ Bari 55 - PLAZA, Zaragoza, 50197, Spain, espiliotopoulou@zlc.edu.es, Prashant Yadav

Extending a simple general disease model to include the emergence and evolution of resistance, we quantify the benefits associated with drug variety, and compare them against the cost of higher variety in the supply chain (procurement and safety stock holding costs). We apply the model for the case of malaria treatment. Our model lends insights to policy makers into the socially optimal size of the drug assortment.

TD12

12- Verdun

OR Applications in Healthcare

Sponsor: INFORMS Optimization Society

Sponsored Session

Chair: Fatih Safa Erenay, Assistant Professor, University of Waterloo, 200 University Avenue West, Waterloo, ON, 53706, Canada, ferenay@connect.uwaterloo.ca

1 - Optimizing Colorectal Cancer Screening Policies Considering Screening and Treatment Costs

Fatih Safa Erenay, Assistant Professor, University of Waterloo, 200 University Avenue West, Waterloo, ON, 53706, Canada, ferenay@connect.uwaterloo.ca, Oguzhan Alagoz, Adnan Said

Periodic colonoscopy screening significantly reduces the lifetime risk of colorectal cancer. Therefore, determining efficient and cost-effective colonoscopy screening policies is important for the clinical community. In this context, we develop a finite-horizon POMDP model to determine pre- and post-CRC colonoscopy screening policies that maximize the weighted sum of total quality adjusted life-years (TQALYs) and related costs. We use clinical data for our analysis to show that we can drive more economical and effective colonoscopy screening policies than the current guidelines.

2 - Economic Analysis of Pharmacogenetic Information for the Anti-coagulation Treatment of the Elderly

Mustafa Akan, Carnegie Mellon University, Pittsburgh, PA, 15213, United States of America, akan@cmu.edu

We investigate the benefit of genetic information while choosing Warfarin (blood thinner) dosage, which is considered as the most likely first mainstream usable example in pharmacogenetics. The study develops a genotypic dosing algorithm and involves the first Randomized Clinical Trial (on humans).

3 - Reducing Wait Times and Improving Treatment Planning Process for Radiation Therapy

Mehmet Begen, University of Western Ontario, Richard Ivey School of Business, London, ON, Canada, mbegen@ivey.uwo.ca, Inge Aivas, Vusal Babashov, Michael Lock, Greg Zaric

Recent statistics show that London Regional Cancer Program (LRCP) consults 45% and treats 85% of patients within Cancer Care Ontario's (CCO) wait time targets. We develop a simulation model to determine bottlenecks and reduce wait times at LRCP. The ultimate goal is to perform scenario and sensitivity analysis and recommend alternate policies on process changes and improvements, staffing levels, and schedules of resources that most efficiently achieve COO's target wait times.

TD13

13- Lachine

Modeling in Healthcare II

Contributed Session

Chair: Aditya Iyer, University of Pittsburgh, 3550 Terrace Street, Pittsburgh, PA, 15261, United States of America, aki9@pitt.edu

1 - Dynamic Outpatient Scheduling through Automated Multilateral Negotiation

Chun Wang, Assistant Professor, Concordia University, 1515 St. Catherine West, EV7.649, Montreal, QC, H3G 2W1, Canada, cwang@ciise.concordia.ca, Ketra Schmitt, Patrice Godin

This paper presents a distributed dynamic scheduling approach for diagnostic services in a hospital setting. In particular, we focus on how to effectively allocate the last-minute available diagnostic timeslots and how to deal with dynamic changes in existing outpatient schedules. We propose an agent-based scheduling system which allocates available diagnostic services timeslots to outpatients through an iterative multilateral negotiation procedure. We also evaluate and analyze the possibility of implementing the proposed system in large scale outpatient scheduling environments. Our experiments show that the system performs well at a scale of managing a thousand standby waiting patients.

2 - Using Simulation to Validate Operating Theatre Related Flows

Jean Beaudoin, CEO, Momentum Conseil, Montreal, Canada, jean.beaudoin@momentumconseil.com, Steve Paré

Operating theatres are key components of the modern hospital and their superior performance is often dictated by logistic flows. This presentation describes how a simulation model was built to support architects and engineers working on the design of a new 35 operating room facility. The model looked at both case carts and patient flows.

3 - Simulation Based Estimates of the Effect of Presumed Consent on Liver Transplant Outcomes

Aditya Iyer, University of Pittsburgh, 3550 Terrace Street, Pittsburgh, PA, 15261, United States of America, aki9@pitt.edu

It has been debated whether the United States should adopt an opt-out (presumed consent) organ donation policy, or keep an opt-in (informed consent) policy. We seek to understand the effects of implementing an opt-out policy by using a biologically based discrete-event simulation of liver disease and the liver donation and allocation processes. Patient and organ arrivals were modeled as non-homogenous Poisson processes and the time spent waiting for a liver, the number of annual transplants and deaths, and patient/graft survival were evaluated for both donation policies.

Wednesday, 8:30am - 10:00am**■ WA01**

01- Fontaine Ballroom C

Healthcare Delivery Systems I

Contributed Session

Chair: Jennifer Percival, Assistant Professor, University of Ontario Institute of Technology, 2000 Simcoe Street N, Faculty of Business and IT, Oshawa, ON, L1H7K4, Canada, jennifer.percival@uoit.ca

1 - Optimal Designs Approach to Resource Allocation for Effective Health Care Delivery in Niger Delta

Idorenyin Etukudo, University of Calabar, Dept of Maths/Stats & Computer Science, P. M. B. 1115, Calabar, 54, Nigeria, nseobongidorenyin@gmail.com, Hannah Etta

One particularly known problem that confronts operators of health care delivery system in the Niger Delta region of Nigeria is that of allocating scarce resources optimally in order to meet the objectives of the funding agencies. In order to aid such operators, a model for this purpose is hereby developed. Numerical illustration presented herein through optimal designs approach gives optimal allocation of available resources for effective health care delivery.

2 - Improving Healthcare Delivery for Posttraumatic Stress Disorder: An Interrelated Approach

Scott Alexander McKenzie, Research Associate, Naval Postgraduate School, 1411 Cunningham Road, Monterey, CA, 93943, United States of America, samckenz@nps.edu

PTSD is prevalent among military veterans. Due to budget restrictions, the VA must continuously innovate to provide mental healthcare to military veterans who suffer from PTSD. We seek to find improved avenues of treatment for PTSD patients that maximize the potential for patient recovery within the constraints of current resources (facilities and mental healthcare providers). Using the Palo Alto VA Health Care System as a test case, we investigate the practical issues surrounding the delivery of PTSD healthcare, examine encounter data, and prescribe solutions to improve PTSD treatment.

3 - Extending the Patient Journey Modeling Architecture (PaJMa) Framework to Integrate E-health Systems

Jennifer Percival, Assistant Professor, University of Ontario Institute of Technology, 2000 Simcoe Street N, Faculty of Business and IT, Oshawa, ON, L1H7K4, Canada, jennifer.percival@uoit.ca, Carolyn McGregor

There is currently a significant trend towards the implementation of health information technologies (HIT) such as electronic health records (EHR) in order to reduce administrative costs and improve patient care. However, there is currently very little understanding of how to integrate information systems into existing clinical practice and how using EHR systems can be implemented to benefit the patient, staff and delivery of care process. This paper presents current research on the development of an extended patient journey modeling architecture to support the identification of workflow changes due to the integration of HIT into clinical practice. An updated version of the Patient Journey Modeling Architecture (PaJMa) including a technology and infrastructure layer is used to assist in visually depicting how EHR can benefit patient care through improved information flows among the entire healthcare team through the integration of technology and clinical practice.

■ WA02

02- Fontaine Ballroom D

Novel Models of Healthcare Delivery

Sponsor: POMS, College of Healthcare Operations Management
Sponsored Session

Chair: Sarang Deo, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, s-deo@kellogg.northwestern.edu

1 - The Changing Financial Landscape of Procedural Medicine

Warren Sandberg, Professor & Chair, Department of Anesthesiology, Vanderbilt University School of Medicine, 1211 21st Avenue South, MAB 722, Nashville, TN, 37212, United States of America, warren.sandberg@Vanderbilt.Edu

The financial landscape of medical care in the U.S. is changing rapidly. The advent of value-based care and bundled payments for episodes of care will change the fundamental targets for optimization in procedural medicine. Heretofore, the focus has been on throughput, at times sacrificing incremental margin to develop systems that serve as many patients as possible per unit of time. Going forward, with what is essentially a capitated payment for an entire episode of care, the focus will be on efficiency and value, with healthcare organizations themselves bearing the cost of inefficiency.

2 - The Landscape of Healthcare

Linda Laganga, Mental Health Center of Denver, 4141 East Dickenson Place, Denver, CO, 80222, United States of America, Linda.Laganga@MHCD.org, CJ McKinney

Healthcare is delivered in a landscape where resources are allocated along a service continuum that includes the dimensions of delivery setting (inpatient and outpatient) and focus (physical and behavioral health). Effective outpatient care can reduce overall healthcare expenses and improve quality for patients. Emerging models of integrated care consider the interaction between behavioral and physical health and the achievement of high quality outcomes in the context of accountable care.

3 - Improving Access to Community-based Chronic Care through Improved Capacity Allocation

Karen Smilowitz, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, ksmilowitz@northwestern.edu, Seyed Iravani, Sarang Deo

Most health care operation models focus either on efficiency improvements in the delivery system or improvements in clinical decisions. We consider a novel setting of community-based delivery of chronic asthma care, where it is necessary to integrate these two approaches. We develop and analyze a joint disease progression and capacity allocation model to investigate how operational decisions can improve population level health outcomes. We test our findings using data provided by Mobile C.A.R.E, a community-based provider of asthma care to public school students in Chicago.

■ WA03

03- Fontaine Ballroom E

Joint Session HAS/OR in Public Health: OR and Public Health Policy

Sponsor: INFORMS Health Applications Section/Operations Research for Public Health

Sponsored Session

Chair: Ruben Proano, Assistant Professor, Rochester Institute of Technology, 81 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, rproano@rit.edu

1 - Hospital Stockpile for Influenza Pandemics Considering Public Health Interventions

Po-Ching DeLaurentis, Indiana University/ Regenstrief Institute, Inc., 410 W. 10th St., Suite 2000, Indianapolis, IN, 46202, United States of America, pcdelaure@iupui.edu, Roland Gamache

This talk addresses inventory stockpiling of medical supplies for a group of hospitals in preparing for an influenza pandemic. We consider various scenarios in which different public health interventions are implemented, and examine the impact of these interventions on patient demand using a flu spread simulation model. These different flu scenarios are then used as input to a game model to calculate hospital stockpile levels. Discussion and insights for public health will also be provided.

2 - Vaccine Market: Operational Issues and Externality Effect

Hamed Mamani, University of Washington, ISOM, Foster School of Business, Seattle, WA, 98195, United States of America, hnamani@uw.edu, Elodie Adida Goodman, Debabrata Dey

Prevention of infectious diseases is an important concern for managing public health. Although vaccines are the most effective means for preventing infectious diseases, negative consumption externality often makes it difficult for vaccine coverage to reach a level that is socially optimal. In this research, we consider how a subsidy program can induce a socially optimal vaccine coverage, both for a perfect and an imperfect vaccine, when vaccine producers form a competitive oligopoly market.

3 - Modeling the Care Journey for Traumatic Spinal Cord Injuries

Derek Atkins, Professor, Sauder School of Business, University of BC, Vancouver, BC, Canada, derek.atkins@sauder.ubc.ca, Marcel Dvorak, Argelio Santos, Rachel Lewis, Vanessa Noonan, James Gurling, Andrew Barnes

The Rick Hansen Institute for Spinal Cord Care is partnering with the Centre for Operations Excellence at the Sauder School, UBC to develop a model of the end-to-end journey of care for traumatic spinal cord injuries: first response, acute, rehabilitation and home/community. The ultimate aim is a flexible platform on which both administrative and clinical interventions can be simulated and evaluated in terms of both immediate impacts and long term patient outcomes.

■ WA04

04- Fontaine Ballroom F

Radiation Therapy Optimization

Sponsor: Canadian Operational Research Society

Sponsored Session

Chair: Timothy C. Y. Chan, University of Toronto, 5 King's College Road, Toronto, ON, Canada, tcychan@mie.utoronto.ca

1 - Shaping the Dose

Yuriy Zinchenko, University of Calgary, 2500 University Drive NW, MS446, Calgary, AB, Canada, yzinchen@ucalgary.ca

External radiation is a primal modality in treating various cancers. The clinical outcome of the treatment directly relates to the radiation dose delivered to the patient. Therefore, accurate formulation of the dose distribution requirement within the context of radiation therapy treatment planning is important. We present a fully linear approach to shaping the dose distribution in fluence map optimization. Unlike a conventional MIP approach, this allows us to solve the resulting optimization problem on a single computing station. We extend our approach to beam-angle selection.

2 - Fast Isocenter Selection for Gamma Knife Perfexion using Grassfire and Sphere-packing

Kimia Ghobadi, University of Toronto, Department of Mech. & Ind. Engineering, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, kimia.ghobadi@utoronto.ca, Hamid Ghaffari, Dionne Aleman, Mark Ruschin, David Jaffray

We present a fast geometrical algorithm to select isocenter locations for both radiotherapy and radiosurgery treatment plans using Gamma Knife Perfexion (Elekta, Stockholm, Sweden). The isocenter selection is based on a hybrid grassfire and sphere-packing algorithm. As many as 450 isocenters can be selected in under 10 seconds. The radiation shot shapes for the isocenters are optimized using our sector duration optimization algorithm. Resulting treatment plans show good conformity and organ sparing.

3 - Approximate Inverse Optimization for Intensity-modulated Radiation Therapy Treatment Planning

Taewoo Lee, University of Toronto, Rosebrugh Building, 164 College Street, Rm#206, Toronto, ON, M5S 3G9, Canada, taewoo.lee@utoronto.ca, Timothy C. Y. Chan, Michael B. Sharpe, Tim Craig

In a multi-objective optimization problem for radiation therapy treatment planning, the determination of weights for different organ-specific objective functions is based on subjective beliefs and manual iterative loops. We present a novel inverse optimization model that objectively and efficiently determines the weights using historical treatment data from prostate cancer patients. Furthermore, we show that different geometric characteristics of anatomies affect the determination of the weights.

■ WA05

05- Fontaine Ballroom G

Case Studies: Impact of Technology

Contributed Session

Chair: James Rodger, Professor, Indiana University of Pennsylvania, 488 Bloom Road, Hooversville, PA, 15936, United States of America, jrodger@iup.edu

1 - Data Mining Medication Error Data and Information Quality's Impact on Patient Safety Decision Making

Michael Gray, Postdoctoral Research Fellow, Hewlett Packard Labs, 1501 Page Mill Road, Palo Alto, CA, 94304, United States of America, graymid@gmail.com

Using a hospital's medication use process as a case study, this research project tested the boundary of effective system decision making in situations where input data is inaccurate or sporadic. This research considered medication error data spanning a 30 month period from a 340-bed regional hospital. Data mining clustering algorithms were used to analyze the medication error dataset. The results of this project have led to the development of a series of data quality thresholds that are the foundation for simulating other medication use process information quality experiments.

2 - An Inspirational Memory Technology Intention Integrative Framework of the Fifth Kind

James Rodger, Professor, Indiana University of Pennsylvania, 488 Bloom Road, Hooversville, PA, 15936, United States of America, jrodger@iup.edu, Stephen Gonzalez

A data set ($n = 338$) of health care workers were collected to test the proposed model that inspiration, memory and inspirational memory affects end user intention to adopt a digitized patient record software application. The results of the structural equation modeling (SEM) data analysis show that, as expected,

inspiration from managers and trainers impacts the individual behavior of the end users. Inspiration, through memory shows an interactive impact on the collective acceptance of the technology, thereby effecting subsequent evaluations and behavior. The model was also nomologically validated through the use of a portable platform for electronic collection of operational-level healthcare software with embedded metrics that measured memory of the individuals through survey completion times, errors and completeness. This paper contributes to the literature by introducing inspiration as a key driver to improve memory that impacts on end user intention to use the digitized patient record technology.

■ WA06

06- Fontaine Ballroom H

Hospital Occupancy Planning

Sponsor: INFORMS Health Applications Section

Sponsored Session

Chair: Michael Carter, University of Toronto, Mechanical & Industrial Engineering, 5 King's College Rd, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca

1 - Discharge Process Reliability

Tammy Sieminowski, Attending Physician, Neurorehabilitation, Bridgepoint Hospital, 14 St Matthew's Rd, Toronto, ON, M4M2B5, Canada, tsiemin@rogers.com, Michael Carter

The discharge process for patients undergoing inpatient neurorehabilitation is complex and quantitatively poorly understood. It involves forecasting functional gains without quantitative tools; fluctuations in medical condition; consideration of discharge location, caregiver support, finances, etc. The multidisciplinary team establishes, and then works towards meeting a discharge date. Uncertainty in this process affects length of stay, the admission process, unit occupancy, etc. We will present a mathematical model examining the reliability of this process.

2 - A Generic Bed Planning Model

Tian Mu Liu, University of Toronto, Mechanical and Industrial Engineering, Toronto, ON, Canada, tianmu.liu@utoronto.ca, Michael Carter

Hospitals want to allocate their resources to maximize the efficient use of acute care beds. We introduce a generic bed planning model that allows any hospital to estimate the number of beds that are required during a typical busy week in order to provide a given level of service.

3 - Discharge Planning to Mitigate Bed Block and ER Overcrowding

Jonathan E. Helm, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48105, United States of America, jhelm@umich.edu, Mark Van Oyen, Rene Bekker

Bed block in hospitals leads to long waits in Emergency Department, patients being placed in the hallways on stretchers, poor quality of care, high costs and mortalities. The timing of discharges from inpatient beds significantly impacts bed block. This research models the census and discharge process to reduce bed block.

■ WA07

07- Mont Royal

Day-of-Surgery Operations

Sponsor: POMS, College of Healthcare Operations Management

Sponsored Session

Chair: Vikram Tiwari, Assistant Professor, University of Houston, Information & Logistics Tech., 312 Tech II Bldg., Houston, TX, 77204-4023, United States of America, vtiwari@uh.edu

1 - Improvement in Day-of-surgery Operations After Implementation of a Real-time Patient Tracking System

Vikram Tiwari, Assistant Professor, University of Houston, Information & Logistics Tech., 312 Tech II Bldg., Houston, TX, 77204-4023, United States of America, vtiwari@uh.edu, David Berger

Ensuring that day-of-surgery operations function seamlessly is critical for efficiency of the OR and patient satisfaction. Non-visibility of patients' current status and location, as they move through the OR, leads to uncertainty about the current status of various ORs. This limits the staff from achieving their optimal productivity. This research describes the extent and sources of improvement that are occurring at an OR after implementation of a real-time patient tracking system. Both, expected (lower OR turnaround time) and unexpected (staff's increased focus on efficiency) were noted.

2 - Surgeons' and Anesthesiologists' Perceptions of Turnover Time Reflect Team Activity Not Actual Times

Franklin Dexter, Professor, University of Iowa, Anesthesia 6JCP, 200 Hawkins Drive, Iowa City, IA, 52242, United States of America, franklin-dexter@uiowa.edu, Danielle Masursky

78 surgeons and anesthesiologists at a US hospital were surveyed in 2010 and estimated characteristics of his/her turnover times in 2009. Quantitative and qualitative analyses show that comments made about turnover times are not literally referring to the time, but instead factors perceived as contributing to the time (e.g., attitude about facility and activity of its personnel). Results explain why satisfaction with turnover times has been unrelated to changing times. Results show too that managers should not rely on surgeons or anesthesiologists for their expert judgment on turnover times.

3 - Nurse Scheduling Problem in Operating Suites

Gino Lim, University of Houston, Houston, TX, United States of America, ginolim@uh.edu, Arezou Mobasher

We introduce two MIP models for the nurse scheduling optimization problem in the operating suites. The models are designed to assign nurses to different surgery cases considering several contiguous attributes including such as surgery complexity and shift limitations. A Nurse Assignment Model (NAM) has been developed to assign all surgery cases the required number of nurses with necessary specialties and procedure complexities in a daily schedule. Based on the results of NAM, the second model is used for lunch schedule. We show the effectiveness of our model using a real OR case.

■ WA08

08- Hampstead

Capacity Management and Productivity

Contributed Session

Chair: Jiang Zhang, Associate Professor, Adelphi University, 1 South Avenue, Garden City, NY, 11530, United States of America, zhang@adelphi.edu

1 - Emergency Department Patient Flow Simulations using Spreadsheets

Michael Klein, PhD Student, McGill University, Desautels Faculty of Management, 1001 Sherbrooke Street West, Montreal, QC, H3A 1G5, Canada, michael.klein2@mail.mcgill.ca, Gilles Reinhardt

We propose a discrete-event simulation platform that runs in spreadsheets. The popularity of spreadsheet programs makes such simulation more accessible to stakeholders who may rely on it to test the value of potential interventions, to develop utilization and performance expectations, or as a medium to long range budgeting and planning tool.

2 - Multi-period Ward Layout Planning for Different-sized Patient Rooms in Hospitals

Ines Arnolds, Research Assistant, Karlsruhe Institute of Technology, Kaiserstr. 12, Building 11.40, Karlsruhe, 76131, Germany, ines.arnolds@kit.edu, Stefan Nickel

Due to changing requirements a static ward layout may not reflect the current demand for different-sized bedrooms in a hospital. Hence, we present a multi-period binary linear programming formulation to model wall movements and installations in each period according to the respective demand. The aim is to minimize the overall costs to install and move walls. Furthermore, it has to be assured that the costs for adapting a layout do not exceed the benefits of such change.

3 - A Network-based Approach for Hospital Capacity Management in a Pandemic

Jiang Zhang, Associate Professor, Adelphi University, 1 South Avenue, Garden City, NY, 11530, United States of America, zhang@adelphi.edu, Lihui Bai

The outbreaks of H1N1 influenza have shown that the demand for intensive care unit resources and ventilators can overtake the hospital's capacities. During a pandemic, the drastic surge in patient volume will cause hospitals to operate beyond their capacities in many other resources. This talk proposes an incentive-based approach to help direct patients to alternative hospitals so that capacity shortages across all hospitals are balanced.

■ WA09

09- Cote St. Luc

Aspects of Congestion in Health Care Systems II

Sponsor: Canadian Operational Research Society

Sponsored Session

Chair: David Stanford, University of Western Ontario, London, ON, Canada, stanford@stats.uwo.ca

1 - Evaluating the Impact of Emergency Observation and Assessment Wards on Hospital Performance

Maartje Zonderland, PhD Student, Stochastic Operations Research, University of Twente, Postbox 217, Enschede, 7500AE, Netherlands, M.E.Zonderland@lumc.nl, Michael Carter, David Stanford, Richard J. Boucherie

Over the last two decades, the emergency room (ER) has become more crowded, resulting in among others an increased length of stay and prolonged waiting times for patients. In this research we focus on the impact of operating emergency observation and assessment wards on hospital performance. We develop a mathematical model that quantifies the effects on patient flow and required bed capacity at the emergency room, emergency ward and nursing wards. Our main focus is to improve ER throughput.

2 - Improving the Performance of a Surgical Department

Pinar Keskinocak, Georgia Institute of Technology, 765 Ferst Dr. NW, Atlanta, GA, United States of America, pinar@isye.gatech.edu, Monica Villarreal, Pengyi Shi

We conduct an empirical analysis for the surgical department of a tertiary hospital in Georgia. After assessing the current operations (e.g., case scheduling, pre-operative process), we identify several major reasons causing tardiness of case starting time: underestimating case duration, long turnover time, and patients arriving late. We propose several ways to improve the performance of the surgical department, and test our recommendations via a simulation model.

3 - Modeling and Optimizing Emergency Department (ED) Workflow and Patient Throughput

Niquelle Brown, Georgia Institute of Technology, Atlanta, GA, United States of America, niquelle.brown@gatech.edu, Eva Lee

This is a joint work with Grady Memorial Hospital. The studies are motivated by overcrowding of the ED; excessive presence of patients with non-urgent medical conditions (~40% across the nation); long wait times; decreased quality of care and patient satisfaction; unnecessarily long length-of-stay (LOS), and return/readmission of patients. We describe system models and process optimization to improve performance efficiency, timeliness and quality of patient care, and reduction of healthcare costs.

■ WA10

10- Westmount

Ambulance Fleet Management

Sponsor: Canadian Operational Research Society

Sponsored Session

Chair: Michel Gendreau, École Polytechnique de Montréal, C.P. 6079, succ. Centre-ville, Montreal, QC, H3C 3A7, Canada

1 - A Flexible Approach To Paramedics and Healthcare Staff Scheduling

Julien Crowe, PhD Student, HEC Montreal and CIRRELT, 3000 Chemin de la Côte-Sainte-Catherine, Montreal, H3T 2A7, Canada, julien.crowe@hec.ca, Patrick Soriano

Staff scheduling in Canadian hospitals and emergency medical services is a decentralized management task where a large number of very different schedules is generally needed to run daily operations. To deal with this situation, we propose a flexible heuristic algorithm inspired from mathematical decomposition techniques. Our approach can solve a large variety of healthcare staff scheduling problems, including the typically more complex paramedic staff scheduling problems.

2 - An Approach for Dynamic Redeployment of Emergency Medical Vehicles

Valérie Bélanger, PhD Student, HEC Montréal and CIRRELT, Université de Montréal, Pavillon André-Aisenstadt, Bureau: 3504, Montréal, Canada, valerie.belanger@cirrelt.ca, Patrick Soriano, Angel Ruiz, Roberto Woffler Calvo

This study focuses on modeling and solving the dynamic redeployment problem for emergency medical vehicles. The dynamic redeployment problem consists in relocating vehicles when the state of the system changes sufficiently and requires such a re-optimization in order to ensure a good service to the population. Two models are formulated to tackle this problem. Both models are solved by a column-generation-based heuristic. A set of experiments will be performed using data representative of real application context. The models will be analyzed and compared based on preliminary results.

3 - Managing a Fleet of Ambulances to Respond to Emergency or Standard Patient Transportation Requests

Yannick Kergosien, Postdoctoral Fellow, Cirrelt, Université de Montréal, C.P. 6128, Succ. Centre-ville, Montreal, QC, H3C 3J7, Canada, yannick.kergosien@gmail.com, Patrick Soriano, Angel Ruiz, Michel Gendreau

The pre-hospital emergency medical service in Montreal has to provide medical assistance and the transportation of patients to a hospital. They also have a second mission to respond to transportation demands between hospitals. The demands can be performed by the same ambulances and they currently manage these two types of demands independently by managing two ambulance fleets separately (for simplicity reason). This paper aims at designing and evaluating integrated management strategies to make better use of ambulance and improve the services quality.

■ WA11

11- Outremont

Healthcare Supply Chain Operations

Sponsor: INFORMS Computing Society

Sponsored Session

Chair: Chase Rainwater, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, cer@uark.edu

1 - A Levels, Requirement, and Impact Evaluation Model for GS1 Data Standards Adoption in Healthcare

Vijith Varghese, University of Arkansas, 4207 Bell Engineering Building, Fayetteville, AR, 72701, United States of America, varghese.vijith@gmail.com, Paiman Farrokhvar, Nebil Buyurgan, Raja Jayaraman, Ashraf Hajiyev, Ronald Rardin, Angelica Burbano, Nabil Lehlou, Eghbal Rashidi

Despite unanimous consensus across healthcare supply chain that data standards enhances system interoperability, supply chain visibility and thus improving supply chain operations and patient safety, widespread adoption has been impeded by lack of means to justify the related investment. Full-scale implementation is overwhelming and hence a sequential approach of adoption by different levels of implementation is proposed. We present a model quantifying the impact of different level of GS1 adoption on healthcare supply chain operations as exception, productivity etc.

2 - Implementing GS1 Data Standards in Healthcare Provider Supply Chain

Raja Jayaraman, Post Doctoral Fellow, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, rjayaram@uark.edu, Ronald Rardin, Nebil Buyurgan, Vijith Varghese, Angelica Burbano, Nabil Lehlou, Paiman Farrokhvar, Eghbal Rashidi

Healthcare supply chain data standards adoption can translate into systemwide improvements to materials management practices, productivity gains and several cost saving opportunities in hospitals. This presentation discusses the identified challenges and opportunities faced by healthcare providers in implementing data standards and results from our pilot implementation at two provider sites.

3 - Measuring the Quality Perception of Chilean Healthcare Centers: A Provider's Perspective

Martha Ramirez-Valdivia, Assistant Professor, Universidad de La Frontera, Dpto. Ing. de Sistemas, Avenida Francisco Salazar 01145, Temuco, Chile, marthar@ufro.cl, Irma Vargas-Palavicino, Jennifer Mendoza-Alonzo, Ana Moraga-Pumarino, Jorge Salgado-Contreras

Primary healthcare plays an important role in the development of emerging countries like Chile. We develop and measure the quality of the service provided by each family healthcare center nationwide through a standard. Therefore, we are capable of identifying opportunities to increase the satisfaction of the population under their care.

■ WA12

12- Verdun

Modeling and Optimization: Case Studies

Contributed Session

Chair: Sharon Johnson, Worcester Polytechnic Institute, School of Business, 100 Institute Road, Worcester, MA, 01609, United States of America, sharon@wpi.edu

1 - Emergency Room Scheduling Featuring Optimization of Intra-hospital Routing

Verena Schmid, Assistant Professor, University of Vienna, Bruenner Strasse 72, Vienna, 1210, Austria, verena.schmid@univie.ac.at, Karl F. Doerner

Hospitalized patients typically have to undergo several examinations before their actual surgery. Transportation between service units is provided by trained personnel who escort patients by foot. We present an integrated combinatorial optimization model combining both scheduling and routing related aspects, which will be solved using an iterative hybrid metaheuristic. Traditionally both underlying subproblems are solved independently. The synchronized approach however yields substantial advantage over the decoupled optimization process.

2 - Development of a Model to Estimate the Burden of Maternal Alcohol Use on Preterm Birth in the US

Odette Reifsnider, Doctoral Candidate, Clemson University, 110 Freeman Hall, Clemson, SC, 29631, United States of America, osaleeb@clemson.edu, Maria Mayorga, Khoa Truong

We estimate the aggregate burden of maternal drinking on preterm birth across sociodemographic groups in the US in 2008. A simulation model is developed to count the total preterm births due to maternal binge drinking under different scenarios using data from the National Center for Health Statistics, US Census, National Vital Statistics Report, BRFSS, and literature. Maternal binge drinking contributed significantly to preterm birth and differentially across sociodemographic groups.

3 - Using Simulation to Explore the Value of Flexible Capacity for Compensation and Pension Examinations

Sharon Johnson, Worcester Polytechnic Institute, School of Business, 100 Institute Road, Worcester, MA, 01609, United States of America, sharon@wpi.edu, Tom Rust, Deanna Haidar, Rohit Gorhe, Isa Bar-On, Bengisu Tulu

Providing timely and accurate compensation and pension examinations is a critical service provided by the Veterans Health Administration (VHA). We developed a simulation model to support agile and proactive facility-level planning in the face of a 70% increase in exam requests, which can be used to explore the effects of resource and process changes. In this talk, we describe the model and its use for planning, as well as explore the value of using more dedicated and flexible providers.

■ WA13

13- Lachine

Optimization Applications I

Contributed Session

Chair: Sommer Gentry, Associate Professor, United States Naval Academy, 572-C Holloway Road, Mailstop 9E, Annapolis, MD, 21402, United States of America, gentry@usna.edu

1 - A Model for Covering In-hospital Cardiac Arrest

Besma Glaa, Post-Doctoral Fellow, INSEAD, 4th Street (Muroor Rd), Abu Dhabi, 48049, United Arab Emirates, besma.glaa@insead.edu, Stephen Chick

Rates of survival and complete physiological recovery following In-Hospital Cardiac Arrest (IHCA) are poor in all age groups. For example, fewer than 20% of adult patients having an in-hospital cardiac arrest will survive to go home. Our analysis uses a weighted covering model to determine the appropriate number of nurses in different units of a hospital and who are trained in CPR and hospital Survival Chain processes to maximize risk weighted coverage for a timely response to IHCA.

2 - Applying Covering Models to Ambulance System of Megalopolitan Area in Japan

Takehiro Furuta, Tokyo University of Science, 1-3 Kagurazaka Shinjuku, Tokyo, Japan, takef@fw.ipsj.or.jp, Hozumi Morohosi

We discuss ambulance deployment problems for a megalopolitan area of Japan. We apply traditional location covering models to the ambulance system of the area as case study of ambulance deployment problems from the practical point of view of practitioners. Our computational results show not only the difference between the optimal solutions and the actual locations but also realize in what point the obtained solutions are better than the actual locations.

3 - Designing Geographic Allocation Regions for Equitable Access to Liver Transplant

Sommer Gentry, Associate Professor, United States Naval Academy, 572-C Holloway Road, Mailstop 9E, Annapolis, MD, 21402, United States of America, gentry@usna.edu, Krista Lentine, Nino Dzebisashvili, Mark Schnitzler, Dorry Segev, David Axelrod

Donated livers should be allocated to the sickest nearby person, but geographic boundaries cause unfair distribution of livers. We design new regional boundaries using a simplified integer programming model of liver allocation. Then we test candidate designs with a clinically detailed agent-based Liver Simulated Allocation Model, to capture unmodeled aspects of the allocation process.

Wednesday, 10:30am - 12:00pm

■ WB01

01- Fontaine Ballroom C

Evaluating Performance in Healthcare Delivery

Contributed Session

Chair: Kelly Slaughter, Senior Manager, Concentra, 5080 Spectrum Drive, Addison, TX, 75001, United States of America, kelly.slaughter@gmail.com

1 - A Continuity Score to Improve Pediatric ICU MD Schedule Design for Enhanced Handoff Efficiency

Hannah Smalley, Georgia Institute of Technology, 765 Ferst Dr. NW, Atlanta, GA, United States of America, hkolberg3@gatech.edu, Pinar Keskinocak, Atul Vats

We propose a Handoff Continuity Score (HCS) as a novel approach for objectively assessing continuity and familiarity among oncoming physicians at handoff. We used the HCS to analyze a pediatric intensive care unit MD schedule before and after a schedule redesign implemented to improve continuity. Increased HCS was associated with an MD qualitative assessment of enhanced continuity and handoff efficiency resulting from the schedule redesign. We developed an integer program which identified the potential for additional scheduling improvements.

2 - Performance Department Creation in Healthcare Organizations

Ludovick Valéra, Doctoral Student, Université du Québec - Trois-Rivières, Dept. Génie Industriel, 3351 boul. Des Forges, Trois-Rivières, Qc, G9A5H7, Canada, valera@uqtr.ca, Denis Lagacé

The public healthcare system in the province of Quebec is struggling to provide satisfactory services to residents. This paper focuses on the design of a performance department tailored to healthcare organizations. Action-research is a flexible methodology suitable to address these performance improvement issues. This research will help to determine the essential elements of a performance department and it will contribute to the knowledge of performance management for healthcare organizations.

3 - Pushing Frontiers: Combining Data Envelopment Analysis and Simulation to Model Patient Cycle Time

Kelly Slaughter, Senior Manager, Concentra, 5080 Spectrum Drive, Addison, TX, 75001, United States of America, kelly.slaughter@gmail.com

Through data envelopment analysis (DEA) of a one year, three hundred outpatient center cycle time data set we identified an empirically established efficient frontier. We next used nominal group techniques with subject matter experts to model process improvements through simulations. The simulation data was in turn used with DEA to generate simulated efficient frontiers and an overall combined frontier, allowing for the identification of creative yet practical process improvements.

■ WB02

02- Fontaine Ballroom D

Incentives in Healthcare

Contributed Session

Chair: Brandon Pope, Texas A&M University, 1204 Baywood Ct., College Station, TX, United States of America, brandon_pope@tamu.edu

1 - Tradeoffs in Procurement Decisions: An Application to the Healthcare Industry

Cigdem Gurgur, Professor, Purdue University, Doermer School of Business, 2101 East Coliseum Blvd., Fort Wayne, IN, 46825, United States of America, gurgurc@ipfw.edu

In this study we consider supplier selection and quantity allocation decisions for a single firm facing supply unreliability and demand uncertainty. We use a traditional newsvendor framework to determine the optimal number of suppliers to place an order with and the corresponding quantities of those orders. One caveat of our approach is that we simplify the choice between single-sourcing and multiple-sourcing as the tradeoff between partnership and risk: The benefit of having a large supplier pool is expressed in the form of reduced risk against supply disruptions. Using a single source, on the other hand, provides cost savings due to higher trust between the buyer and the supplier and better partnership. We also explicitly address the strategic behavior of suppliers in pricing decisions. We use data from Parkview Healthcare System, a large healthcare provider in Indiana to test the implications of our study.

2 - Using Physician Incentives to Improve Hospital Performance

Herbert Lewis, Stony Brook University, Department of Technology and Society, Stony Brook, NY, 11790-3607, United States of America, herbert.lewis@stonybrook.edu, Melissa Dolan, Thomas Sexton, Todd R. Griffin

We present a methodology for a physician incentive program and its application to a large academic medical center. The methodology categorizes performance measures into three categories called Gold, Silver, and Bronze. The total incentive is allocated among the three categories according to relative importance. DEA models for each category compute factor efficiencies that determine each physician's incentive. The physician's incentive is the sum of the incentives across all three categories.

3 - Dynamic Knowledge-based Incentives in Healthcare

Brandon Pope, Texas A&M University, 1204 Baywood Ct., College Station, TX, United States of America, brandon_pope@tamu.edu, Andrew Johnson, Abhijit Deshmukh, James Rohack

U.S. healthcare costs have experienced unsustainable growth, with expenditures of \$2.5 trillion in 2009. One proposed solution gaining attention for controlling costs is the use of incentives to guide autonomous decisions. While the primary means of giving incentives has been contracts with patients and providers and the contingent payments they generate, incentives can be generally thought of as any mechanism that affects decision making. This broader view of incentives motivates interest in other means of modifying behavior besides payments. The incentives we consider in this paper are created by providing knowledge to healthcare consumers. By using a learning model of consumer behavior, we model a policy maker's knowledge provision problem as a Markov decision process. We utilize this framework to solve for optimal knowledge provision policies regarding behaviors pertinent to coronary heart disease.

■ WB03

03- Fontaine Ballroom E

OR in Global Health

Cluster: Operations Research for Public Health

Invited Session

Chair: Eva Lee, Professor & Director, Georgia Institute of Technology, Ctr for OR in Medicine & HealthCare, Industrial and Systems Engineering, Atlanta, GA, 30332, United States of America, evakylee@isye.gatech.edu

1 - The Cost-effectiveness of an HIV Vaccine with Exponentially Declining Efficacy

Elisa Long, Assistant Professor, Yale University, 135 Prospect Street, New Haven, CT, 06520, United States of America, elisa.long@yale.edu

With 56,000 new HIV infections occurring annually in the US, additional prevention efforts are needed. Results from a 2009 clinical trial in Thailand showed an HIV vaccine with rapidly waning efficacy. We estimated a parametric function for vaccine efficacy and applied this to a dynamic HIV transmission model to estimate potential HIV infections prevented and the cost-effectiveness of a mass vaccination program in the US.

2 - Analyzing the Effect of Vaccine Prioritization

Fan Yuan, PhD Student, Georgia Institute of Technology, Center for Operations Research in Medici, Atlanta, GA, United States of America, fanyuan@gatech.edu, Eva Lee

This work is joint with CDC Strategic National Stockpile. When limited vaccines are available, prioritized vaccination is considered the best strategy to mitigate the impact of a pandemic. Currently, a mixed strategy is used that starts with prioritization and switches to non-prioritization. A critical issue is to determine when the switch should occur. We will describe an agent-based simulation system and an ODE-queueing model to determine the optimal switch time that will result in minimum overall infectivity and mortality.

3 - Data Aggregation for Modeling Risk in Food Safety

Artur W Dubrawski, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, awd@cs.cmu.edu, Lujie Chen

Food safety analysts are always on the outlook for more accurate and more prognostic approaches for estimating risks of events which could impact public health, agriculture, and food industry. However, implementing data-driven risk estimation is not very easy in this domain. Complexity and plurality of involved factors is exacerbated with sparseness of the available data. We review a few successful attempts to remedy the issues by using data mining methodology to purposively aggregate evidence.

WB04

04- Fontaine Ballroom F

Therapy and Treatment

Contributed Session

Chair: Kuntal Bhattacharyya, PhD Fellow, Kent State University, A409, College of Business, P.O. Box 5190, Kent, OH, 44242, United States of America, kbhatta1@kent.edu

1 - Systems Biology Based Important Protein Identification for T2DM

Manini Madireddy, Pennsylvania State University, 311 Leonhard, State College, PA, 16802, United States of America, manini@psu.edu, Soundar Kumara

Currently, there are 180 million diabetics in the world and would reach 380 million by 2025. More than 85% of these diabetics suffer from type 2 diabetes mellitus (T2DM). A few of the morbidly obese T2DM patients who underwent bariatric surgery were resolved. We in our current work want to rank order the human proteins according to their relevance to T2DM remission as a consequence of bariatric surgery. We have used tools from network science and systems biology to tackle this problem. The obtained results were very motivating.

2 - A Dynamic Programming Approach to Adaptive Radiation Therapy

Jagdish Ramakrishnan, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-D666, Cambridge, MA, 02139, United States of America, jagdish@mit.edu, David Craft, Thomas Bortfeld, John Tsitsiklis

Conventional radiation therapy procedures deliver an equal dose to the tumor every day over the course of 30-40 days. In this work, we consider delivering a different dose each day depending on the observed patient anatomy. We formulate the problem using a dynamic programming framework and discuss the theoretical structure of an optimal policy. Such an approach and other heuristic approaches result in a lower cumulative dose to an organ-at-risk over the course of treatment.

3 - Drug-vitamin Interaction and Healthcare Economics:**The Strange Case of Statins and Vitamin D**

Kuntal Bhattacharyya, PhD Fellow, Kent State University, A409, College of Business, P.O. Box 5190, Kent, OH, 44242, United States of America, kbhatta1@kent.edu, Arup Maitra, Shikha Bhattacharyya

This ongoing research investigates the extent to which vitamin D may lower statin-induced myalgia symptoms and/or enhance the effect of statins in lowering cholesterol levels towards reducing heart diseases. The impact on healthcare economy due to reduction of myalgia symptoms and statin dosage from vitamin D interaction is also addressed.

WB05

05- Fontaine Ballroom G

Data Mining at the Bedside II

Sponsor: INFORMS Data Mining Section

Sponsored Session

Chair: Gilles Clermont, MD, CM, MSc, University of Pittsburgh, Scaife 602A, 3550 Terrace, Pittsburgh, PA, 15261, United States of America, cler@pitt.edu

1 - Biomarkers and Diagnostic Tools: Computational Advances in Omics Data Mining

Michael A. Langston, Professor, University of Tennessee, 203 Claxton Complex, 1122 Volunteer Boul, Knoxville, TN, 37996, United States of America, langston@eecs.utk.edu

We will discuss the use of innovative algorithms and powerful computational platforms in the analysis of genome-scale biological data. Effective load balancing and efficient combinatorial search are core concerns. We will address issues with

noisy data, and the role of model organisms in successful applications to human health. Examples will be drawn from genomic, transcriptomic, methylation and other types of high-throughput data.

2 - Predicting Alzheimer's Disease Risk via Neuropsychological Tests

Tsung-Ling Wu, Georgia Institute of Technology, Atlanta, GA, United States of America, tlwu@isye.gatech.edu, Eva Lee

This work is joint with Emory Alzheimer's Disease Center. In this talk, we will first describe the neuropsychological tests that are used for capturing the cognitive status of an individual. Next, we will describe an optimization-based predictive model that is used for predicting early sign of Alzheimer's Disease. We will present results on a set of real patient cases.

3 - Data Mining of Pharmacy Medication Error Factors

Kalyan Pasupathy, University of Missouri, CE732 CS&E Building, Columbia, MO, 65212, United States of America, pasupathyk@missouri.edu, Beilei Zhang, Linsey Barker, Luis Occena

Medication errors are a major safety and cost issue. Studies have primarily focused on medication errors during the drug administration process. As hospitals implement bar-coding to detect errors, questions are raised related to the effectiveness of these technologies. We used a multi-factorial approach that takes into account the various dimensions that are part of the anatomy of a medication error, mined the relationships among factors to identify classification and association rules.

WB06

06- Fontaine Ballroom H

Surgery Planning and Scheduling

Sponsor: IIE, Society for Health Systems

Sponsored Session

Chair: Serhat Gul, Post-doctoral Research Associate, Arizona State University, School of Computing, Informatics and, Decision Systems Engineering, Tempe, AZ, 85281, United States of America, serhatgul.az@gmail.com

1 - Scheduling of Cataract Surgeries in an Eye Hospital

Lars Monch, Professor, University of Hagen, Universitaetsstrasse 1, Hagen, 58097, Germany, lars.moench@FernUni-Hagen.de, Hanna Wenke

This research is motivated by a scheduling problem found in a German eye hospital. The data collection and input modeling effort to create a simulation model is discussed. We are interested in reducing waiting time of the patients and in increasing the utilization of the operating rooms. A NSGA-II scheme with a random key representation is proposed. Simulation is used to calculate the fitness function taking the availability of the staff and the stochastic surgery durations into account. Results of computational experiments are presented. Extensions of the researched problem are discussed.

2 - Threshold-based Heuristics for the Single-day Surgery Scheduling Problem

William Herring, University of Maryland, Department of Mathematics, College Park, MD, 20742, United States of America, wherring@math.umd.edu, Jeffrey Herrmann

Scheduling elective surgeries is a dynamic, sequential decision-making process that must balance the costs of deferring waiting cases and blocking higher-priority cases. The single-day scheduling problem combines surgical block schedules, block release policies, and waiting lists. This talk presents a stochastic dynamic programming approach, an optimal algorithm for a special case, heuristics for the general case, and computational results that demonstrate the heuristics' effectiveness.

3 - Using Time Stamp Data to Improve Operating Rooms' Capacity Planning

Diwakar Gupta, University of Minnesota, 111 Church Street S.E., Minneapolis, MN, United States of America, guptad@me.umn.edu

This talk will show how time stamp data may be utilized to improve OR planning decisions. It will include a summary of data, a series of models, and results from applying these models to a hospital's data. The models address the following questions. How much of the total staffed time should be blocked for each service? What should be the block configuration? What changes should be made to room assignments a day before to achieve better staffed-capacity utilization? Configuration is defined by three parameters: the number of OR blocks, start/end time of each OR block, and auto-release date.

■ WB07

07- Mont Royal

Transparency and Resource Allocation to Improve Effectiveness in the Perioperative Environment

Sponsor: POMS, College of Healthcare Operations Management
Sponsored Session

Chair: Warren Sandberg, Professor & Chair, Department of Anesthesiology, Vanderbilt University School of Medicine, 1211 21st Avenue South, MAB 722, Nashville, TN, 37212, United States of America, warren.sandberg@Vanderbilt.Edu

1 - Transparency and Situational Awareness - Mobile Apps Improve Operating Room Safety and Efficiency

Brian Rothman, Assistant Professor of Anesthesiology, Vanderbilt University School of Medicine, Nashville, TN, 37212, United States of America, brian.rothman@vanderbilt.edu

Meeting user expectations of instant, accurate, easy-access information in perioperative settings is challenging. Pushing usable information is data-workflow- and device-dependent. If poorly integrated, data delivery is delayed, inaccurate, or incomplete. The VigiVU mobile app for operating room situational awareness delivers real-time information to all personnel regardless of location. The current app gives workflow transparency. Decision support algorithms guiding action are still needed.

2 - A Quantitative Framework for Staffing in a Department of Anesthesia

Farhad Ghassemi, Post-Doctoral Fellow, Massachusetts Institute of Technology, Sloan School of Management, Cambridge, MA, United States of America, farhad@mit.edu, Danny Segev, Retsef Levi, Wilton Levine, Warren Sandberg, Peter Dunn

We provide a quantitative framework to design staffing models for a group of anesthesiologists in a medical facility. This framework allows efficient short-term staff scheduling and long-term staff planning. A staffing model specifies the desired numbers of physicians for various tasks over a given time horizon and it must be designed by taking into account: 1) Demand profile, 2) Resource constraints, 3) Clinical, academic and research objectives, 4) Adaptability to absorb new changes. Our quantitative framework outlines how these factors can be considered in a staffing model.

3 - An Optimization Framework for Smoothing Surgical Bed Census via Strategic Block Scheduling

Timothy Carnes, Post-Doctoral Fellow, Sloan School of Management, MIT, 77 Massachusetts Ave, E62-389, Cambridge, MA, 02139, United States of America, tcarnes@mit.edu, Retsef Levi, Devon Price, Bethany Daily, Peter Dunn, Sue Moss

The usage of hospital floor beds at MGH varies predictably across days of the week, with low census on the weekends, and an occupancy peak on Wednesdays. We find the main contributor to this "hump" shape is the elective surgery population, which is scheduled in advance into blocks of time owned by a surgeon or surgical service. By rearranging the surgical block structure, we can affect what part of the week certain types of patients enter the hospital. With this method we are able to achieve a significant predicted reduction in the peak average bed census.

■ WB08

08- Hampstead

Hospital Capacity Management

Contributed Session

Chair: Parag Pendharkar, Professor of Information Systems, Pennsylvania State University-Harrisburg, 777 West Harrisburg Pike, Middletown, PA, 17057, United States of America, ppx19@psu.edu

1 - Modeling Health Care Services of Medical Specialists at Hospital/Macro Level

Siegfried Voessner, Graz University of Technology, Engineering and Business Informatics, Kopernikusgasse 24/II, Graz, 8010, Austria, voessner@tugraz.at, Gerhard Stark, Andreas Martischinig

We have developed and applied a novel method to model health care services of medical specialists at the hospital level by focusing on required productive time resources and a common service classification. The model can be calibrated using actual hospital data and offers the unique possibility of iterative refinement where needed. Thus we provide a flexible model which can handle data at all granularity levels. Applied in practice, our modeling approach has proven to be capable of capturing all details sufficiently well as well as to provide the opportunity for later on refinement when doing detail analysis.

2 - Optimization-based Decision Support for Hospital Evacuation Transportation Planning

Esra Agca, Graduate Teaching Assistant, Grado Department of Industrial and Systems Engineering (0118), Virginia Tech, 250 Durham Hall, Blacksburg, VA, 24061, United States of America, esra1986@vt.edu, Douglas Bish

In a hospital evacuation patients must be transported to alternative care facilities. To solve this logistical problem, we introduce an optimization-based planning model that minimizes the expected risk (from the threat instigating the evacuation and from the movement of patients), given limited resources and considering patients having different medical needs and logistical requirements. The model is illustrated using a large-scale case study.

3 - Particle Swarm Optimization Based Fuzzy Neural Network For Predicting Hospital Size

Parag Pendharkar, Professor of Information Systems, Pennsylvania State University-Harrisburg, 777 West Harrisburg Pike, Middletown, PA, 17057, United States of America, ppx19@psu.edu

We Develop a hybrid particle swarm optimization (PSO) based adaptive neural fuzzy inference system (ANFIS) for predicting hospital size in terms of number of employees. Using real-world hospital data, we compare our PSO-ANFIS with traditional neural network and find that the PSO-ANFIS performs well.

■ WB09

09- Cote St. Luc

Tutorial: Healthcare Reform in the US and Canada

Cluster: Tutorials

Invited Session

Chair: Antonia Maioni, Associate Professor, McGill Institute for the Study of Canada, Montreal, QC, Canada, antonia.maioni@mcgill.ca

1 - Healthcare Reform in the US and Canada

Antonia Maioni, Associate Professor, McGill Institute for the Study of Canada, Montreal, QC, Canada, antonia.maioni@mcgill.ca

Health care reform is an enduring issue on the policy landscapes of both the United States and Canada. This tutorial covers the basic differences in the two health care systems, explains the reasons for their convergent development over time, and explores the implications of recent health reform debates in the two countries.

■ WB10

10- Westmount

Emergency Medical Service Operations

Sponsor: Canadian Operational Research Society

Sponsored Session

Chair: Bora Kolfal, University of Alberta, School of Business, Edmonton, AB, Canada, bora.kolfal@ualberta.ca

1 - Model Specification and Data Aggregation for EMS Station Location

Ray Patterson, University of Alberta, 3-21 E Business Building, Edmonton, AB, T6G-2R6, Canada, ray.patterson@business.ualberta.ca, Erik Rolland, Geoff Holmes, Armann Ingolfsson

This work explores the relative impacts of aggregation errors and model choice errors, and their interaction, for an EMS station location model. We compare two model choices (probabilistic and deterministic) using a year of actual call data from the Edmonton EMS service. We demonstrate that model specification error dominates aggregation error.

2 - Optimization of Public Access Defibrillator Locations

Timothy C. Y. Chan, University of Toronto, 5 King's College Road, Toronto, ON, Canada, tcychan@mie.utoronto.ca, Heyse Li, Laurie Morrison, Steven Brooks

For most cardiac arrest patients, receiving timely treatment with a defibrillator can significantly improve the odds of survival. Portable defibrillators are installed in public locations to allow bystanders to treat a cardiac arrest victim. In this talk, we present a model to optimize the locations of public defibrillators, by identifying cardiac arrest hotspots underserved by existing defibrillators. We apply our model to data from Toronto, Canada. We will also discuss some lessons learned at the interface of operations research and emergency medicine.

3 - A Markov Chain Model for an EMS System with Repositioning

Bora Kolfal, University of Alberta, School of Business,
Edmonton, AB, Canada, bora.kolfal@ualberta.ca

We propose and analyze a two-dimensional Markov chain model of an Emergency Medical Services system that repositions ambulances using a compliance table policy, which is commonly used in practice. The model is solved via a fixed-point iteration. We validate the model against a detailed simulation model. We demonstrate that the model provides accurate approximations to various system performance measures, such as the response time distribution and the distribution of the number of busy ambulances, and that it can be used to identify near-optimal compliance tables.

WB11

11- Outremont

Healthcare Supply Chain

Sponsor: INFORMS Computing Society

Sponsored Session

Chair: Ali Ekici, Assistant Professor, University of Houston, Department of Industrial Engineering, E221A Engineering Building 2, Houston, TX, 77004, United States of America

1 - Improving Patient Flow in an Obstetric Unit

Jacqueline Griffin, PhD Student, Georgia Institute of Technology,
Atlanta, GA, United States of America, jackie.griffin@gatech.edu,
Shuangjun Xia, Pinar Keskinocak, Siyang Peng

To study the tradeoffs in patient satisfaction and system efficiency, a patient flow simulation model is developed with the incorporation of patient classification, blocking effects, and time dependent arrival and departure patterns. Performance metrics include blocking, utilization, wait times, and percentage of time at full. In the application of the model at DeKalb Medical Center, we demonstrate the value of implementing swing rooms to decrease bottlenecks and blocking within Mother Baby and Antepartum units.

2 - Routing for Blood Supply Management

Orsan Ozener, Özyegin University, Istanbul, Turkey,
Orsan.Ozener@ozyegin.edu.tr, Ali Ekici

In many countries, people still die because of inadequate supply of blood products. Blood is needed for several types of treatments including organ transplants, cancer and anemia treatments, and major surgeries such as open heart surgery. In blood supply management, an important step is processing donated blood within a certain amount of time after donation. In this research, motivated by the practices in blood supply management, we study the Blood Collection Problem and develop heuristic algorithms to find good solutions.

3 - The Impact of Individual Decisions on the Equity of H1N1 Vaccine Distribution

Jessica Heier Stamm, Kansas State University, Manhattan, KS,
United States of America, jlhs@k-state.edu, Nicoleta Serban,
Julie Swann

We study supply chain problems motivated by response scenarios where individual decision-makers' choices impact system outcomes. We develop models to assign users (centralization) or allow user choice (decentralization) for service sites and apply them to actual shipment data from the 2009-2010 H1N1 vaccination campaign. We compare the two systems and use spatial statistics to explain service inequity as a function of factors such as income, ethnicity and race, and service site availability.

WB12

12- Verdun

Markov Decision Processes

Contributed Session

Chair: Mehdi Bigdeli, PhD Student, McMaster University, 1902-75 Queen St. N., Hamilton, ON, L8R 3J3, Canada, bigdelm@mcmaster.ca

1 - Storing and Dispensing Hospital Supplies to Nursing Wards – The RFID-enabled Two-bin System

Claudia Rosales, Assistant Professor, Michigan State University,
301 N Business Complex, East Lansing, MI, 48824, United States
of America, crosales@msu.edu, Michael Magazine, Uday Rao

Two-bin inventory systems have been used at hospitals to store and replenish large numbers of medical supplies. The adoption of RFID technology to track empty bins has enabled continuous time tracking of system conditions. We present a semi-Markov decision model for the two-bin system. We characterize the optimal replenishment policy and propose a solution methodology to obtain the optimal average shortage and replenishment cost and the system conditions that should trigger bin replenishment.

2 - Modeling the Transition from Healthy to Asymptomatic State in Breast Cancer Patients using a HMM

Konstantin Shestopaloff, University of Toronto, Department of
Mechanical and Industrial Engineering, 5 King's College Road,
Toronto, ON, M5S3G8, Canada, kshestop@mie.utoronto.ca,
Viliam Makis

A Hidden Markov Model is used to model the transition between the healthy state and the asymptomatic disease state for breast cancer patients. The progression is modeled in continuous-time with intermediate states being used to account for non-exponential transition times. The model is fitted using screening tests performed at discrete time intervals with an extension to incorporate covariates.

3 - Markov Decision Processes in Modelling Community Care Services

Mehdi Bigdeli, PhD Student, McMaster University,
1902-75 Queen St. N., Hamilton, ON, L8R 3J3, Canada,
bigdelm@mcmaster.ca, Farhad Ghassemi

Community centers as building blocks of a community care system provide various long-term services including nursery, rehabilitation, mental and senior care for their patients. Due to the long-term dependency of patients to such centers, efficient utilization of the resources in the centers has a great impact on treatment outcomes as well as the throughput in the whole health care system. In this study, we model the interaction of a patient population with regional community care centers and demonstrate how the model can be utilized for more efficient allocation of resources.

WB13

13- Lachine

Optimization Applications II

Contributed Session

Chair: Brigitte Werners, Professor, Ruhr-University Bochum, Institute of Management, Dep. of Management and Economics, Bochum, 44780, Germany, or@rub.de

1 - Scheduling Chemotherapy Preparations with Perishable Raw Materials Constraints

Jean-Charles Billaut, Professor, University of Tours, Laboratoire
d'Informatique, 64 Avenue Jean Portalis, Tours, 37200, France,
jean-charles.billaut@univ-tours.fr, Patrick Esquirol,
Jean-François Tournamille

Producing chemotherapy doses for cancer treatment requires the use of raw materials that are active principles, expensive and perishable products. Doses have to be prepared and delivered to patients at given due dates. We consider the scheduling problem of chemotherapy preparations, considering the use of perishable active principles. The two objective functions are: the minimization of lost products and of maximum lateness. The NP-hardness of the problem is established. LP and Constraint Programming are used for solving the problem and computational results are presented.

2 - Operating Theatre Efficiency and Capacity Planning

Saeedeh Ketabi, Assistant Professor, University of Isfahan,
Department of Management, Hezarjerib, Isfahan, Iran,
sketabi@yahoo.com, Marziye Soltanolkottabi, Mehdi Mahnam

Different surgical services demand operating rooms (OR) to treat elective patients, each competing for a limited supply of OR time. Data envelopment analysis (DEA) can be used as tools in management control and planning. While conventional DEA models set targets separately for each decision making unit (DMU), in this paper we consider that there is a centralized decision maker (Operatin theatre manager) who supervises all the surgical services. The current research studies the efficiency of elective operating theatre within Azzahra Hospital, a teaching large-specialty hospital in Isfahan, Iran, where there are 20 ORs for elective surgeries of 10 groups, approximately 65-75 surgeries per day. OR blocks are assigned to the surgical services by the centralized DEA model.

3 - Robust Allocation of Limited Capacity

Brigitte Werners, Professor, Ruhr-University Bochum, Institute of Management, Dep. of Management and Economics, Bochum, 44780, Germany, or@rub.de, Sebastian Rachuba

Allocating limited capacity is of special importance for hospitals and other health care service providers. In addition to the variety of objectives of multiple stakeholders, uncertainty of the environment complicates the allocation. A multicriteria optimization approach using fuzzy decision making to handle several criteria and to determine a robust solution for capacity allocation is presented. The results of exemplary calculations demonstrate the advantage of robust solutions.

Wednesday, 1:30pm - 3:00pm**WC01**

01- Fontaine Ballroom C

Innovations and Improvements in Healthcare Delivery

Contributed Session

Chair: Rajesh Tyagi, Assistant Professor, HEC Montreal, 3000, chemin de la Côte-Sainte-Catherine, Montreal, QC, H3T 2A6, Canada, rajesh-kumar.tyagi@hec.ca

1 - Improving Customer Service and Productivity in Blood Collection Using Donor Driven Data Collection

Sudha Rajderkar, PhD Precandidate, University of Michigan, School of Dentistry, 1011 N. University, Ann Arbor, MI, 48105, United States of America, rsudha@umich.edu, Rema Padman, Melanie Heuston

A mobile unit with a three to one ratio of bed to phlebotomist experienced shorter wait time on the donation bed before bleeding. Simulation modeling and analysis highlighted the importance of strategic scheduling of donors at regular intervals. The unique feature of this study was the collection of data through donor volunteers in three different donation environments that had no interference from or to operational levels. The strategy was cost effective, practical and yielded sufficient data that gave useful results. This method can be used as a model for data collection in most health care services' settings with appropriate modifications.

2 - Innovation in the Health Sector: A Predictive Model

James K Hazy, Associate Professor, Adelphi University, 1 South Avenue, Garden City, NY, 11530, United States of America, hazy@adelphi.edu, Jeffrey Goldstein

We describe a dynamical systems and complex adaptive systems model of innovation for the health care sector. The model consists of internal variables in concert with parameters reflecting the impact of external factors and can be applied across scale, from industry sectors to particular delivery locations. It also incorporates novelty generating mechanisms that construct new organizing processes that address pressing issues with new properties. Further, we describe how this predictive model can be tested empirically and used practically.

3 - An Exploratory Study of Values in Canadian Hospitals

Rajesh Tyagi, Assistant Professor, HEC Montreal, 3000, Chemin de la Côte-Sainte-Catherine, Montreal, QC, H3T 2A6, Canada, rajesh-kumar.tyagi@hec.ca, James Belohlav, Lori Cook, John Olson

Performance in the healthcare sector has become a worldwide issue. The goal of this research was to examine the core values in Canadian hospitals and its relationship to the adoption of improvement programs. In addition, differences in core values between English speaking and French speaking hospitals were examined. Primary data were collected nationally from 134 Canadian hospitals.

WC02

02- Fontaine Ballroom D

Healthcare Strategy and Policy I

Contributed Session

Chair: Idris Adjerid, PhD Student, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, iadjerid@andrew.cmu.edu

1 - Investment and Disinvestment of Health Technologies: The Need for Two Cost-effectiveness Thresholds

Mike Paulden, Research Associate, University of Toronto, THETA Collaborative, 144 College Street, Toronto, ON, M5S 3M2, Canada, mike.paulden@theta.utoronto.ca

The concept of a cost-effectiveness "threshold" has been adopted by health care decision makers in numerous jurisdictions. This paper demonstrates that, under very weak assumptions, decision makers ought to adopt separate thresholds for investment and disinvestment decisions. These assumptions are that: (a) there is fixity in the set of adopted technologies in the short term; and (b) either (i) productivity changes over time, or (ii) available information changes over time, or both. This has implications for policy making, the interpretation of ICERs, net benefit calculation, and VOI analysis.

2 - Understanding Health Insurance Needs of Small Businesses in the USA

Rahul Bhaskar, Professor, California State University, 800 North College Boulevard, Fullerton, CA, 92834, United States of America, rbhaskar@fullerton.edu, Bhushan Kapoor

As the cost of health insurance has escalated and benefits reduced, the decisions of employers concerning health insurance offerings are very important for employees. The focus of this research was to identify the key benefit attributes and their preferences by the employers and employees of small businesses between 2 and 50 employees. Specifically, this research had the following main objectives 1) Identify the health insurance attributes and their relative importance to the employers and employees 2) Identify the tradeoffs employees and employers are willing to make when deciding which health insurance product to purchase.

3 - Health Disclosure Laws and Health Information Exchanges

Idris Adjerid, PhD Student, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, iadjerid@andrew.cmu.edu, Rema Padman, Julia Adler-Milstein, Alessandro Acquisti, Rahul Telang

We investigate the relationship between the success of health information exchanges (HIEs) and state privacy laws limiting the disclosure of health information. Stronger privacy laws can result in increased incentives for healthcare entities to pursue trusted networks for health information exchange, but can also inhibit organizations from sharing protected health information. Our preliminary analysis suggests a significant and positive correlation between HIE success and the strength of state-level privacy legislation: states with stronger privacy laws, limiting the disclosure of health information, appear more likely to pursue HIE efforts, have more HIEs exchanging data, and have better success rates with HIEs. However, failure rates did not seem to be affected by health disclosure laws.

WC03

03- Fontaine Ballroom E

NSF Center for Health Organization Transformation – Projects and Purpose

Cluster: Putting Healthcare IE/OR into Practice in the US

Invited Session

Chair: James Benneyan, Professor of Industrial Engineering, Center for Health Organization Transformation New England VA Engineering Resource Center, Northeastern University, 360 Huntington Avenue, Boston, MA, 02115, United States of America, benneyan@coe.neu.edu

1 - Implementing CHOT Collaborative Healthcare Operations Research

James Benneyan, Professor of Industrial Engineering, Center for Health Organization Transformation New England VA Engineering Resource Center, Northeastern University, 360 Huntington Avenue, Boston, MA, 02115, United States of America, benneyan@coe.neu.edu

We describe several projects cutting across our healthcare member's 3 core focus areas: scheduling, safety, and readmissions. CHOT's process for defining collaborative projects with our members, current novel problems, implementation tests, and cross-center collaboration also are discussed.

2 - Optimizing Care Delivery, Advancing Patient Safety, and Using Electronic Medical Records

Eva Lee, Professor & Director, Georgia Institute of Technology, Ctr for OR in Medicine & HealthCare, Industrial and Systems Engineering, Atlanta, GA, 30332, United States of America, evakylee@isye.gatech.edu

This work is joint with Grady Memorial Hospital, Children's HealthCare of Atlanta, Morehouse School of Medicine, Meadows Regional Hospital and the Georgia Trauma Care Network Commission. We will briefly provide overview of the several projects with our health systems partners. Challenges, successes and lessons learned will be described.

3 - Evidence-Based Healthcare Management Research

Nicholas Edwardson, Assistant Director, Texas A&M Health Science Center, TAMU 1266, College Station, TX, 77843, United States of America, edwardson@tamhsc.edu

Texas A&M Health Science Center is currently conducting five action research projects with six leading, Texas-based healthcare systems including: East Texas Medical Center, Lone Star Circle of Care, Texas Children's Hospital, Texas Health Resources, and St. Luke's Episcopal Health System. These research projects range from EMR installation, to managing organizational capacity for change, to better understanding the theoretical underpinnings of Studer Group initiatives. Nick will discuss how these projects' results are changing the way healthcare organizations approach change initiatives.

WC04

04- Fontaine Ballroom F

Therapy and Treatment II

Contributed Session

Chair: Mehdi Taobane, Student in Master Degree, École Polytechnique de Montréal, 2500, chemin de Polytechnique, Montréal, QC, H3T 1J4, Canada, mehdi.taobane@polymtl.ca

1 - Urinary Incontinence Diagnosis, a Data Mining Approach

Nooshin Habibollah, Islamic Azad University Science and Research Branch, Hesarak, Poonak, Tehran, Iran, n.habibollah@gmail.com, Mohammad Mehdi Sepehri, Babak Teimourpour, Saeedeh Kalhor

This paper presents a novel approach for the differential diagnosis of female urinary incontinence (stress, urge and mixed incontinence) by using data mining techniques. The motivational factor is the difficulty of diagnostic tasks. In this study, a decision tree is extracted to produce the rules from cystoscopy results for accurate diagnosis.

2 - A Combinatorial Approach for Designing Operations in the Department of Radiation Oncology

Mehdi Taobane, Student in Master Degree, École Polytechnique de Montréal, 2500, chemin de Polytechnique, Montréal, QC, H3T 1J4, Canada, mehdi.taobane@polymtl.ca, Louis-Martin Rousseau, Pierre Baptiste, Marie-Andrée Fortin

The administrators of l'Hôpital Cité de la Santé in Laval are confronted with uncertain decisions in designing a new Department of Oncology. However, the difficulty, at this stage, is to assess the impact of decisions on the functioning of operations. By the combinatorial approach of operational research and simulation, key parameters are analyzed such as stochasticity at patients' arrival, coordination of operations and resources allocation. The objective is to provide patients with the shortest waiting time, and a continuous quality treatment.

WC05

05- Fontaine Ballroom G

Healthcare Technology

Contributed Session

Chair: Emanuela Guerriero, Professor, Dip. Ingegneria dell'Innovazione Università del Salento, Via per Monteroni, Lecce, 73100, Italy, emanuela.guerriero@unisalento.it

1 - A Universal Tool for Vaccine Scheduling: Applications for Children and Adults

Sheila Isbell, Research Scientist, Georgia Tech Research Institute, 250 14th Street NW, Atlanta, GA, United States of America, sheila.isbell@gtri.gatech.edu, Hannah Smalley

Georgia Institute of Technology, in collaboration with the CDC, developed decision support tools for creating optimized catch-up immunization schedules for four target groups: children through age 6, adolescents ages 7 through 18, and adults ages 19+ in the U.S., and children and adolescents through age 19 in Canada. Each decision support tool constructs the recommended immunization schedule for the user by means of a dynamic programming (DP) algorithm. The tools simplify and expedite the tedious process of manually constructing immunization schedules, and eliminate errors.

2 - OR Advances in Immunoassays Clinical Analyzers

Emanuela Guerriero, Professor, Dip. Ingegneria dell'Innovazione Università del Salento, Via per Monteroni, Lecce, 73100, Italy, emanuela.guerriero@unisalento.it, Antonio Grieco

From the early 1990s, the introduction of high-throughput clinical analyzers has significantly changed the workflow of In-Vitro-Diagnostics (IVD) tests. These high-tech instruments have helped clinical laboratories control costs, reduce unnecessary spending, and get more for every dollar they spend. Nevertheless, IVD industrial research has been up to now largely hardware-driven. In our opinion, to reach the full potential of laboratory automation, one must address the challenge of making the most intelligent use of the hardware that is deployed. Focusing on time efficiency, our team has devised an operations research-based optimization method for high-throughput clinical analyzers.

WC06

06- Fontaine Ballroom H

Operating Room Scheduling and Predictive Models

Cluster: Medical Decision Making

Invited Session

Chair: Oleg Shylo, University of Pittsburgh, 3700 O'Hara St., 1046 Benedum Hall, Pittsburgh, PA, 15261, United States of America, olegio@gmail.com

1 - A Multi-stage Stochastic Programming Model for Surgery Planning

Serhat Gul, Post-doctoral Research Associate, Arizona State University, School of Computing, Informatics and Decision Systems Engineering, Tempe, AZ, 85281, United States of America, serhatgul@asu.edu, Brian Denton, John Fowler

We study a multi-stage stochastic mixed integer programming formulation for the allocation of surgeries to ORs over a finite planning horizon. The demand for surgery and surgical duration are random variables. The objective is to minimize two competing criteria: expected surgery cancellations and OR overtime. Progressive Hedging is implemented to find near optimal surgery plans. Properties of the model are discussed and methods are proposed to improve the performance of the algorithm. Finally, the results for numerical experiments that provide insight into surgery planning are presented.

2 - Using Markov Chain Monte Carlo Methods to Characterize Surgery Procedure Duration

Louis Luangkesorn, Research Assistant Professor, University of Pittsburgh, 1048 Benedum, 3700 O'Hara St., Pittsburgh, PA, 15261, United States of America, lol11@pitt.edu, Zeynep Eren Dogu

The number of distinct procedures at a multi-specialty surgery suite means that even with several years of historical data a large fraction of the cases will have little or no historical data. Bayesian methods can be used to combine historical data with expert judgment to provide estimates, but obtaining expert judgment in an operational setting can be infeasible. We combine expert classification of procedures by complexity category with historical data in a Markov chain Monte Carlo model and test these methods over one year of actual surgery cases at a multi-specialty surgical suite.

3 - Batch Scheduling of Surgical Suite within Block-booking System

Oleg Shylo, University of Pittsburgh, 3700 O'Hara St., 1046 Benedum Hall, Pittsburgh, PA, 15261, United States of America, olegio@gmail.com, Oleg Prokopyev, Andrew Schaefer

We consider the problem of optimal scheduling of elective patients under the block-booking system. Intuitively, the problem consists of finding an assignment of surgeries to scheduling blocks that provides a reasonable balance between overtime and utilization. We provide an exact algorithm for this problem that uses the concavity of the objective function under the assumptions of normality for the sum of surgery durations. Effectiveness of this algorithm was tested on the historical data set provided by the Veterans Affairs Pittsburgh Health Care System.

■ WC07

07- Mont Royal

Empirical Studies

Contributed Session

Chair: Changmi Jung, PhD Student, Carnegie Mellon University, 4800 Forbes Ave., Pittsburgh, PA, 15213, United States of America, changmi@andrew.cmu.edu

1 - Identifying Factors Related to Hospital Length of Stay with Structural Equation Modelling

Rukiye Numanoglu Tekin, Research Assistant, Baskent University, Eskisehir Yolu 20. Km, Baglica Kampusu Etimesgut, Ankara, 06810, Turkey, numanoglu@baskent.edu.tr, Halil Kemal Ilter

Length of stay (LOS) is one of the main components of costs of health care services. The main purpose of this study is to identify factors related to LOS in Turkey. The study population consisted of inpatients who stayed in hospitals in Turkey between 2009 - 2010. Patient's data were taken from MEDULA. In this study structural equation modelling is used to determine and analyze variables that may affect to LOS. As a result of the analysis, factors affecting to LOS was determined. According to these factors, recommendations for both health care providers and policy makers have been made.

2 - Identifying Key Drivers of eVisit Service: A Preliminary Analysis

Changmi Jung, PhD Student, Carnegie Mellon University, 4800 Forbes Ave., Pittsburgh, PA, 15213, United States of America, changmi@andrew.cmu.edu, Rema Padman

In this study, we estimate the likelihood of eVisit usage based on individual patient demographic characteristics and their utilization of online healthcare information on the portal. We obtained eVisit data including patient demographics, diagnoses, medications as well as portal logon information from 4 practices associated with a major medical center covering the time period from April 2009 to May 2010. From our analysis, retired status, gender, age, and the frequency of patient portal access as well as insurance information seem to be significant factors.

■ WC08

08- Hampstead

Capacity Management Modeling

Contributed Session

Chair: Sylvain Housseman, Ecole des Mines de Saint-Etienne, 880, Route de Mimet, Gardanne, 13541, France, sylvain.housseman@gmail.com

1 - A Multi-criteria Approach to the Allocation of Physicians' Working Time

José Ferrao, Center for Management Studies - Instituto Superior Técnico, Av. Rovisco Pais, 1, Lisbon, 1049-001, Portugal, jose.ferrao@ist.utl.pt, Mónica D. Oliveira, Carlos Bana e Costa

This study explores how multi-criteria decision analysis can assist clinical managers in allocating scarce physicians' working time to activities within a hospital department. Using the principles of process consultation, a methodology was developed to generate allocation alternatives and build a resource allocation model based on multi-criteria portfolio analysis. The clinical manager valued both the results from application and his full participation in building the model, showing the potential role of the proposed approach in addressing such decision problem.

2 - Identifying Near-bottlenecks for Hospital Congestion Relief

Renata Konrad, Worcester Polytechnic Institute, 100 Institute Rd, Worcester, MA, 01609, United States of America, rkonrad@wpi.edu, Ali Kefeli

We present a solution methodology that aims to address issues pertaining to hospital capacity management. We model the problem in a production planning framework and show that conventional linear programming approaches do not model congestion caused by work-in-process accurately and hence may result in impractical solutions. We present an original methodology that (1) uses data mining approaches to construct previously unavailable patient routings and resource requirements and (2) uses non-linear clearing functions to model congestion, and identify near bottlenecks.

3 - Chemotherapy Production Scheduling with Skill-Learning

Sylvain Housseman, Ecole des Mines de Saint-Etienne, 880, Route de Mimet, Gardanne, 13541, France, sylvain.housseman@gmail.com, Rémy Collomp, Nabil Absi, Dominique Feillet

This paper presents on original model for the scheduling of chemotherapy production in hospitals. The purpose is to investigate how service expectations implied by due dates and learning opportunities for technicians offered by idle times can be combined when computing a production schedule. An optimization module was developed based on a tabu search heuristic for the scheduling part and included in a simulation which contains a Learn-Forget Curve Model for the technician competences to evolve.

■ WC09

09- Cote St. Luc

Process Improvement

Contributed Session

Chair: Jiun-Yu Yu, National Taiwan University, Department of Business Administration, No. 85, Sec. 4, Roosevelt Road, Da-An, Taipei, 106, Taiwan - ROC, jyyu@ntu.edu.tw

1 - Use of Business Process Management Technology and LEAN Implementation Methodology in Healthcare

Andy Steele, Director, Medical Informatics, Denver Health, 660 Bannock, Denver, CO, 80218, United States of America, andy.steele@dhha.org, Deborah Scherger

Healthcare organizations are faced with increasing complexity of care, diminishing resources, and increased regulatory oversight. Denver Health, a large integrated delivery health network, has adopted an approach to bring together a quality improvement program utilizing LEAN management tools with the use of new Business Process Management (BPM) software, to automate the process of care. This approach has led to improved quality of care for nurse documentation and identification of heart failure patients as well as in many other processes of care.

2 - Innovative TeleHealth Business Model for Patients with Cardiovascular Disease

Jiun-Yu Yu, National Taiwan University, Department of Business Administration, No. 85, Sec. 4, Roosevelt Road, Da-An, Taipei, 106, Taiwan - ROC, jyyu@ntu.edu.tw, Yi-Lwun Ho, Ruey-Shan Guo

To provide postdischarge heart failure patients with ubiquitous home-based care, a telehealth service is developed. To ensure this telehealth service operates with lasting efficiency and quality, an innovative business model and a matrix of KPIs, based on VISOR framework and Balanced Scorecard, are constructed. System Dynamics is applied to study the causal dynamics among KPIs to inform the resource utilization decisions. Patients are highly satisfied as their physical conditions and quality of life have been substantially improved.

■ WC10

10- Westmount

EMS Operations

Sponsor: Canadian Operational Research Society

Sponsored Session

Chair: Dan Haight, Managing Director, University of Alberta, 3rd Floor Business Building, Edmonton, AB, T6G2R6, Canada, dan.haight@ualberta.ca

1 - Predicting Spatial Patterns of Heart Attack Incidence in Alberta

Amir Rastpour, University of Alberta, Edmonton, AB, Canada, arastpour@ualberta.ca, Reidar Hagtvedt, Padma Kaul, Armann Ingolfsson

Knowledge of heart attack incidence rates in different parts of Alberta can help authorities utilize treatment capacity effectively and efficiently. In this research, we apply a Poisson regression model with a linear link function to estimate the heart attack occurrence rate of the population of Alberta. The model is based on age, education, and income level variables.

2 - A Simulation Analysis of an Emergency Department Fast Track System

Jennifer La, Master's Graduate, University of Waterloo,
200 University Avenue West, Waterloo, ON, N2L 3G1, Canada,
j2la@uwaterloo.ca

Discrete event simulation was used to model a fast track area of an emergency department and to analyze the effect of various operational policies to determine an optimal fast track strategy that reduces patients' length of stay. Wait times were most significantly reduced with an increased physician presence towards the fast track system. The second most significant reduction in performance measures occurred with an additional emergency nurse practitioner in fast track. Finally, implementing "See-and-treat" had a negligible effect on patient wait times.

3 - A Patient-centric Approach to Ambulance Station Location

Dan Haight, Managing Director, University of Alberta, 3rd Floor
Business Building, Edmonton, AB, T6G2R6, Canada,
dan.haight@ualberta.ca

We look at how ambulance station location models are impacted by input choice. Specifically, we test how patient subset, candidate locations, response targets, and complementary services can affect the optimal station configuration and response performance. We demonstrate that choices that are focused on the patient as opposed to the service have the potential to yield better performance, lower costs, and improved patient outcomes.

WC11

11- Outremont

Matching Supply and Demand

Contributed Session

Chair: Nico Dellaert, Associate Professor, Technische Universiteit
Eindhoven, P.O. Box 513, Eindhoven, 5600MB, Netherlands,
n.p.dellaert@tue.nl

1 - Goal-programming Models for Nurse Scheduling Assessment of Two Critical Intensive Care Units

Abdelghani Bouras, King Saud University, P. O. Box 800, Riyadh,
11421, Saudi Arabia, bouras@ksu.edu.sa, Anis Gharbi,
Mohamed Louly, Mohamed Naceur Azaiez

We compare the performance of the manual schedules of the hospital (based on the tuning of the One-Staff initial schedules) against the optimal schedules obtained through the use of this study. The assessment takes into account three levels of comparisons; namely, the hospital rules, the patient care criteria and the nurses' preferences criteria. The models have been implemented using Lingo 11. The results show that major improvements have been obtained by opting for the suggested goal-programming models. The improvements are particularly considerable since the understaffing was significant leading to important violations of the hospital rules, errors and highly unbalanced schedules.

2 - Overview of the Most Appropriate Logistic Model for Immunizing Products

Alexandre Jean Lauzon, PhD Student, École Polytechnique
Montréal, 2900 Boulevard Edouard-Montpetit, Montréal, QC, H3T
1J4, Canada, alexandre-jean.lauzon@polymtl.ca,
Élisabeth Bussièrès, Diane Riopel, Marcelo Cabral

The research work allowed an overview of the most appropriate logistic model for immunizing products (centralized or decentralized), and a analyze of the best practices in logistic using optimization model for transport, as well as stock management model. The project was done in collaboration with the Health and Social Service Centre-University Institute of Geriatrics of Sherbrooke (CSSS-IUGS) and The Public Health Department of the Eastern Townships.

3 - Linking Improved Surgery Tactical Plans to Elective and Emergency Patient Service: Analytical Method

Nico Dellaert, Associate Professor, Technische Universiteit
Eindhoven, P.O. Box 513, Eindhoven, 5600MB, Netherlands,
n.p.dellaert@tue.nl, Jully Jeunet

We assess the impact of any master surgery tactical plan on patient service by developing analytical methods that derive from any stream of planned patients the exact distribution of waiting time and resources utilization at the operational level. We also explore two strategies to improve tactical plans in terms of waiting time.

WC12

12- Verdun

Modeling under Robust Optimization Criteria

Contributed Session

Chair: Ana Cecilia Zenteno, Columbia University, 500 W. 120th Street,
313 S. W. Mudd Bldg, New York, NY, 10027, United States of America,
acz2103@columbia.edu

1 - Robust Appointment Scheduling

Shashi Mittal, Student, Massachusetts Institute of Technology,
Operations Research Center, 77 Massachusetts Avenue,
Bldg. E40-130, Cambridge, MA, 02139, United States of America,
mshashi@mit.edu, Sebastian Stiller

We construct robust appointment schedules for jobs with uncertain length in a high cost health care facility avoiding extreme costs due to both idle time and delay. Given the order of the jobs during the day and for each job its maximum and minimal possible length, arbitrary overage cost, and (during the day non-decreasing) underage cost we give a closed form for the unique robust optimum. We achieve broad insights into the structure of the optimum and characterize its worst case scenarios.

2 - Robust Facility Location under Service Constraints

Hussein Naseraldin, ORT Braude College, P.O. Box 78,
Karmiel, 21982, Israel, nhussein@braude.ac.il, Opher Baron

Facility location is a strategic issue. In the service industry this issue has an additional importance because service cannot be stored. In particular in the healthcare sector, locating a healthcare clinic entails a significant investment and the over-capacity in one period cannot help to level the demand in another period. Moreover, uncertainty in the input that its accuracy deteriorates with time, add to the complexity of the problem. We shed light on designing a robust facility location with random demand and a service level measure.

3 - Alleviating the Social Cost of an Influenza Pandemic

Ana Cecilia Zenteno, Columbia University, 500 W. 120th Street,
313 S. W. Mudd Bldg, New York, NY, 10027, United States of
America, acz2103@columbia.edu, Daniel Bienstock

We analyze strategies for mitigating the impact of a severe influenza pandemic on social and industrial infrastructure. Our approach involves the procurement of additional resources in response to a robust model of the evolution of the epidemic. We describe algorithms analogous to generalized Benders' decomposition that proves fast and numerically accurate. Our goal is to bring insights on the structure of optimal robust strategies and on practical rules-of-thumb that can be deployed during the epidemic.

WC13

13- Lachine

Simulation Studies

Contributed Session

Chair: Gerhard Stark, Steiermärkische Krankenanstaltengesellschaft
m.b.H., Stiftingtalstraße 4-6, Graz, 8010, Austria,
Gerhard.Stark@lkh-deutschlandsberg.at

1 - Using Simulation to Redesign Cardiac Surgery

Anantha Kollengode, Operations Manager, Research
Administration, Mayo Clinic, 200 First Street SW, Rochester,
MN, 55905, United States of America,
kollengode.anantha@mayo.edu, David Cook, Thoralf Sundt,
Thomas Rohleder, Jeffrey Thompson

Simulation models played a pivotal role in cardiac surgery redesign at Mayo Clinic, Rochester, MN. The models helped stakeholders to better understand and visualize the end-to-end impact of the proposed changes to meet the goal of reducing costs by 20% while improving the quality, safety and staffing needs. Using modeling early in the project planning phase helped to get buy-in from the leadership and staff and helped in saving over \$4 million in 2010.

2 - Using GIS and Simulation for Analyzing Optimal Organ Allocation for Liver Transplant

Naoru Koizumi, Assistant Professor, George Mason University,
3351 Fairfax Drive, MS3B1, Arlington, VA, 22201, United States
of America, nkoizumi@gmu.edu, Monica Gentili, Amit Patel,
Yang Xu, Chen Chun-Hung, Nigel Waters, Rajesh Ganesan

Geographical disparity in access to organ transplant has long been discussed among transplant researchers. Our study develops an analytical framework for investigating (i) geographical disparity in access to liver transplant using Geographic Information Systems (GIS) based spatial analysis and (ii) organ sharing boundaries as a contributing factor to the disparity using Discrete Event Simulation (DES). The latter analysis leads us to simulation optimization that identifies the boundaries that minimize geographic disparity in access to liver transplant.

3 - Computer Simulation Based Prognosis of the Rate of Screening Colonoscopy in the Population at Risk

Gerhard Stark, Steiermaarkische Krankenanstaltengesellschaft m.b.H., Stiftingtalstraße 4-6, Graz, 8010, Austria, Gerhard.Stark@lkh-deutschlandsberg.at, Andreas Martischinig, Siegfried Voessner

We present a computer simulation based model for preventive cancer diagnostics to gain insight into the system's behavior and to make predictions for future development. The model is based on medical data from various cancer research projects and was validated using an agent/population based simulation approach. Forecasts calculated with our model use current data and official demographic development forecasts.

Wednesday, 3:30pm - 5:00pm

■ WD01

01- Fontaine Ballroom C

Comparative Effectiveness Studies

Contributed Session

Chair: Joris Van de Klundert, Department Chair, Erasmus University, P.O. Box 1738, Rotterdam, 3000DR, Netherlands, vandeklundert@bmg.eur.nl

1 - Organizational Socialization (Enculturation) of Physicians Entering a Complex Healthcare System

Richard Pitts, Assistant Area Medical Director, Kaiser Permanente Orange County, P.O. Box 7125, Orange, CA, 92863, United States of America, richard.t.pitts@kp.org, Ruth Maurer, PhD

Compelling data support a comprehensive organizational socialization (enculturation) program for physicians entering a complex healthcare system. Survey results from seven years of training demonstrate that benefits from this program include improved organizational efficiency, cost savings, increased informal physician leadership, and effective integration into a complex healthcare system. Program enculturation methods are emphasized. Organizational socialization programs for physicians entering a healthcare system are missing from the scholarly literature.

2 - An Empirical Study Linking Hospital Efficiency and Volume Flexibility

Kenneth Hoyt, University of Alabama, UAB School of Medicine, Dept. of Radiology, Birmingham, AL, United States of America, hoyt@uab.edu, Eric Jack, Thomas L. Powers, Robert Stanford

While researchers have used several measures of hospital efficiency, none have examined links between efficiency and flexibility. In this research, efficiency of 249 hospitals over 5 years is measured using DEA. Volume flexibility as measured using fluctuation ratios in outputs (surgical procedures and discharges) relative to inputs (nursing and physician labor) is then assessed. Results showed system inputs and outputs vary based on hospital size and ownership type. Also, while some hospitals may operate at the efficient frontier, they are not as capable of flexing volume. These results contribute to the understanding of how hospitals leverage efficiency and volume flexible strategies.

3 - Performance Bench Marking using DEA for Dutch Hospitals After System Reform

Joris Van de Klundert, Department Chair, Erasmus University, P.O. Box 1738, Rotterdam, 3000DR, Netherlands, vandeklundert@bmg.eur.nl

The Dutch health system has been reformed in 2006. The insurers now negotiate price and quality of care for around 30 percent of the total volume of hospital care. The market reform was expected to lead to increases in quality and efficiency. In this study we bench mark hospital performance for the complete set of Dutch hospitals using extensive financial and operational information, including quality of care information for the years 2006-2009. We present and discuss the results of DEA analysis, in particular regarding quality and efficiency, including analysis of Mamquist indices.

■ WD02

02- Fontaine Ballroom D

Healthcare Strategy and Policy II

Contributed Session

Chair: Stefano Villa, Assistant Professor, Catholic University, Largo F. Vito I, Roma, Italy, stefano.villa@unicatt.it

1 - Evidence-based Incentive Systems for Medicare's Dialysis Payment Program

Donald Lee, Yale School of Management, 135 Prospect Street, New Haven, CT, 06520, United States of America, donald.lee@yale.edu, Stefanos Zenios

To design an optimal payment system for Medicare's dialysis program, we develop an empirical method to estimate the structural parameters of the principal-agent model underlying the relationship between Medicare and dialysis providers. Numerical results suggest that the optimized system can lengthen patient hospital-free lifespan by 2 weeks per patient per year without increasing Medicare expenditures.

2 - Health Statuses Modeling: Combining Data from Wisconsin Long Term Care Functional Screen and Familycare Encounter Data

Elise Wu, Research Assistant, Center of Health Systems Research Analysis, 1124 WARF Building, 610 Walnut St, Madison, WI, 53726, United States of America, cwu7@wisc.edu, Jim Robinson

The objectives of this study are (1) to define the health statuses in term of Activities of Daily life, Instrumental Activities of Daily Life, and frequency of use of health-related service based on the Wisconsin Long Term Care Functional Screen (2) to predict long term care expenditure based on these health statuses, and (3) to model the migrations between different health statuses.

3 - A Framework for the Analysis of Hospital Patient Flows: The Results of a Benchmarking Study

Stefano Villa, Assistant Professor, Catholic University, Largo F. Vito I, Roma, Italy, stefano.villa@unicatt.it, Isabella Giusepi, Anna Prenestini

The study presents a sound and through analytical framework to assess hospital patient flows' problems. The framework is then used in a benchmarking study that outlines four main aspects: 1. in many of the cases analyzed patient flows problems are not due to a problem of shortage of capacity. 2. urgent/unscheduled cases are less variable and much more predictable compared to elective case. 3. A typical source of patient flow's variability has to do with badly designed Operating Rooms' planning systems. 4. Correlations analysis show that ED length of stay is related to the presence of a disequilibrium between admissions and discharges in a given day.

■ WD03

03- Fontaine Ballroom E

Joint Session HAS/OR and Public Health: Pandemic and Vaccine Planning

Sponsor: INFORMS Health Applications Section/Operations Research for Public Health

Sponsored Session

Chair: Dionne Aleman, Assistant Professor, University of Toronto, Director, Medical Operations Research Laboratory (morLAB), Mechanical and Industrial Engineering, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, aleman@mie.utoronto.ca

1 - Pediatric Vaccine Procurement Policy: The Monopsonist's Problem

Sheldon Jacobson, Professor, University of Illinois, Urbana, IL, 61801, United States of America, shj@illinois.edu, Matthew Robbins

The Monopsonist Vaccine Formulary Pricing and Purchasing Problem seeks pediatric vaccine prices and quantities that ensure a fully immunized birth cohort at minimum cost while ensuring reasonable profit levels. The problem is used to assess CDC pricing and purchasing policies with respect to the long-term provision of pediatric vaccines.

2 - Effect of Influenza Pandemic on Work Absenteeism

Ali Ekici, Assistant Professor, University of Houston, Houston, TX, United States of America, aekici@Central.UH.EDU, Julie Swann, Pinar Keskinocak

The U.S. Department of Health & Human Services and the U.S. Department of Commerce estimate that in the next pandemic 20% of working adults may become ill, and there may be a 40% workforce loss during the pandemic peak. In this research, we develop a disease spread model to investigate the effect of influenza pandemic and the intervention strategies on the active workforce. We provide guidelines for governments and businesses about what to do during an influenza pandemic to maintain employee and population safety as well as business continuity.

3 - Testing Influenza Pandemic Mitigation Strategies through Simulation Experiments

Michael Beeler, Graduate Student, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, michael.beeler@utoronto.ca, Dionne Aleman, Michael Carter, Brian Schwartz

We present the results of a factorial experiment that tests influenza pandemic mitigation strategies through an agent-based pandemic simulation. The simulation tests policies under different scenarios of pathogen virulence. The relationships between model inputs and outputs reveal which policy interventions best save lives and minimize social disruption, in what combinations and in which scenarios.

■ WD04

04- Fontaine Ballroom F

Clinical and Policy Modeling

Contributed Session

Chair: George Miller, Institute Fellow, Altarum Institute, 3520 Green Court, Suite 300, Ann Arbor, MI, 48105, United States of America, george.miller@altarum.org

1 - Genetic Algorithms in Optimization of Gene Interactive Rules

Farhad Azadivar, Professor, University of Massachusetts Dartmouth, 40 William Street, South Dartmouth, MA, 02748, United States of America, fazadivar@umassd.edu

Often tumor and non-tumor cellular networks contain the same cancer causing genes but interaction among these and other genes in tumor networks cause cancerous genes while in non-tumor networks they do not. There is a potential to alter gene regulatory networks to prevent formation of cancerous cells. This paper utilizes a genetic algorithm based mathematical approach to determine the optimum change to induce to the nature of network regulatory rules to prevent formation of cancerous tumors.

2 - Elementary Diagnosis Based on the Patient's Symptoms

Toktam Khatibi, Tarbiat Modares University, Tehran, Iran, toktam@gmail.com, Mohammad Mehdi Sepehri

Sometimes, patients with the same disease may have different symptoms with different severities. So, finding the most relevant diseases to their symptoms is difficult. A linear programming model based on the fixed charge location model is introduced for this problem. A heuristic approach is introduced for solving this model.

3 - What Do We Really Spend on Prevention, and What is Missing from Our Calculations?

George Miller, Institute Fellow, Altarum Institute, 3520 Green Court, Suite 300, Ann Arbor, MI, 48105, United States of America, george.miller@altarum.org, Charles Roehrig, Paul Hughes-Cromwick, Ani Turner

We estimate the portion of the National Health Expenditure Accounts (NHEA) devoted to prevention activities. Our estimate that approximately 8.6% of NHEA expenditures are devoted to prevention is roughly three times commonly-cited values of 3% or less. We also summarize ongoing extensions of this work that expand the estimate beyond the NHEA and explore interactions in the cost effectiveness of alternative investments in prevention, treatment, and research to develop new interventions.

■ WD06

06- Fontaine Ballroom H

Healthcare Processes

Contributed Session

Chair: Ravi Kumar, FPM (Doctoral) Student, Indian Institute of Management, Lucknow, IIM, FPM Office, Prabandh Nagar, Off Sitapur Road, Lucknow, 226013, India, rshekharkumar@gmail.com

1 - Healthcare Services Productivity: The Effects of Interruptions and Forgetting

Craig Froehle, Associate Professor, University of Cincinnati, College of Business, 2925 Campus Green Drive, Cincinnati, OH, 45221-0130, United States of America, craig.froehle@uc.edu, Denise White

We examine how within-task interruptions, and the forgetting they induce, hamper productivity. Empirical data (from observing radiologists) seed a discrete-event simulation with varying levels of forgetting, interruption arrivals, and sequestering (blocking a resource from being interrupted). Using cost proxies, we evaluate trade-offs in service levels and overall system performance.

2 - When Efficiency Meets Flexibility in the Frontline Service Office – A Health Care Study

Ting Yu, Postdoctoral Research Fellow, University of Technology, Sydney, School of Marketing, BO 123, Broadway, Sydney, NSW, 2007, Australia, ting.yu@uts.edu.au, Ching-Fu Chen, Sigg Gudergan

Hospitals maintain their efficiency level at the expense of service quality, and nurses are often caught in the middle between meeting hospital demand for efficiency and meeting patient's requirement for being flexible. We provide psychological insights into how nurses cope with such a dilemma. We found that nurses' attitudes toward ambidexterity, social norms, and self-efficacy have a direct impact on their intention to achieve the dual goals of efficiency and flexibility. Whether their intention leads to individual ambidexterity appears to be moderated by the hospital control system.

3 - Exploring Relationships Among Marketing Effort, Health-related Lifestyle and Hospital Experience

Ravi Kumar, FPM (Doctoral) Student, Indian Institute of Management, Lucknow, IIM, FPM Office, Prabandh Nagar, Off Sitapur Road, Lucknow, 226013, India, rshekharkumar@gmail.com, Prem Purwar, Satyabhusan Dash, Shailendra Singh

The present study aims to assess the effects of marketing effort in creating unique, memorable and sustainable hospital experience for patients having different health-related lifestyle. Based on a literature review on marketing mix elements, customer experience and health-related lifestyle, and qualitative in-depth interviews with Indian patients the study proposes a causal framework of hospital brand experience in which marketing effort is antecedent to hospital brand experience and health-related lifestyle moderates the relationship between marketing effort and hospital brand experience.

■ WD07

07- Mont Royal

Case Studies

Contributed Session

Chair: Rukiye Numanoglu Tekin, Research Assistant, Baskent University, Eskisehir Yolu 20. Km, Baglica Kampusu Etimesgut, Ankara, 06810, Turkey, numanoglu@baskent.edu.tr

1 - Live, Open, Voluntary and Collaborative Mapping of Healthcare Delivery Networks

Benoit Montreuil, Professor, Université Laval, 2325, rue de la Terrasse, Pavillon Palasis-Prince, local 2642, Quebec, G1V0A6, Canada, benoit.montreuil@cirrelt.ulaval.ca, Moez Charfeddine, Vincent Augusto, Caroline Cloutier, Christelle Montreuil

Traditional mapping approaches do not satisfy the various dynamic and evolving needs of healthcare actors today. We present a novel approach for live, open, voluntary and collaborative mapping of healthcare delivery networks. This approach is illustrated via a Web-based mapping platform prototype to support the mapping of Québec's local healthcare networks (Canada). Our presentation will describe the architecture and the functionalities of the platform as well as our preliminary findings.

2 - Hospital Department Performance Evaluation using the PROMETHEE Multicriteria Methodology

Bertrand Mareschal, Professor, ULB, Bvd du Triomphe, CP210/01, Bruxelles, 1050, Belgium, bmaresc@ulb.ac.be, Jim Ilunga, Sarah Ben Amor

We propose to use the PROMETHEE and GAIA multicriteria methods in order to evaluate the performance of departments within a hospital based on data such as turnover, profit and resources used. PROMETHEE is used to identify best practices while GAIA helps the hospital management to identify strengths and weaknesses and to establish priorities and performance targets. Actual data from two Brussels hospitals are analyzed.

3 - Simulating the Hospital Length of Stay

Halil Kemal Ilter, Instructor, Baskent University, Eskisehir Yolu 20. Km, Baglica Kampusu Etimesgut, Ankara, 06810, Turkey, kilter@baskent.edu.tr, Rukiye Numanoglu Tekin

Since the length of stay (LOS) affects overall cost structure of health care services, modeling the LOS is becoming an important issue in the health policies. This paper presents the study of modeling LOS with a computer simulation approach to provide effective usage of bed capacities and to reveal situations about optimal allocation of resources in health care services. Population space of the analysis presented contains inpatients who stayed in cardiology departments of hospitals in Turkey. Paper delivers (1) the determination of effects of the bed capacity change on the LOS, and (2) the explanation of possible reduction of LOS by optimal utilization of bed capacities with a simulation model and several what-if scenarios.

■ WD08

08- Hampstead

Managing Surgical Capacity

Contributed Session

Chair: Mohammad Mehdi Sepehri, Tarbiat Modares University, Jalal-e Al-e Ahmad Highway, Tehran, Iran, mehdi.sepehri@modares.ac.ir

1 - Tabu Search Solutions for Operating Room Planning

Paolo Landa, PhD Student, Department of Economics and Quantitative Methods, University of Genova, Via Vivaldi 5, Genova, 16126, Italy, paolo.landa@yahoo.it, Roberto Aringhieri, Elena Tanfani, Angela Testi, Patrick Soriano

This work deal with the Operating Room (OR) planning and scheduling problem at a tactical level (i.e., weekly timetable and assignment among OR, days and specialties, and elective patients assignment to OR blocks), using a block scheduling approach. Firstly a MIP model is proposed to solve in a concise framework the proposed problem. The aim is maximizing the overall societal benefit, by reducing patients' waiting time cost and reducing hospital costs. Given the complexity of the problem we propose a metaheuristic solution approach mainly based on Tabu Search methodology. The results show the goodness of the algorithm proposed both in terms of solution quality and CPU time.

2 - Assignment and Scheduling of Cases in Operating Room (OR) under Uncertainty

Isabelle Beaulieu, PhD Student, HEC Montréal, 3000, chemin de la Côte-Sainte-Catherine, Montréal, QC, H3T 2A7, Canada, isabelle.2.beaulieu@hec.ca, Patrick Soriano, Michel Gendreau

OR managers must build schedules that maximize resources utilization while minimizing cancellations and overtime. In this work, a 4-steps approach is proposed. First, cases are assigned to a given day. Then, they are scheduled with different strategies, which are then evaluated through a simulation tool, allowing for feedback and rescheduling if needed. Uncertainty is taken into consideration implicitly through the load level of the schedule built and in the simulation step. Computational experiments performed on sixteen sets of data are used to compare the different strategies.

3 - Optimization of Surgery Scheduling in Teaching Hospitals

Mohammad Mehdi Sepehri, Tarbiat Modares University, Jalal-e Al-e Ahmad Highway, Tehran, Iran, mehdi.sepehri@modares.ac.ir, Somayeh Ghazalbash, Arezoo Atighehchian

In this research our aim is to build a novel model for maximizing the utilization of operating rooms in teaching or university hospitals. Using this model, we endeavor to allocate the required resources including operating rooms, surgeons, and assistant / resident / fellow surgeons to surgeries and also determine the sequence of surgeries within operating rooms and the start time of each surgery.

■ WD10

10- Westmount

Emergency Medical Services: Challenges and Models

Sponsor: Canadian Operational Research Society

Sponsored Session

Chair: Eman Almehdawe, PhD Candidate, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, ealmehda@gmail.uwaterloo.ca

1 - Advancing EMS and Traumatic Injury Patient Care

Oguzhan Ozlu, PhD Student, Georgia Institute of Technology, Atlanta, GA, United States of America, aozlu3@isye.gatech.edu, Eva Lee

This work is joint with the Georgia Trauma Care Network Commission. In this talk, we will describe our effort in developing a service investment analyzer (combinatorial optimization engine) and a trauma system simulator for decision and policy analysis. Systems modeling and simulation analysis of the statewide trauma care is critical for measuring, optimizing, and transforming the systems performance. The tools enable decision makers to perform the best investment of limited financial capital.

2 - Optimal Ambulance Location with Tiered Response Time Standards

Beth Jewkes, Professor, University of Waterloo, Waterloo, ON, Canada, emjewkes@uwaterloo.ca

The Province of Ontario plans to implement a new Land Ambulance response time standard in October 2012. The new standard has tiered response time targets that depend on the acuity of the patient whereas the current standard uses a single target. This talk examines the impact of the coming change for the Region of Waterloo, Ontario, Canada. A series of nonlinear mixed integer optimization models look at attainable coverage levels and optimal ambulance locations given specified resource levels.

3 - A Markovian Queueing Model for Ambulance Offload Delays

Eman Almehdawe, PhD Candidate, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, ealmehda@gmail.uwaterloo.ca, Beth Jewkes, Qiming He

Offload delays occur when ambulance paramedics arriving at a hospital Emergency Department (ED) cannot transfer care of the patient immediately. Using queueing theory, we model the interface between an Emergency Medical Services provider in a region, and an ED. We solve for the steady state probability distributions of queue lengths and waiting times using Matrix Analytic Methods. Moreover, we derive a number of performance measures used to evaluate the system.

■ WD12

12- Verdun

Policy Modeling Applications

Contributed Session

Chair: Cinzia Cirillo, Assistant Professor, University of Maryland, 1179 Glenn M Hall, College Park, MD, 21114, United States of America, cccirillo@umd.edu

1 - Cross-scale Prediction of Hemodynamic Instability Based on Arterial Pressure Self-similarity

Jue Wang, PhD Student, University of Toronto, Dept of Mechanical & Industrial Engineer, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, juewang@mie.utoronto.ca, Chi-Guhn Lee

In intensive care units, mean arterial pressure (MAP) is continuously monitored to detect life-threatening conditions such as hemodynamic instability. We propose a novel method for hemodynamic instability prediction exploiting the self-similarity of MAP time series. Using Haar's wavelet, the longitudinal prediction of MAP fluctuations in time domain is transformed into the hierarchical prediction of wavelet coefficients on a binary tree. Numerical studies based on real data show 94% average reduction in mean squared prediction error compared with existing method.

2 - Overcoming the Barriers: Getting Simulation used in Healthcare

Sally Brailsford, Professor, University of Southampton, School of Management, Southampton, SO17 1BJ, United Kingdom, s.c.brailsford@soton.ac.uk

This paper addresses the apparent failure of simulation modeling to become truly embedded within healthcare organizations. Despite numerous applications in the academic literature, very few journal papers report on model implementation and practical outcomes. This talk describes an innovative and practical attempt to overcome this problem.

3 - Econometric Models for Obesity Level Predictions

Cinzia Cirillo, Assistant Professor, University of Maryland, 1179 Glenn M Hall, College Park, MD, 21114, United States of America, cccirillo@umd.edu, Partha Lahiri, Jean Michel Tremblay

In the US, obesity affects a large part of the population and is demanding increasing resources from the health system. In this paper, discrete choice models in the form of ordered probit are applied to predict level of obesity in the population and to estimate the major factors affecting the propensity to be obese. The models are calibrated on NHIS data by using Bayesian estimation procedures. The methodology can be used by public health planners to identify factors that affect obesity and by health professionals to distinguish between two subgroups of population: normal and subject to obesity. Also, we explore the possibility to complete the NHIS data by merging it with other reliable sources of data.

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 Xu, Jie TA04
 Xu, Susan H. TD09
 Xu, Yang WC13

Y

Yadav, Prashant TC03, TC11, TD11
 Yadav, Prashant TB03
 Yaylali, Emine MA03
 Yom-Tov, Galit MD13
 Yoogallingam, Reena MD09
 Youm, Sekyoung TD05
 Young, Terry Poster Session
 Yu, Jiun-Yu WC09
 Yu, Ting WD06
 Yuan, Fan WB03
 Yuen, Ivan Poster Session

Z

Zacharias, Christos MD08
 Zafari, Zafar MD12
 Zaric, Greg TA09, TD09, TD12
 Zarrabi, Mahmood MB12
 Zayas Cab-n, Teresa MD01
 Zenios, Stefanos TA10, TC10, WD02
 Zenteno, Ana Cecilia WC12
 Zhang, Beilei WB05
 Zhang, Dan TB06
 Zhang, Jiang WA08
 Zhang, Shengfan MA04
 Zhang, Wenbo TA03
 Zhang, Yue TD02
 Zhang, Zhihai TC04
 Zheng, Kai Poster Session
 Zheng, Zhiqiang (Eric) MD05
 Zhu, Zhen TB02
 Ziedins, Ilze TC01
 Zinchenko, Yuriy WA04
 Ziya, Serhan TC06, TC07
 Zonderland, Maartje WA09

Monday, 8:30am – 10:00am

MA01	Aspects of Congestion in Health Care Systems I
MA02	OR in Practice I
MA03	Joint Session MDM/OR for Public Health: Public Health Emergency Response
MA04	Modeling for Medical Decision Making
MA05	Joint Session DM/OR for Public Health: Novel Approaches in Public Health Surveillance I: BioSense Program Redesign, Meaningful Use, and Syndromic Surveillance
MA06	Personnel Scheduling
MA07	Center for Healthcare Operations Improvement & Research: University of Twente, The Netherlands
MA08	Improving Patient Flow Through Optimized Scheduling
MA09	Capacity Management in Hospitals
MA12	Applications of Simulation to Health Care
MA13	Case Studies: Modeling Applications

Monday, 10:30am – 12:00pm

MB01	Panel Discussion: Collaboration of Healthcare Systems Academic Programs Through a New Alliance
MB02	Successful OR Applications in Health Care Practice
MB03	Joint Session MDM/OR for Public Health: Resource Allocation Models for Infectious Disease Control
MB03	Joint Session MDM/OR for Public Health: Resource Allocation Models for Infectious Disease Control
MB04	Stochastic Models for Medical Decision Making
MB05	Tutorial: Health Informatics
MB06	Health Care Operations Management
MB07	Resource Allocation and Staff Scheduling
MB08	Improving Patient Flow for Cancer Treatment
MB09	Application of Lean Methods to Improve Patient Flow
MB12	OR in OA: Osteoarthritis Examined Through OR Models
MB13	Queueing Models I
MB14	Public Health and Technology Studies

Monday, 1:00pm – 2:00pm

Poster Session

Monday, 2:00pm – 3:15pm

MC10	Plenary
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Monday, 3:30pm – 5:00pm

MD01	Panel Discussion: Research Funding Opportunities in Healthcare Operations Research
MD02	Healthcare Potpourri
MD03	Public Health, Emergency Response, and Medical Preparedness
MD04	Predictive Models of Health Outcomes Related to Obesity and Diabetes
MD05	Healthcare IT
MD06	Healthcare Operations Management

MD07	Patient Scheduling Methods
MD08	Patient Flow Management I
MD09	Capacity Management Decisions at Tertiary Hospitals
MD12	Stochastic Models I
MD13	Queueing Models II

Tuesday, 8:30am – 10:00am

TA01	Multi-objective Approaches to Policies and Resource Problems in Healthcare
TA02	Healthcare Delivery Systems
TA03	Joint Session ICS/OR for Public Health: Innovative Global Health Models
TA04	Integrating Patient Perspectives into Consumer and Clinical Decision-making
TA05	Data Mining at the Bedside I
TA06	The Use of Lean Management Techniques in the Hospital Sector
TA07	Healthcare Operations Management I
TA08	Optimal Resource Allocation
TA09	Disease Modeling
TA10	Models in Organ Transplantation
TA11	Healthcare-Product Supply-Chain Management I
TA12	Optimization of Radiation Therapy Treatment Plans
TA13	Modeling in Healthcare I

Tuesday, 10:30am – 12:00pm

TB01	Panel Discussion: Emerging Teaching and Degree Options in Healthcare Systems Engineering
TB02	Quantitative Decision Making in Long Term Care
TB03	Tutorial: Designing and Conducting Large-scale Randomized Experiments to Understand Health Care Delivery in Developing Countries
TB04	Population Analysis for Individualized Medical Decision Support
TB05	Where Health Informatics and Operations Research Meet
TB06	Healthcare Operation
TB07	Healthcare Operations Management II
TB08	Using Approximation Methods to Improve Patient Flow
TB09	Joint Session Pharm/OR for Public Health: Economic Evaluation of HIV Interventions
TB10	Organ Transplant Models
TB11	Healthcare-Product Supply-Chain Management II
TB12	Successful OR Applications in Inpatient Healthcare
TB13	Applications of M&S in Healthcare Management

Tuesday, 1:30pm – 3:00pm

TC01	Models for Healthcare System Improvement – Part I
TC02	Efficient Delivery of Home Health Care
TC03	Improving Public Health Supply Chains in Low Income Countries
TC04	Optimization in Rehabilitation and Orthopaedic Surgery
TC05	Data Mining in Healthcare
TC06	Patient Management
TC07	Appointment Scheduling with No-Shows
TC08	Patient Flow Management II
TC09	Joint Session Pharm/OR for Public Health: Infectious Disease Network Models

TC10	Panel Discussion: Challenges and Opportunities in Transplant Operations Research
TC11	Health Care Supply Chain
TC12	Applications of Optimization in Healthcare
TC13	Learning and Sequential Decision-making in Medicine

Tuesday, 3:30pm – 5:00pm

TD01	Models for Healthcare System Improvement – Part II
TD02	Long Term Care Modelling
TD03	Academic/Industry Collaboration Panel: Challenges in HealthCare: Marching Forward
TD04	Imaging based Medical Decisions
TD05	Case Studies: Unlocking the Value of Information
TD06	Scheduling Applications
TD07	Perspectives on Nurse Staffing
TD08	Case Studies: Capacity and Patient Flow Management
TD09	Modeling in Pharmaceutical Market
TD10	Transplant Modeling and Logistics
TD11	Operational Models of Drug Resistance
TD12	OR Applications in Healthcare
TD13	Modeling in Healthcare II

Wednesday, 8:30am – 10:00am

WA01	Healthcare Delivery Systems I
WA02	Novel Models of Healthcare Delivery
WA03	Joint Session HAS/OR in Public Health: OR and Public Health Policy
WA04	Radiation Therapy Optimization
WA05	Case Studies: Impact of Technology
WA06	Hospital Occupancy Planning
WA07	Day-of-Surgery Operations
WA08	Capacity Management and Productivity
WA09	Aspects of Congestion in Health Care Systems II
WA10	Ambulance Fleet Management
WA11	Healthcare Supply Chain Operations
WA12	Modeling and Optimization: Case Studies
WA13	Optimization Applications I

Wednesday, 10:30am – 12:00pm

WB01	Evaluating Performance in Healthcare Delivery
WB02	Incentives in Healthcare
WB03	OR in Global Health
WB04	Therapy and Treatment
WB05	Data Mining at the Bedside II
WB06	Surgery Planning and Scheduling
WB07	Transparency and Resource Allocation to Improve Effectiveness in the Perioperative Environment
WB08	Hospital Capacity Management
WB09	Tutorial: Healthcare Reform in Canada and US
WB10	Emergency Medical Service Operations
WB11	Healthcare Supply Chain
WB12	Markov Decision Processes
WB13	Optimization Applications II

Wednesday, 1:30pm – 3:00pm

WC01	Innovations and Improvements in Healthcare Delivery
WC02	Healthcare Strategy and Policy I
WC03	NSF Center for Health Organization Transformation – Projects and Purpose
WC04	Therapy and Treatment II
WC05	Healthcare Technology
WC06	Operating Room Scheduling and Predictive Models
WC07	Empirical Studies
WC08	Capacity Management Modeling
WC09	Process Improvement
WC10	EMS Operations
WC11	Matching Supply and Demand
WC12	Modeling under Robust Optimization Criteria
WC13	Simulation Studies

Wednesday, 3:30pm – 5:00pm

WD01	Comparative Effectiveness Studies
WD02	Healthcare Strategy and Policy II
WD03	Joint Session HAS/OR and Public Health: Pandemic and Vaccine Planning
WD04	Clinical and Policy Modeling
WD06	Healthcare Processes
WD07	Case Studies
WD08	Managing Surgical Capacity
WD10	Emergency Medical Services: Challenges and Models
WD12	Policy Modeling Applications

Transformation



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