



# UCL

## Clinical Operational Research Unit

Annual report

**2012**

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# The Team

## Professor Martin Utley

Martin joined CORU in 1996 with a PhD in high-energy physics and has since worked on a wide variety of problems in health and health care. Martin has honorary posts with Great Ormond Street Hospital and University College London Hospital and edits the journal Operations Research for Health Care.

## Dr Christos Vasilakis

Christos has qualifications in operational research and computer science and over ten years of experience as a researcher in health systems. Christos joined CORU in 2007 as a Principal Research Fellow and is currently working on projects related to hospital acquired infections and pharmacy.

## Professor Tom Treasure

Tom joined CORU following a long and successful career as a cardiothoracic surgeon. In his honorary role, Tom contributes his considerable experience and clinical knowledge to our work as well as conducting his own research to improve the evidence base for thoracic surgery.

## Mr Chris Sherlaw-Johnson

Chris spent many years at CORU, notably working on cervical cancer screening and monitoring clinical outcomes. He now leads a team within the surveillance division of the Care Quality Commission and is an Honorary Senior Research Fellow within the unit.

## Dr Christina Pagel

Christina joined CORU in 2005 after 3 years as a post-doctoral space-physicist in Boston. In 2008, she was promoted to Senior Research Fellow and began leading our work on global health. In addition to this, she is currently working on projects related to health protection policy and paediatric cardiac surgery.

## Dr Sonya Crowe

With a PhD in experimental condensed matter physics, Sonya worked for the Government Operational Research Service as a senior OR analyst at the Department of Health before joining CORU in 2009. She is working on projects related to health protection policy and clinical risk modelling. In 2013 she begins a Health Foundation Improvement Science Fellowship.

## Professor Steve Gallivan

With a PhD in pure mathematics, Steve started his OR career in traffic engineering before transferring his skills to health. He served as Director of CORU between 1995 and 2007, devoting his time since then to research. In 2009, Steve was awarded the Canadian Operational Research Society's Harold Lardner prize.

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# Example research projects in 2012

CORU conducts research on a wide range of topics. Some of the research projects that the unit was engaged in during 2012 are described below.

## Exploring strategies for reducing maternal and neonatal mortality in low income countries



We led a multi-region project combining data from 5 Asian trials to understand recent trends in birth practices in rural Asia. We also contributed to an important meta-analysis on community groups to tackle maternal and newborn deaths in low income countries, estimated levels of unattended births over the coming decade and promoted the use of graphical tools for monitoring population health outcomes.

See publications **8, 21, 30, 40**

## Forecasting demand for a cardiac intensive care unit



We developed and implemented a mathematical model for estimating demand for paediatric cardiac intensive care beds. The model is used to account for information about those

patients resident on the unit, planned surgical activity and historical patterns of emergency referrals. It is now being used daily by staff at Great Ormond Street Hospital.

## Mathematical analysis concerning the use of bridging technologies in heart transplantation programmes

We worked with surgeons, cardiologists and intensivists to address a number of questions raised by the availability of "bridging" technologies that can be used to prolong the life of some children awaiting heart transplantation. Bridging can increase the chance of an individual patient receiving a transplant and of a donated organ being used. However, these benefits need to be considered alongside the impact on other patients, the opportunity costs and the fact that, for some patients, this burdensome intervention will prove unavailing.

See publications **6, 9**

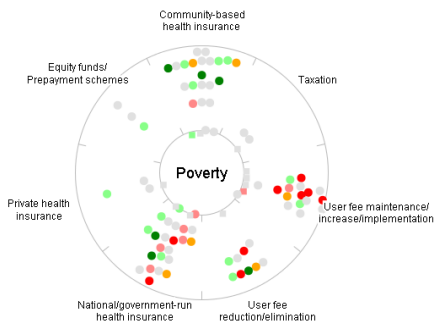
## Cancer prevalence in the UK



In work funded by Macmillan Cancer Support, CORU worked with colleagues at the Thames Cancer Registry to estimate and characterise cancer prevalence in the UK and to generate projections of cancer prevalence over the coming decades.

See publication **4**

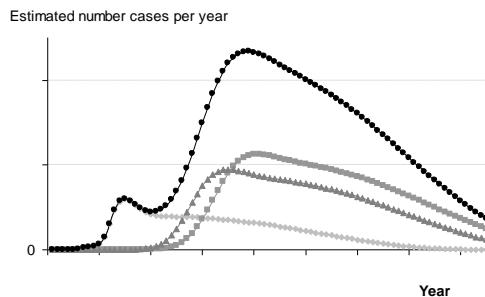
### Navigating the evidence on health financing options for low and middle income countries



We worked with colleagues at the UCL Centre for International Health and Development and Save the Children to review the published evidence on the impact and feasibility of different models of health financing. We then helped to develop a web based tool that will allow policy makers to explore and navigate the evidence generated by the literature review with respect to their own contexts and priorities.

See publication **24**

### Estimating the number of clinical cases of vCJD attributable to blood transfusion



As part of a responsive programme of work on Health Protection Policy for the Department of Health, we developed a simple modelling framework for estimating the number of vCJD cases attributable to transfusion of infective blood. The model has been used by DH

to explore the implications of different beliefs around the key unknowns in this complex problem and to gauge the potential impact of different counter-measures.

See publication **39**

### Risk-modelling in paediatric heart surgery

Audit and clinical governance in adult cardiac surgery have benefited greatly from the existence of a widely accepted model for the risk of peri-operative death and tools developed within CORU for monitoring risk-adjusted outcomes.

CORU worked with surgeons and intensivists at Great Ormond Street Hospital for Children and with the NICOR Congenital Database to develop a model for partial risk-adjustment of short-term surgical outcomes. We then piloted the use of the model in monitoring risk-adjusted outcomes at 3 centres.

See publications **20, 31, 32, 37**

### The surgical removal of pulmonary metastases

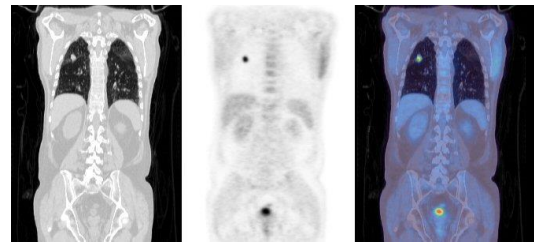


image courtesy of Dr Sally Barrington

The surgical removal of pulmonary metastases in patients with colorectal cancer has become common practice. We have been engaged in a programme of research to challenge the evidence cited in support of this practice and to provide better evidence as to whether surgery confers benefit that outweighs the harmful effects of the operation. This has culminated in the launch of a randomised controlled trial.

See publications **15, 17, 26, 29, 33, 36**

# Publications in 2012

Copies of all publications are available on request.

1. Utley M, Brown K, Tsang V (2012) Invited commentary. **Ann Thorac Surg** , 94 (5) 1602 - 1603. [10.1016/j.athoracsur.2012.07.003](https://doi.org/10.1016/j.athoracsur.2012.07.003).
2. Utley M, Peters M (2012) Bring on the geeks: the case for improved modelling of capacity requirements. **Arch Dis Child** , 97 (11) 933 - 934. [10.1136/archdischild-2012-302411](https://doi.org/10.1136/archdischild-2012-302411).
3. Vasilakis C, Pagel C, Gallivan S, Richards D, Weaver A, Utley M (2012) Modelling toolkit to assist with introducing a stepped care system design in mental health care. **Journal of the Operational Research Society** [10.1057/jors.2012.98](https://doi.org/10.1057/jors.2012.98).
4. Maddams J, Utley M, Moller H (2012) Projections of cancer prevalence in the United Kingdom, 2010-2040. **British Journal of Cancer** , 107 (7) 1195 - 1202. [10.1038/bjc.2012.366](https://doi.org/10.1038/bjc.2012.366).
5. Treasure T, Russell C, Morton D, Macbeth F, Utley M (2012) Surgical resection of lung cancer England: more operations but no trials to test their effectiveness. **Thorax** , 67 (9) 759 - 761. [10.1136/thoraxjnl-2012-202006](https://doi.org/10.1136/thoraxjnl-2012-202006).
6. Gallivan S, Crowe S (2012) A stochastic model associated with paediatric heart transplantation. **Health Systems** , 2 (1) 24 - 31. [10.1057/hs.2012.10](https://doi.org/10.1057/hs.2012.10).
7. Pepper J, Rega F, Petrou M, Mohiaddin R, Thornton W, Crowe S, Di Mario C, Lees B, Golesworthys T, Treasure T, Cardiovas (2012) Individualised external support of the Marfan aortic root using computer aided design and rapid prototyping to manufacture a customised implant: characteristics and follow up of the first 30 recipients. In: **European Heart Journal**. (pp. 504 - 504).
8. Pagel C, Prost A, Nair N, Tripathy P, Costello A, Utley M (2012) Monitoring mortality trends in low-resource settings. **Bull World Health Organ** , 90 (6) 474 - 476. [10.2471/BLT.11.092981](https://doi.org/10.2471/BLT.11.092981).
9. Crowe S, Pagel C, Bull K, Fenton M, Vasilakis C, Gallivan S, Utley M (2012) Using a mathematical model to assist with the management of paediatric heart transplant waiting lists: a case study. **IMA Journal of Management Mathematics**, 23 (2) 99 - 116. [10.1093/imaman/dpr006](https://doi.org/10.1093/imaman/dpr006).
10. Russell RC, Treasure T (2012) Counting the cost of cancer surgery for advanced and metastatic disease. **Br J Surg** , 99 (4) 449 - 450. [10.1002/bjs.8695](https://doi.org/10.1002/bjs.8695).
11. Sanders J, Keogh BE, Van der Meulen J, Browne JP, Treasure T, Mythen MG, Montgomery HE (2012) The development of a postoperative morbidity

- score to assess total morbidity burden after cardiac surgery. **J Clin Epidemiol** , 65 (4) 423 - 433. [10.1016/j.jclinepi.2011.11.004](https://doi.org/10.1016/j.jclinepi.2011.11.004).
12. Tan C, Treasure T, Utley M (2012) Reply to d'andrilli and rendina. **Eur J Cardiothorac Surg** , 41 (4) 969 - 970. [10.1093/ejcts/ezr097](https://doi.org/10.1093/ejcts/ezr097).
  13. Treasure T, Morton D (2012) GRIST: Growing Recruitment in Interventional and Surgical Trials. **J R Soc Med** , 105 (4) 140 - 141. [10.1258/jrsm.2011.110307](https://doi.org/10.1258/jrsm.2011.110307).
  14. Vasilakis C, Chausalet T, Baker R (2012) Part Special Issue on Quantitative Modelling in the Management of Health Care. **IMA Journal of Management Mathematics** , 23 (2).
  15. Treasure T, Fallowfield L, Lees B, Farewell V (2012) Pulmonary metastasectomy in colorectal cancer: the PulMiCC trial. **Thorax** , 67 (2) 185 - 187. [10.1136/thoraxjnl-2011-200015](https://doi.org/10.1136/thoraxjnl-2011-200015).
  16. Treasure T, Farewell V (2012) Minimization in interventional trials: great value but residual vulnerability. **J Clin Epidemiol** , 65 (1) 7 - 9. [10.1016/j.jclinepi.2011.07.005](https://doi.org/10.1016/j.jclinepi.2011.07.005).
  17. Treasure T (2012) The PulMiCC (Pulmonary Metastasectomy in Colorectal Cancer) trial. **Lung Cancer** , 75 S64 - S64.
  18. Treasure T, Pepper J, Golesworthy T, Mohiaddin R, Anderson RH (2012) External aortic root support: NICE guidance. **Heart** , 98 (1) 65 - 68. [10.1136/heartjnl-2011-301017](https://doi.org/10.1136/heartjnl-2011-301017).
  19. Zaher S, Mclean E, Treasure T, Cane P (2012) Are video-assisted thoracoscopic (VATS) pleural biopsies better than open pleural biopsies for diagnosing malignancy? **Lung Cancer** , 75 S17 - S17.
  20. Brown KL, Crowe SC, Pagel C, Bull C, Muthialu N, Gibbs J, Cunningham D, Utley M, Tsang VT, Franklin R (2012) Use of diagnostic information submitted to the United Kingdom Central Cardiac Audit Database: development of categorisation and allocation algorithms. **Cardiology in the Young** [10.1017/S1047951112001369](https://doi.org/10.1017/S1047951112001369).
  21. Crowe S, Utley M, Costello A, Pagel C (2012) How many births in sub-Saharan Africa and South Asia will not be attended by a skilled birth attendant between 2011 and 2015? **BMC Pregnancy Childbirth** , 12:4 [10.1186/1471-2393-12-4](https://doi.org/10.1186/1471-2393-12-4).
  22. Pagel C, Richards DA, Utley M (2012) A mathematical modelling approach for systems where the servers are almost always busy. **Comput Math Methods Med** , 2012 290360. [10.1155/2012/290360](https://doi.org/10.1155/2012/290360).
  23. Richards DA, Bower P, Pagel C, Weaver A, Utley M, Cape J, Pilling S, Lovell K, Gilbody S, Leibowitz J, Owens L, Paxton R, Hennessy S, Simpson A, Gallivan S, Tomson D, Vasilakis C (2012) Delivering stepped care: an analysis of implementation in routine practice. **Implement Sci** , 7; 3. [10.1186/1748-5908-7-3](https://doi.org/10.1186/1748-5908-7-3).



24. Skordis-Worrall J, Pulkki-Brännström AM, Utley M, Kembhavi G, Bricki N, Dutoit X, Rosato M, Pagel C (2012) Development and formative evaluation of a visual e-tool to help decision makers navigate the evidence around health financing. **JMIR Res Protoc** , 1 (2) e25 [10.2196/resprot.2173](https://doi.org/10.2196/resprot.2173).
25. Treasure T, Crowe S, Chan KM, Ranasinghe A, Attia R, Lees B, Utley M, Golesworthy T, Pepper J (2012) A method for early evaluation of a recently introduced technology by deriving a comparative group from existing clinical data: a case study in external support of the Marfan aortic root. **BMJ Open** , 2 (2) e000725. [10.1136/bmjopen-2011-000725](https://doi.org/10.1136/bmjopen-2011-000725).
26. Treasure T, Fiorentino F, Scarci M, Møller H, Utley M (2012) Pulmonary metastasectomy for sarcoma: a systematic review of reported outcomes in the context of Thames Cancer Registry data. **BMJ Open** , 2 (5) [10.1136/bmjopen-2012-001736](https://doi.org/10.1136/bmjopen-2012-001736).
27. Treasure T, Oligometastatic cancer: an entity, a useful concept, or a therapeutic opportunity? *J R Soc Med*. 2012 Jun;105(6):242-6. [10.1258/jrsm.2011.110279](https://doi.org/10.1258/jrsm.2011.110279).
28. Vasilakis C, Pagel C, Gallivan S, Barber N and Utley M (2012) Agent-based modelling and simulation in patient adherence to medication: a proof-of-concept study. In: Proceedings of the 6th Operational Research Society Simulation Workshop (SW12).

## Publications in 2013 and forthcoming

29. Grünhagen D, Jones RP, Treasure T, Vasilakis C, Poston GJ (2013) The history of adoption of hepatic resection for metastatic colorectal cancer: 1984-95. **Crit Rev Oncol Hematol** , 86 (3) 222 - 231. [10.1016/j.critrevonc.2012.10.007](https://doi.org/10.1016/j.critrevonc.2012.10.007).
30. Prost A, Colbourn T, Seward N, Azad K, Coomarasamy A, Copas A, Houweling TA, Fottrell E, Kuddus A, Lewycka S, MacArthur C, Manandhar D, Morrison J, Mwansambo C, Nair N, Nambiar B, Osrin D, Pagel C, Phiri T, Pulkki-Brännström AM, Rosato M, Skordis-Worrall J, Saville N, More NS, Shrestha B, Tripathy P, Wilson A, Costello A (2013) Women's groups practising participatory learning and action to improve maternal and newborn health in low-resource settings: a systematic review and meta-analysis. **Lancet** , 381 (9879) 1736 - 1746. [10.1016/S0140-6736\(13\)60685-6](https://doi.org/10.1016/S0140-6736(13)60685-6).
31. Crowe S, Brown KL, Pagel C, Muthialu N, Cunningham D, Gibbs J, Bull C, Franklin R, Utley M, Tsang VT (2013) Development of a diagnosis- and procedure-based risk model for 30-day outcome after pediatric cardiac surgery. **J Thorac Cardiovasc Surg** , 145 (5) 1270 - 1278. [10.1016/j.jtcvs.2012.06.023](https://doi.org/10.1016/j.jtcvs.2012.06.023).
32. Pagel C, Utley M, Crowe S, Witter T, Anderson D, Samson R, McLean A, Banks V, Tsang V, Brown K (2013) Real time monitoring of risk-adjusted paediatric cardiac surgery outcomes using variable life-adjusted display: implementation in three UK centres. **Heart** [10.1136/heartjnl-2013-303671](https://doi.org/10.1136/heartjnl-2013-303671).
33. Treasure T, Møller H, Fiorentino F, Utley M (2013) Forty years on: pulmonary metastasectomy for sarcoma. **Eur J Cardiothorac Surg** , 43 (4) 799 - 800. [10.1093/ejcts/ezs448](https://doi.org/10.1093/ejcts/ezs448).
34. Kotiadis K, Tako AA, Rouwette EAJA, Vasilakis C, Brennan J, Gandhi P, Wegstapel H, Sagias F, Webb P (2013) Using a model of the performance measures in Soft Systems Methodology (SSM) to take action: a case study in health care. **Journal of the Operational Research Society**, 64 (1) 125 - 137. [10.1057/jors.2012.21](https://doi.org/10.1057/jors.2012.21).
35. Tsang V, Utley M (2013) Re: Evaluation of the Aristotle complexity models in adult patients with congenital heart disease. **European Journal of Cardiothoracic Surgery**, 43 (1) 135 - 135. [10.1093/ejcts/ezs230](https://doi.org/10.1093/ejcts/ezs230).
36. Treasure T, Utley M (2013) Surgical removal of asymptomatic pulmonary metastases: time for better evidence. **BMJ** , 346:f824. <http://dx.doi.org/10.1136/bmj.f824>.
37. Pagel C, Brown K, Crowe S, Utley M, Cunningham D, Tsang V. (2013) A mortality risk model to adjust for case mix in UK paediatric cardiac surgery **Health Services Delivery and Research**, 1(1). [10.3310/hsdr01010](https://doi.org/10.3310/hsdr01010)

38. Treasure T, Utley M, O'Byrne K, MARS: a sense of perspective and an inconvenient truth. **J Thorac Oncol**. 2013 May;8(5):e48-9. [10.1097/JTO.0b013e318286c72b](https://doi.org/10.1097/JTO.0b013e318286c72b)
39. Crowe S, Bennett P, Daraktchiev M, Utley M (forthcoming) Use of modelling to inform public health policy: a case study on the blood-borne transmission of variant-CJD, **Journal of the Operational Research Society**
40. Roy S, Mahapatra R, Rath S, Bajpai A, Singh V, Rath S, Nair N, Tripathy P, Gope R, Costello A, Pagel C, Prost A, Improved neonatal survival after participatory learning and action with women's groups: a prospective study in rural eastern India, **Bull World Health Organ**: 91:426-433B 2013. [10.2471/BLT.12.105171](https://doi.org/10.2471/BLT.12.105171)

# Selected presentations 2012

Evaluating a stochastic model of short term bed demand, ORAHS 2012, University of Twente, Netherlands.

Data for Improvement, 26<sup>th</sup> Annual Meeting of the European Association for Cardiothoracic Surgery, Barcelona.

NIHR Health Services and Delivery Research programme, NIHR workshop on surgery research, London.

Clinical Operations Research: Modeling with Sparse Data, Singapore Health & Biomedical Congress, Singapore.

Agent Based Modelling and Simulation in Patient Adherence to Medication: A Proof of Concept Study, 6<sup>th</sup> OR Society Simulation Workshop, Worcestershire.

Monitoring Outcomes in Paediatric Heart Surgery, OR 54, Edinburgh.

In addition to conference presentations, Christina Pagel talked to London A-level students on studying mathematics at university and beyond.

# Working with the best: our collaborators

The contributions of our clinical collaborators and academic partners are essential to CORU's research. In 2012 we benefited in particular from collaborations with

Professor Nick Barber	School of Pharmacy
Professor Bryony Dean Franklin	Imperial College Healthcare NHS Trust
Professor Henrik Møller	Kings College London
Mr Jacob Maddams	Kings College London
Professor Dave Richards	The University of Exeter
Mr Victor Tsang	Great Ormond Street Hospital for Children
Dr Peter Wilson	University College London Hospital

Professor Anthony Costello	UCL Institute of Child Health
Dr Audrey Prost	UCL Institute of Child Health
Dr Kate Brown	Great Ormond Street Hospital for Children
Dr Kate Bull	Great Ormond Street Hospital for Children

Dr Matt Fenton	Great Ormond Street Hospital for Children
Professor Lesley Fallowfield	University of Sussex
Professor Vern Farewell	MRC Biostatistics Unit
Ms Carol Tan	St George's Hospital

Dr David Cunningham	NICOR congenital Database
Dr Peter Bennett	Department of Health
Dr Peter Grove	Department of Health
Dr Guy Walker	Department of Health
Dr Tom Barlow	Department of Health

## Our sources of funding

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