Defining Unmet Needs of Clinical Practice

Dr Elaine Dunwoodie

Clinical Research Fellow
Registrar in Medical Oncology

Leeds Institute of Cancer & Pathology, University of Leeds
Leeds Cancer Centre

Objectives

- Appreciation of complexity of clinical pathways
- A method of utilising routine clinical datasets to define clinical pathways
- Importance of defining baseline pathways to quantify innovation impact

Overview

- Worked Example
  - Extent of the clinical problem, neutropenic sepsis
  - Method of defining baseline clinical pathways
    - Routine clinical dataset
    - NETIMIS
  - The innovation
  - Visualising & quantifying where impacts realised

Cancer Statistics

- UK population projected to increase to 70 million by 2027
- Number people ≥ 80 years projected to double to 6 million by 2037
- ≥1/3 cancers diagnosed are in people 75 years and over
- 1 in 2 people in the UK born after 1960 will be diagnosed with cancer in their lifetime
- >1/3 patients diagnosed with cancer in UK each year receive chemotherapy, the true number increasing by 15% each year.

Source: Office for National Statistics, Cancer Resear

Chemotherapy Toxicity

- Nausea and vomiting, alopecia, diarrhoea, mucositis
- Myelosuppression and neutropenic sepsis
  - Medical emergency
  - Clinical review and blood count
  - Admission for IV antibiotics
- Prior to next cycle
  - Toxicity(neutropenia must resolve)

Contact St James's Institute of Oncology immediately if you experience any of the following:

- Temperature of 38°C or above for longer than an hou
- Feeling very unwell.
- Having the shivers.
- Any symptoms of an infection, for example, pain whe passing urine, coughing green/yellow phlegm, sore treatment line, rash.
- Being sick and not being able to keep any fluids down
- Severe diarrhoea.
- Spontaneous bleeding or bruising.
- Sore mouth that is painful.
- Inability to eat or drink.

If you have any of the above symptoms or are feeling seriously unwell please contact:
St James's University Hospital (0113) 243 3144 and ask for the Oncology Patient Enquiries Bleepholder.

Please note that this is only for patients experiencin side effects during or immediately following a cours of treatment (i.e. within 3 to 4 weeks).

General enquiries about appointments etc. should be directed to the appropriate department. For othe problems not related to your treatment, you should contact your GP.

Neutropenic Sepsis

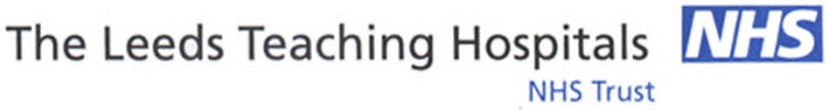
- Incidence febrile neutropenia dependent upon primary cancer site and chemotherapy regimen*.
  - high risk >20%
  - Intermediate risk 10-20%
  - low risk <10%

- Febrile neutropenia**
  - Median admission duration 5 days
  - Mean 9 days
  - Range of 1-60 days

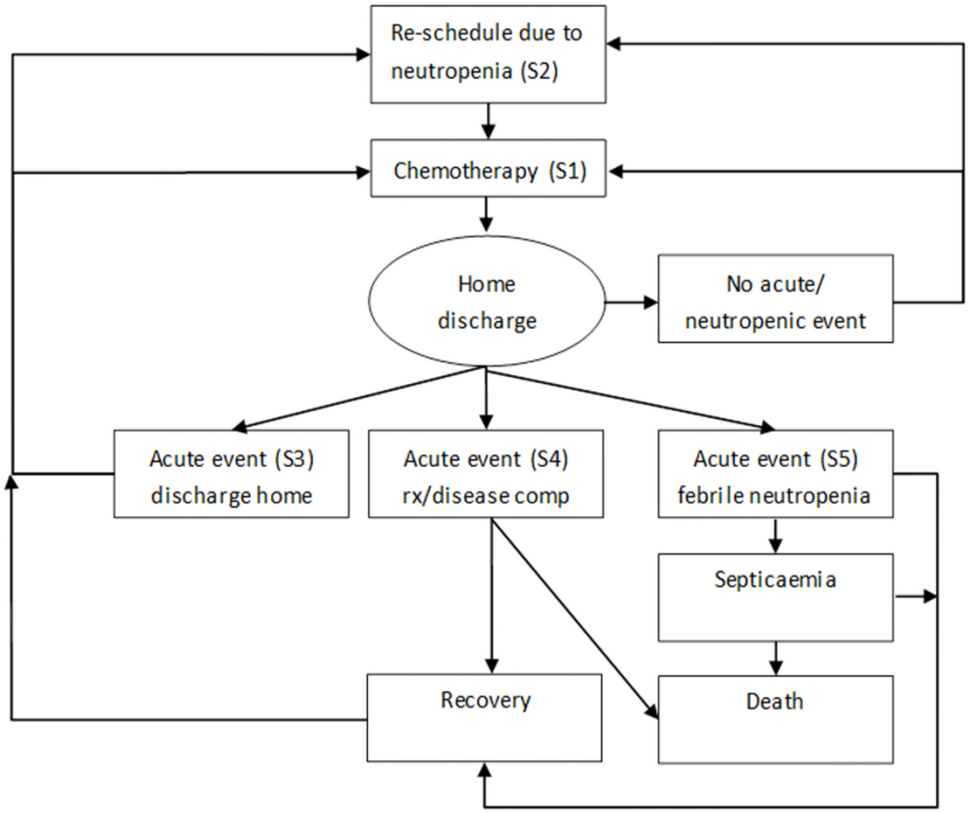
- Inpatient mortality rates of neutropenia complicated by sepsis range from 4.2% to 12.5%**.

*Aapro et al, European Journal of Cancer, 2011. **Oakley et al, Cancer Nursing Practice, 2010. Kuderer et al, Cancer, 2006. Courtney et al, Oncologist, 200

Worked Example

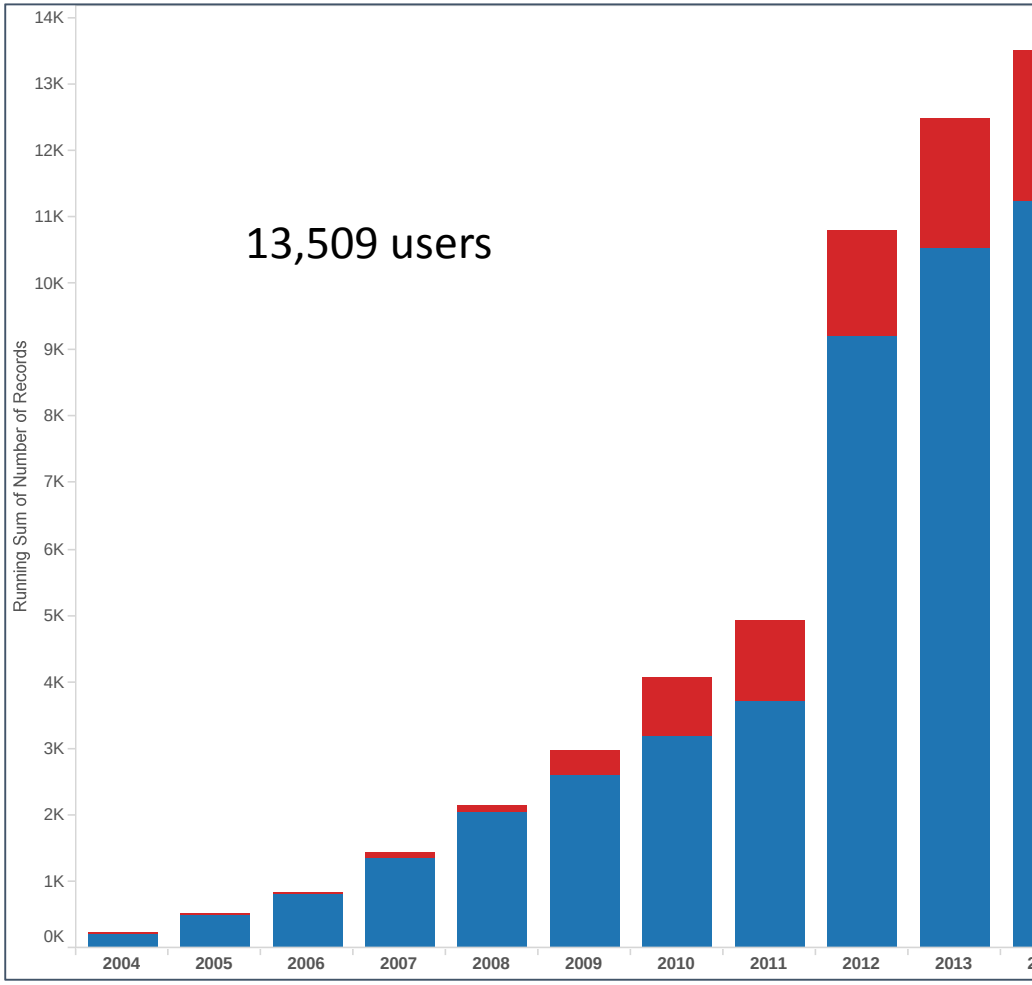


Assumed Clinical Pathways

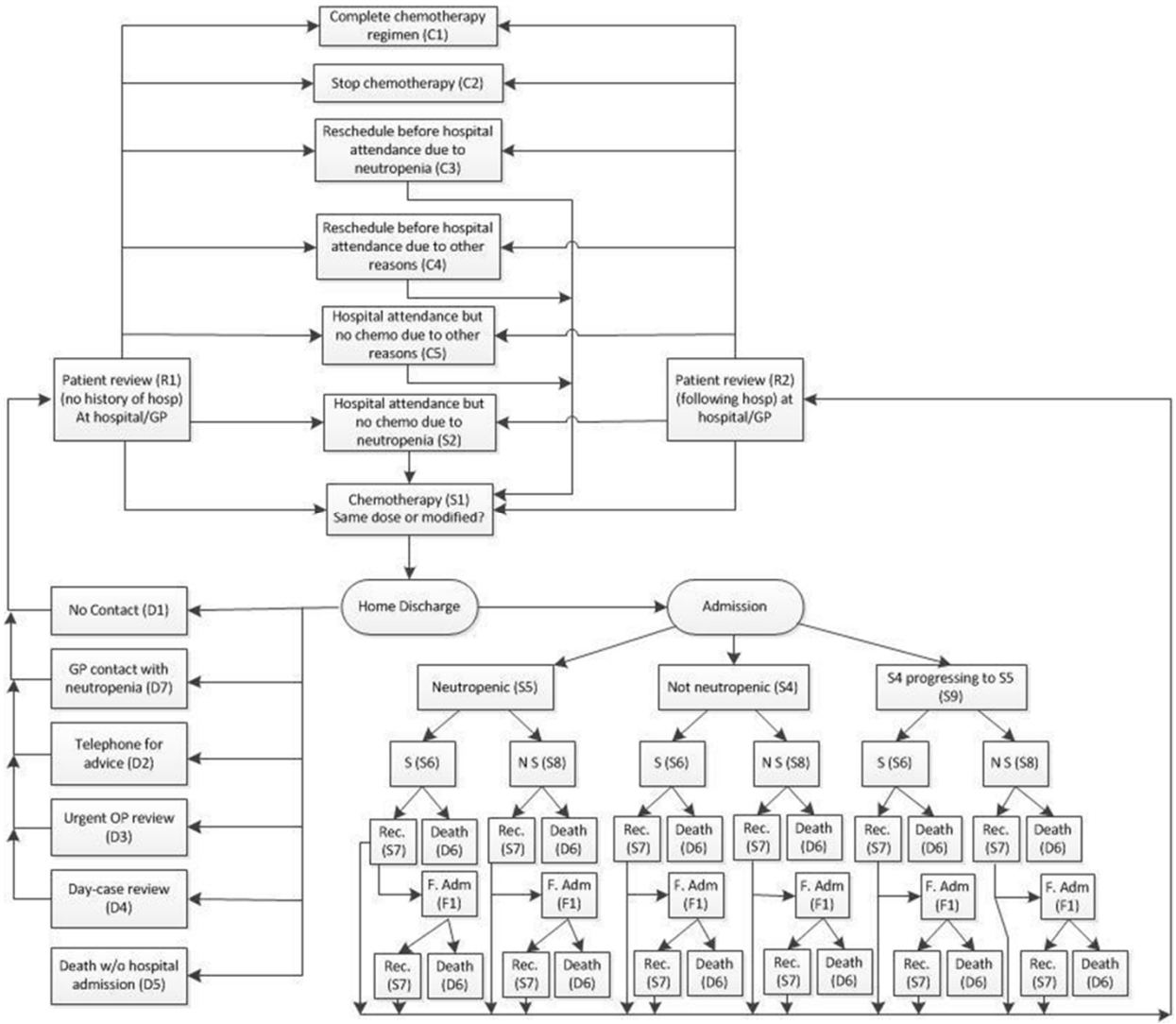


PPM+ Dec 2014

- 1.98 million patients
  - 43 million events
    - 17.5 million out-patient events
    - 3.3 million admissions
  - 65 million blood results
  - 2.9 million plain text annotations
  - 4.7 million plain text radiology reports
  - 578K plain text pathology reports
  - 543K diagnoses
  - 136K radiotherapy treatments
  - 278 K chemotherapy cycles



Better Understand Care Pathway



an we use real data to populate real pathways?

Philips Healthcare Solution

Minicare H-2000 consisti

WBC monitoring

Bluetooth linked thermon

Tele-communications hub

Patient reported outcome

Patient Self testing

e.g. Breast cancer:
6 cycles x 21 days
(4-6 months)

cologist prescribes WBC
me monitoring for "at risk"
tients.

The Oncology team reviews data from patient:
detects early signs of adverse events and intervene

Provides feedback to patient via the tele-hub and/or phone call:

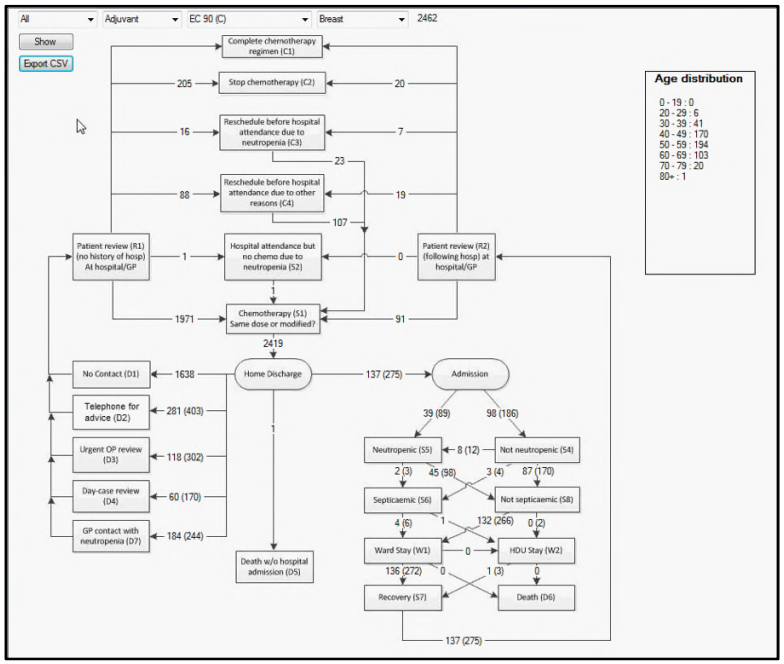
- Intervene with antibiotics (self?)
- Administer growth factors (nurse/ carer)
- Re-schedule next clinic (dose delay)
- Change next chemotherapy dose

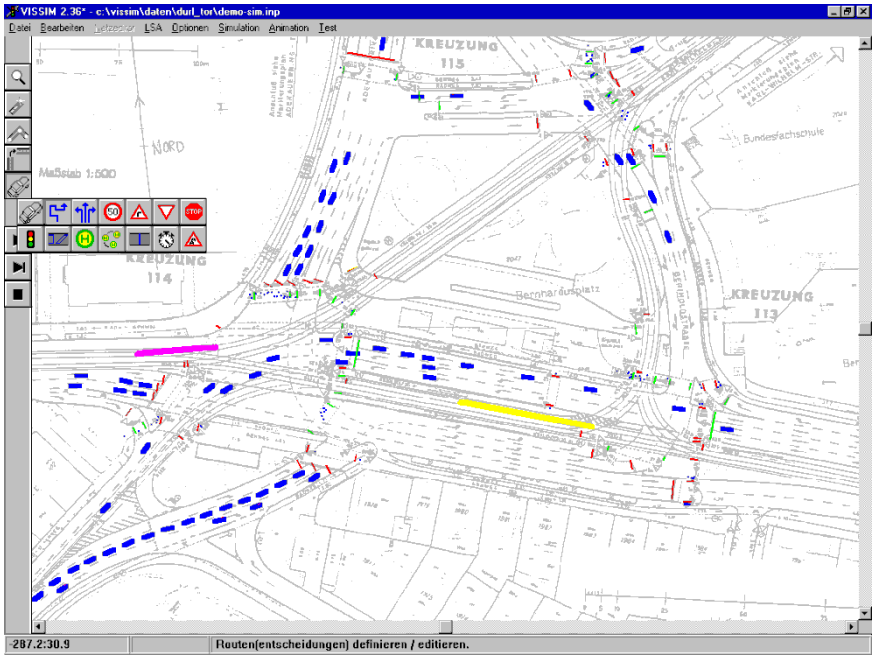
utine outpatient
pointment for
sessment and
escription of next
emotherapy cycle

NETIMIS

Network Tools for Intervention Modelling with Intelligent Simulation

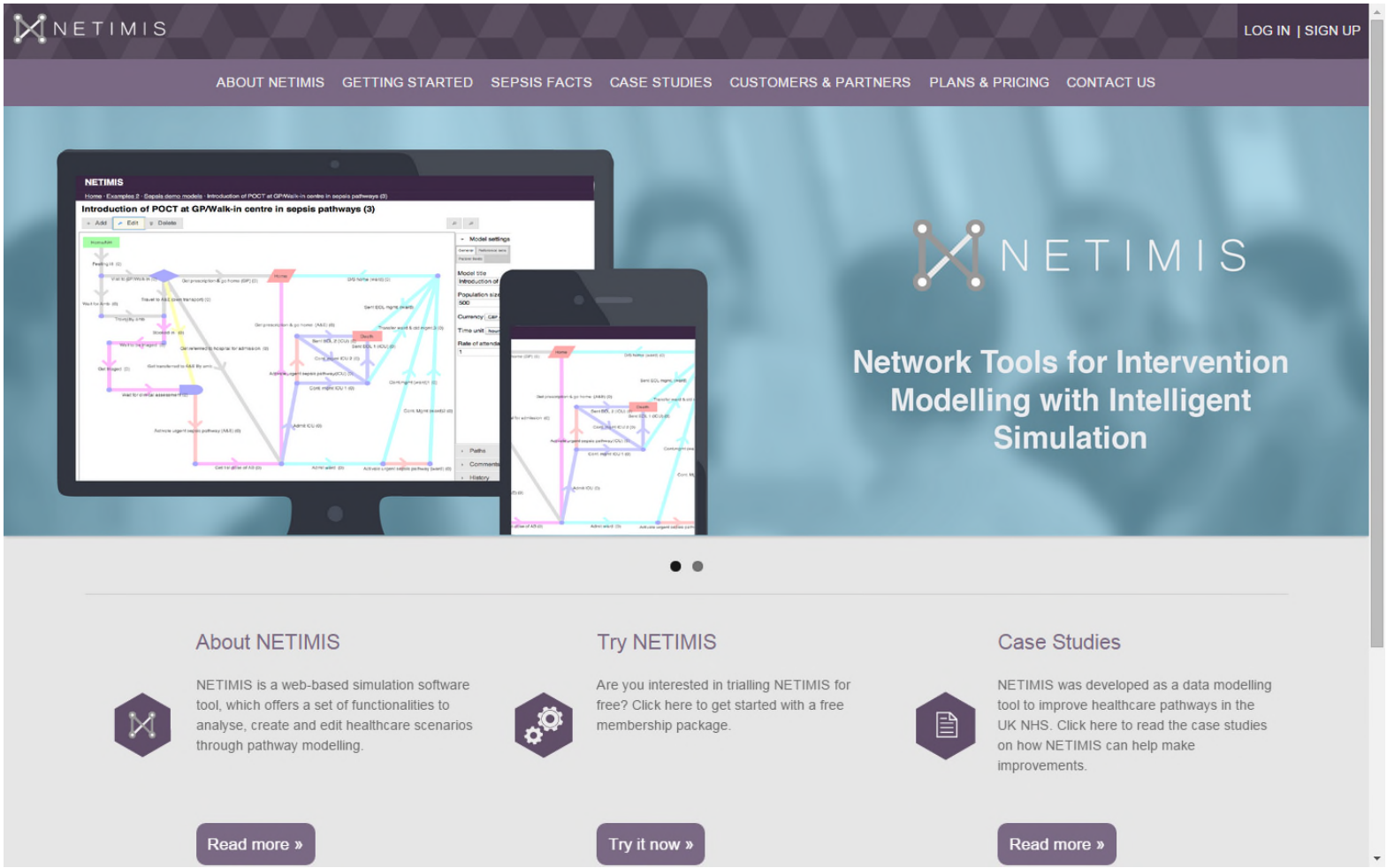
From traffic simulation to patient flows





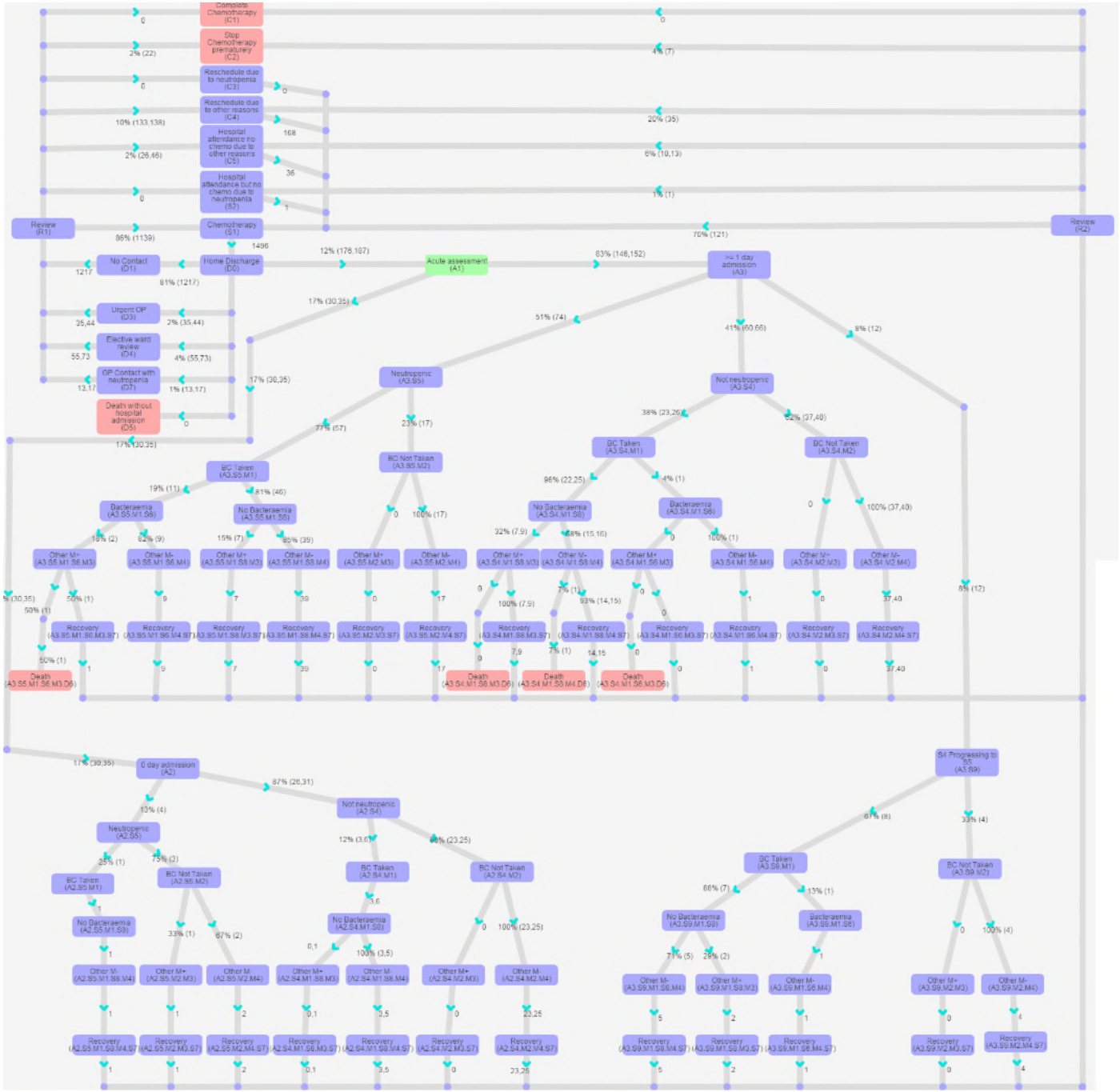
Source: Example of transport simulation software. http://www.its.leeds.ac.uk/projects/smartest/
Institute of Transport Studies, University of Leeds

NETIMIS

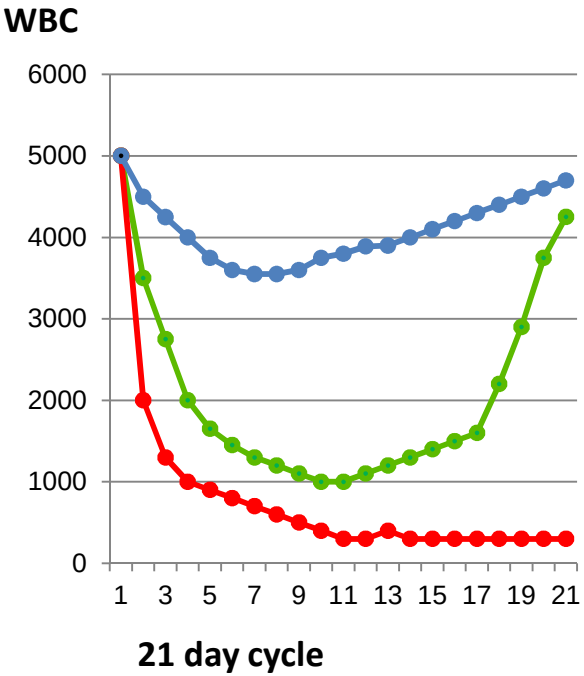


- Simulates patient flow
- Means to experiment with change
- Enables sharing of vis models of current and proposed pathways
- Can assign cost and ti at each action point

www.netimis.co.uk


Complete Chemotherapy (C1)
Stop Chemotherapy prematurely (C2)
Reschedule due to neutropenia (C3)
Reschedule due to other reasons (C4)
Hospital attendance no chemo due to other reasons (C5)
Hospital attendance but no chemo due to neutropenia (S7)
Chemotherapy (S1)
Review (R1)
Review (R2)
No Contact (D1)
Home Discharge (D0)
Acute assessment (A1)
>= 1 day admission (A3)
Urgent OP (D3)
Elective ward review (D4)
GP Contact with neutropenia (D7)
Death without hospital admission (D5)
Neutropenic (A3.S5)
Not neutropenic (A3.S4)
BC Taken (A3.S5.M1)
BC Not Taken (A3.S5.M2)
Bacteraemia (A3.S5.M1.S6)
No Bacteraemia (A3.S5.M1.S8)
Other M+ (A3.S5.M1.S6.M3)
Other M- (A3.S5.M1.S6.M4)
Other M+ (A3.S5.M1.S8.M3)
Other M- (A3.S5.M1.S8.M4)
Other M+ (A3.S5.M2.M3)
Other M- (A3.S5.M2.M4)
BC Taken (A3.S4.M1)
BC Not Taken (A3.S4.M2)
Bacteraemia (A3.S4.M1.S6)
No Bacteraemia (A3.S4.M1.S8)
Other M+ (A3.S4.M1.S6.M3)
Other M- (A3.S4.M1.S6.M4)
Other M+ (A3.S4.M1.S8.M3)
Other M- (A3.S4.M1.S8.M4)
Other M+ (A3.S4.M2.M3)
Other M- (A3.S4.M2.M4)
Recovery (A3.S5.M1.S6.M3.S7)
Recovery (A3.S5.M1.S6.M4.S7)
Recovery (A3.S5.M1.S8.M3.S7)
Recovery (A3.S5.M1.S8.M4.S7)
Recovery (A3.S5.M2.M3.S7)
Recovery (A3.S5.M2.M4.S7)
Recovery (A3.S4.M1.S8.M3.S7)
Recovery (A3.S4.M1.S8.M4.S7)
Recovery (A3.S4.M1.S6.M3.S7)
Recovery (A3.S4.M1.S6.M4.S7)
Recovery (A3.S4.M2.M3.S7)
Recovery (A3.S4.M2.M4.S7)
Death (A3.S5.M1.S6.M3.D6)
Death (A3.S4.M1.S6.M3.D6)
Death (A3.S4.M1.S8.M4.D6)
Death (A3.S4.M1.S6.M3.D6)
0 day admission (A2)
Not neutropenic (A2.S4)
Neutropenic (A2.S5)
BC Taken (A2.S5.M1)
BC Not Taken (A2.S5.M2)
No Bacteraemia (A2.S5.M1.S8)
Other M- (A2.S5.M1.S8.M4)
Other M+ (A2.S5.M2.M3)
Other M- (A2.S5.M2.M4)
BC Taken (A2.S4.M1)
BC Not Taken (A2.S4.M2)
No Bacteraemia (A2.S4.M1.S8)
Other M+ (A2.S4.M1.S8.M3)
Other M- (A2.S4.M1.S8.M4)
Other M+ (A2.S4.M2.M3)
Other M- (A2.S4.M2.M4)
Recovery (A2.S5.M1.S8.M4.S7)
Recovery (A2.S5.M2.M3.S7)
Recovery (A2.S5.M2.M4.S7)
Recovery (A2.S4.M1.S8.M3.S7)
Recovery (A2.S4.M1.S8.M4.S7)
Recovery (A2.S4.M2.M3.S7)
Recovery (A2.S4.M2.M4.S7)
S4 Progressing to S5 (A3.S9)
BC Taken (A3.S9.M1)
BC Not Taken (A3.S9.M2)
No Bacteraemia (A3.S9.M1.S8)
Bacteraemia (A3.S9.M1.S6)
Other M- (A3.S9.M1.S6.M4)
Other M+ (A3.S9.M1.S8.M3)
Other M- (A3.S9.M1.S6.M4)
Other M+ (A3.S9.M2.M3)
Other M- (A3.S9.M2.M4)
Recovery (A3.S9.M1.S8.M4.S7)
Recovery (A3.S9.M1.S8.M3.S7)
Recovery (A3.S9.M1.S6.M4.S7)
Recovery (A3.S9.M2.M3.S7)
Recovery (A3.S9.M2.M4.S7)

Where might the benefits be realised?



Sub-optimal dosing
Personalised therapy (3)

optimal status

Neutropenia and increasing risk of infection and sepsis:
- Hospitalisation/AE (2)
- Delayed therapy (1)

1. Scheduling:
- Missed clinics
- Wasted hospital/ clinic resource

2. Adverse events (AE):
- Emergency hospitalisations (5%)*
- Lengthy bed stays
- Sig. mortality- Neutropenic Sepsis (10%)
- Cost per episode

3. **Personalised treatment:**
- Over-treated or
- Under-treated

Impact on Patients:
- Wasted journeys & delayed treatment
- Lengthy waiting in out-patients
- Emergency Hospitalisations
- Morbidity
- Anxiety & Stress

*41K patient study, Kuderer et al, Cancer, 2006

Where might the benefits be realised?

1. In the pathway, directly for patients
   - Acute scenario
     - Reduce frequency and severity of adverse events
     - Reduce assessments which result in no change to management
     - Reduce other hospital contacts
   - Elective chemotherapy
     - Reduce wasted hospital journeys

2. Indirectly as a result of pathway changes
   - Reduce chemotherapy wastage & cancellation delivery slots
   - Reduce staff & consumable resource
   - Reduce transport costs to NHS & patients (car parking)
   - Reduce Anxiety

Summary

- Extent of the clinical problem, neutropenic sepsis
- Method of defining baseline clinical pathways
  - Routine clinical dataset
  - NETIMIS
- Modelling clinical pathways to visualise where impacts realised

Key Messages

- Awareness of complexity of clinical pathways
- A method of populating pathways with existing routine clinical data
- Importance of defining baseline pathways to quantify innovation impact
  - Enables identification of where there are unmet needs
  - Demonstrates how test might give value at different points in the pathway

Thank you

e.h.dunwoodie@leeds.ac.uk

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