System dynamics modeling on health care: supply and demand of dementia care

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System dynamics and dementia care

Topics

1. System dynamics in health care
2. Stakeholder participation in modeling
3. Modeling dementia care
4. Future steps
System dynamics in health care

Selected applications

• Epidemics (Kreutzer 1987; Roberts, 1989; Dangerfield 2001)
• National health care systems (Kim 1990; Ratanawijitrasin 1993; Hirsch et al. 2004)
• Hospital care (Au 1972; Baugh 1994), community care for chronic illness (Homer et al. 2004)
• Capacity planning (Wolstenholme 2005)
• Staff training (Jones 1978; Winch and Derrick 2006)

Applications in the Netherlands

• National health care costs (Verburgh 1994)
• Referral rates (Vennix et al. 1988; Vennix et al. 1990; Post and Vennix 1992)
• Dental health (Bronkhorst 1990)
• Capacity planning (Van der Sanden et al. 2004)

Special Interest Group of System Dynamics Society

Discussion meeting with health care practitioners at 2005 and 2006 conference
Stakeholder participation in modeling

1. Formation of management team
2. Analysis of trends in performance measures
3. Formulation of high-level map and population with data
4. Validation of structure and behavior
5. Testing of policy options

Diagram:
- New patients visiting family doctor
- Patients ending visit family doctor
- Referral rate
- Proposed intervention: reduce referral rate
- Proposed intervention: reduce referral rate
- Number of patients visiting medical specialist
- Patients ending visit medical specialist
- Number of new patients
- Load
- New patients ordered back
- Number of patients referred back to family doctor
Care offices want to increase their insight into long term developments in AWBZ (long-term and intensive) care

“Will newly constructed nursing homes be left vacant in the future?”

Increase insight into supply and demand of dementia care in nursing homes in the region Kennemerland
1. Formation of management team

- Nine participants from care offices, insurance organisation, infrastructure, Regional Assessment Board (RIO/ CIZ), health care training, nursing homes, research and consultancy
- Interviews, literature study, databases (e.g. CBS, ZOÏS), conference on assessment
- Workshop Oct 25, 2004 and workbook
- Presentation results March 21, 2005
2. Trends in performance measures (‘symptom’)

- Number of people aged 75+ expected to increase in region Kennemerland

- New infrastructure built recently
3. High-level map and data

- Three submodels: patient flow, personnel flow, infrastructure
- Most parameters estimated on the basis of literature and databases and checked with participant group
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Patient flow

- People in self-supply care
- People requesting care
- People in nursing homes
- People on waiting list receiving temporary care
- People in nursing homes

- Incidence dementia
- General
- Incidence ratio
- People aged +75
- Life-time expectancy self-supply care

- Change in perception waiting list pol
- Perceived demand in patients
- Standard delay
- Average time self-supply care
- Effect waiting time on time self-supply care

- People with indication other than nursing care
- Effect waiting time on request re-assignment
- Standard duration before request re-assignment
- Perception waiting list pol

- Indication period
- Indication percentage
- Assignment nursing care
- Assignment other care

- Re-assignment other care
- Re-assignment other care

- People requesting care
- Requests denied
- Requests to RIO

- People on waiting list receiving temporary care
- To nursing homes
- Average waiting time for nursing home

- Available capacity total
- Available capacity infrastructure
- Available capacity personnel

- Change in perception waiting list pol
- Perceived demand in patients

- Perceived waiting list pol
- Mortality waiting list

- Life expectancy
- Effect waiting time on request re-assignment
- Mortality 2

- Standard ratio nursing care
- Ratio assignment nursing care / other care

- Assignment time
- Available capacity infra

- Total demand
- Average care time

- Ending care
- Change in perception waiting list pol
- Policy makers

- Total effective supply care infrastructure
- Capacity personnel

- Time
- Effect waiting time on time self-supply care
- Effect waiting time on time self-supply care

- Standard duration before request re-assignment
- Standard delay
- Average time self-supply care
- Effect waiting time on time self-supply care
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Infrastructure

- approval time
- approval plans
- desired change in care infrastructure
- perception delay demand
- change in perception discrepancy demand - supply
- perception discrepancy demand - supply
- completion care infrastructure
- construction time
- total supply care infrastructure
- discrepancy demand - supply
- expected demand care infrastructure
- infrastructure per person
- desired care for people aged 75+
- number of people aged 75+
- <perceived demand in patients>
- duration outflow care infrastructure
- time to old care infrastructure
- ratio empty old care infrastructure
- ratio new / old care infrastructure
- life expectancy care infrastructure
- outflow care infrastructure
- prediction people aged 75+
- total effective supply care infrastructure
- ratio empty old care infrastructure
- total supply care infrastructure
- ratio new / old care infrastructure
- <perceived demand in patients>
4. Validation of structure and behavior (‘diagnosis’)

Structure and parameters checked against data

Baseline behavior close to reference mode and checked with participants

Inconsistency in data
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Incidence dementia

Waiting list

Patients in nursing homes

Infrastructure under construction
5. Testing of policy options

Option: Extra infrastructure (about 33% in 2005)
- People in nursing homes increases, waiting list decreases
- Increase people in nursing homes > decrease waiting list
- Shorter waiting time increases demand

Option and scenario: Extra infrastructure + preference for new infrastructure (about 30% old infra empty in 2012)
- Reverse effect: People in nursing homes decreases, waiting list increases
- Longer waiting time decreases demand
Conclusion - Will newly constructed nursing homes be left vacant in the future? (‘treatment’)

The model replicates historical data
The model provides insights into the system and enables scenario analysis
None of the scenarios shows long term vacancy
Negative feedback effect through waiting list compensates for increase in supply

Recommendation to Achmea is not to change policy of constructing new nursing homes
"I've got it, too, Omar ... a strange feeling like we've just been going in circles."
Future steps

System dynamics conference July 23 – 27, 2006 Nijmegen

See www.systemdynamics.org

Have started to develop a preliminary model of changes in Dutch health care system

Discussion with international group of health care experts and policy makers at conference