



CHIDS

Center for Health
Information and
Decision Systems

ROBERT H. SMITH SCHOOL OF BUSINESS
AT THE UNIVERSITY OF MARYLAND



WHITE
WORKSHOP ON
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**Reasoning and Decision Making in Health Care Management of
Diabetes Mellitus using as Framework Model Based Systems
Engineering**

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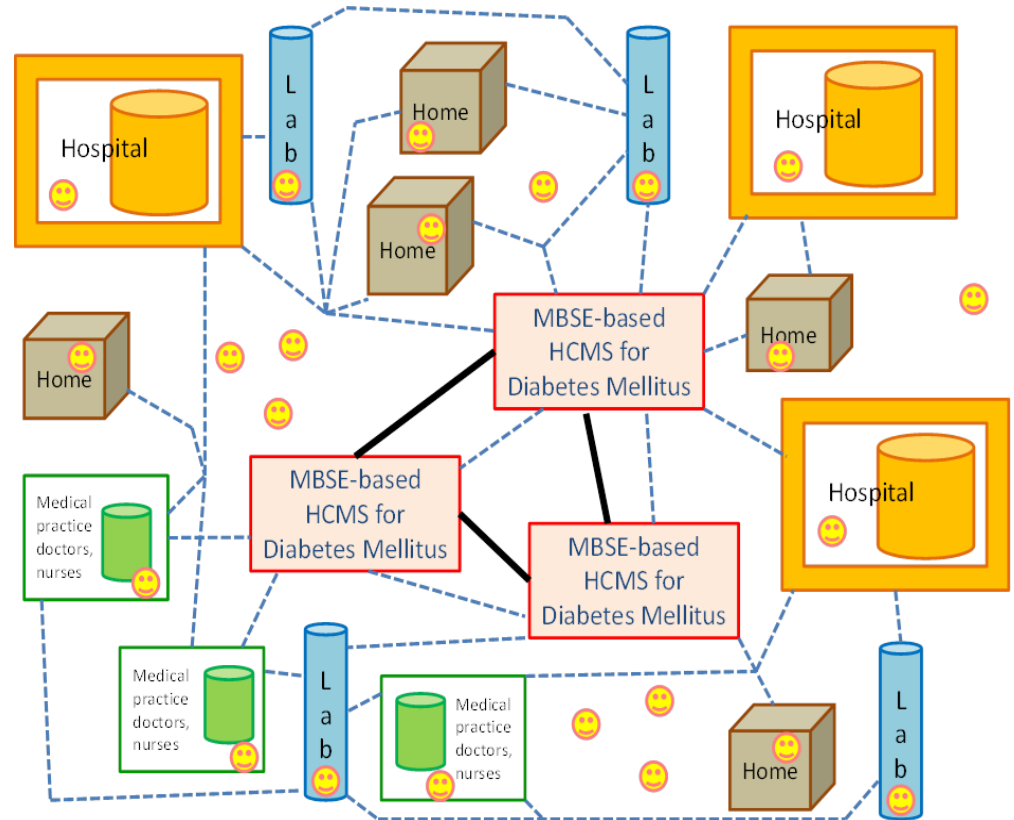
MBSE-based HCMS for diabetes mellitus

A framework using modern MBSE Diabetes Mellitus 2.

A network connectivity between agents.

A framework that is:

- ▶ Scalable
- ▶ Expandable
- ▶ With learning ability
- ▶ Linkable
- ▶ Measurable



Metrics: Health Care Quality and Cost

- **Health Care Quality** : $J_{hc}(i, m_i)$
- ▶ assigned to a specific time history (the m^{th}) for patient i

$$J_{hc}(i, m_i) = V_1^i * O_1^i(m_i) + V_2^i * O_2^i(m_i) + V_3^i * O_3^i(m_i)$$

- **Health Care Cost**

$$C_u^{total}(i, m_i) = \sum_{t=1}^{N_{T,\Delta}} C_u(u(t))$$

Total Cost of interventions for patient i for time period t

$$C_\mu^{total}(i, m_i) = \sum_{t=1}^{N_{T,\Delta}} C_\mu(\mu(t))$$

Total Cost of diagnostic for patient i for time period t

$$C^{total}(i, m_i) = C_\mu^{total}(i, m_i) + C_u^{total}(i, m_i)$$

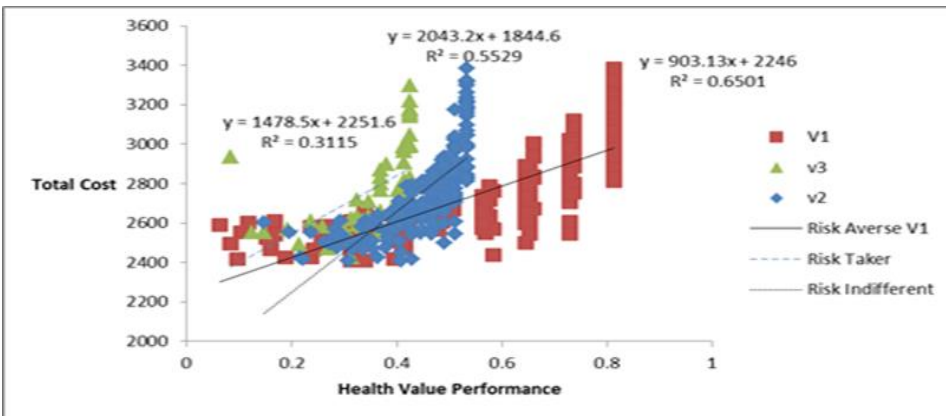
In these sums, the tests and interventions used at each time step of a time history are considered



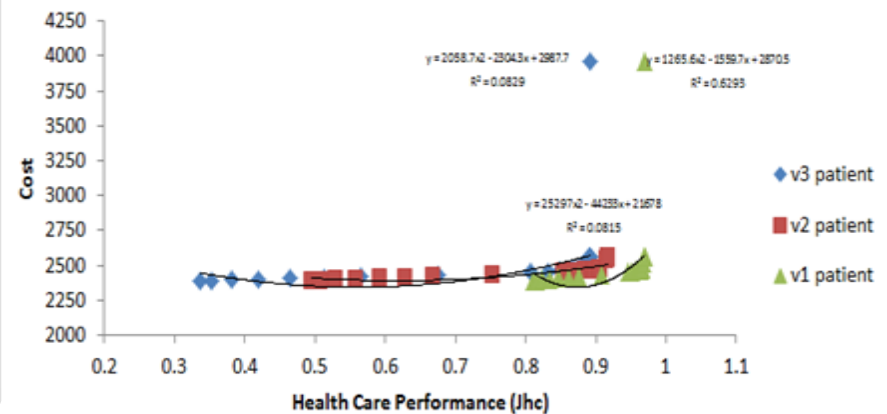
Trade-off analysis using different computational methods and comparisons

Running EMCS (Exhausted Monte Carlo Simulation) with two metrics for 10,000 patients and 32 runs, took a total of 783 sec. Running ECMS with three metrics for 100,000 patients and 9 runs. FOMCO-SN much faster!

Method Name	Function Name	Computing Time
ECMS (Cost, Performance)	Main	1,384.996 sec
	Monte Carlo (random variables generator)	867.597 sec
FOMCO-SN	Main	2.009 sec
	Monte Carlo(random variables generator)	1.336 sec



EMCS



FOMCO-SN

Examples of trade off questions

Type of patient	Improvement between states a to b	Type of test	Times of intervention used in the therapy	Times of improvement	Efficiency
Risk averse	2 to 1	2	769	80	10%
Risk averse	3 to 2	1	741	35	5%
Risk indifferent	2 to 1	1	690	89	13%
Risk indifferent	3 to 2	3	503	21	4%
Risk indifferent	3 to 1	1	690	12	2%
Risk indifferent	3 to 1	3	503	9	2%
Risk taker	2 to 1	1	689	87	13%
Risk taker	3 to 2	2	681	27	4%
Risk taker	3 to 2	3	493	22	4%
Risk taker	3 to 1	1	689	14	2%
Risk taker	3 to 1	2	681	13	2%
Risk taker	3 to 1	3	493	10	2%

Evaluation of diagnostic test for specific improved health state transitions, for each patient type

Evaluation of intervention for specific improved health state transitions, for each patient type

Type of patient	Improvement between states	Type of intervention	Times intervention was used in the therapy	Times of improvement	Efficiency
Risk averse	2 to 1	8	28	1	4%
Risk averse	3 to 2	6	680	34	5%
Risk averse	3 to 1	7	131	4	3%
Risk indifferent	2 to 1	8	26	1	4%
Risk indifferent	3 to 2	6	672	30	4%
Risk indifferent	3 to 2	7	128	5	4%
Risk indifferent	3 to 1	6	672	16	2%
Risk indifferent	3 to 1	7	128	3	2%
Risk taker	3 to 2	6	680	34	5%
Risk taker	2 to 1	8	28	1	4%
Risk taker	3 to 1	6	680	34	5%

