Towards Improving Modeling and Simulation of Clinical Pathways: Lessons Learned And Future Insights

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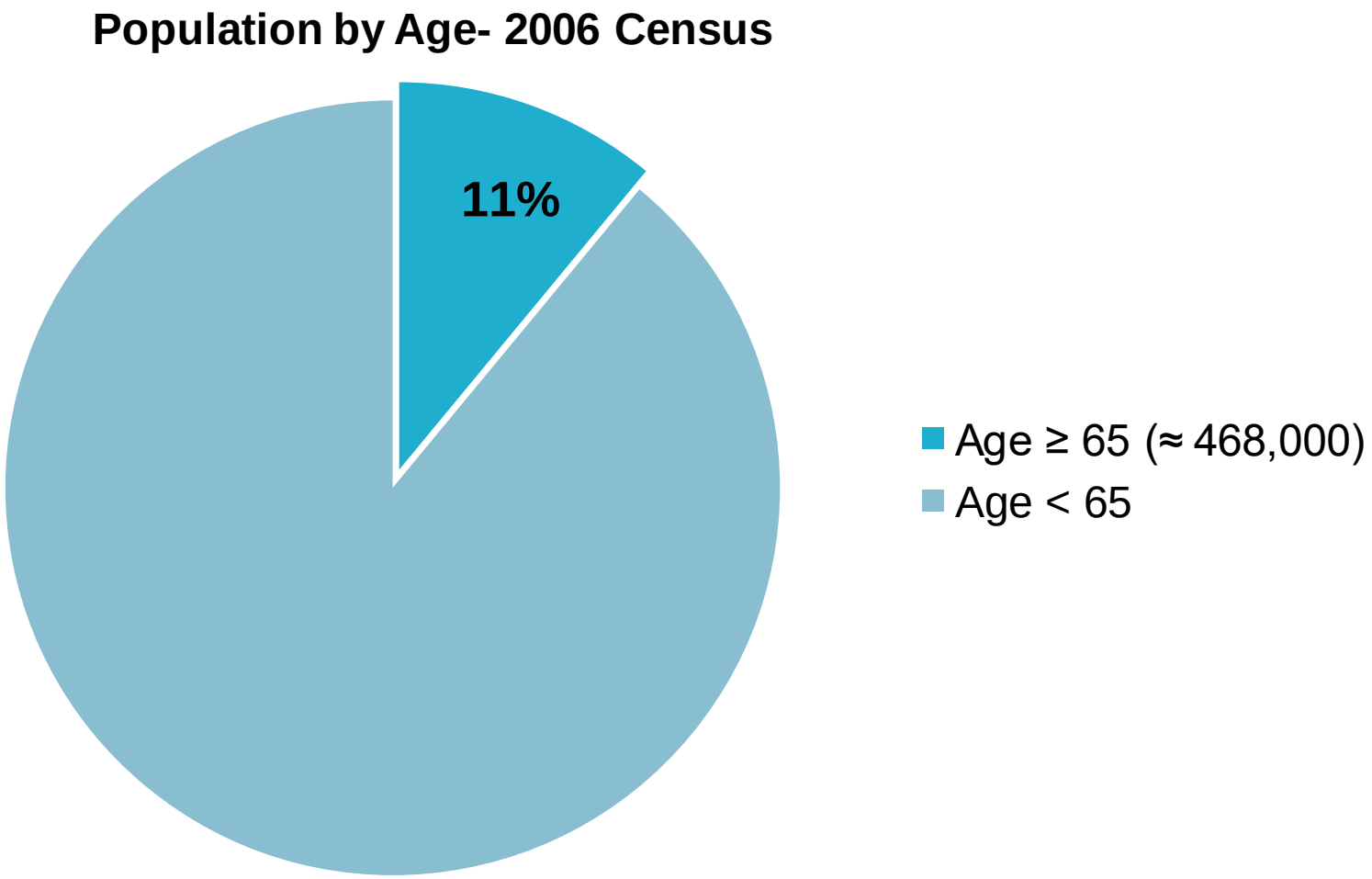
INTRODUCTION

AFFINITY Project – Ireland

- **AFFINITY** (**Activating Falls and Fracture Prevention in Ireland Together**) program, overseen by the State Claims Agency and the HSE (Health Service Executive) in Ireland.

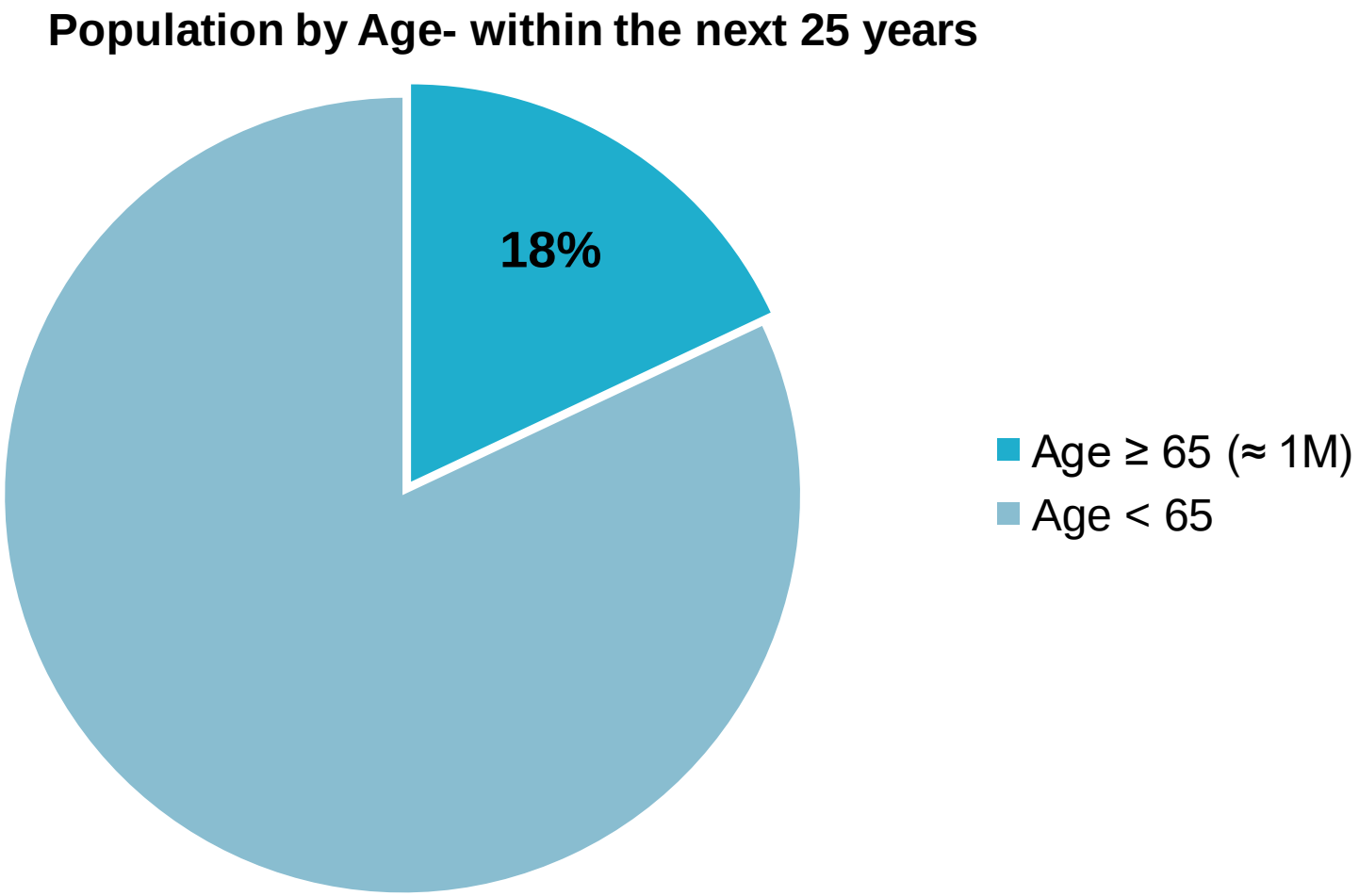
  http://www.affinityfallsbonehealth.ie

Ireland's Aging Population



Source : HSE Report "Strategy to Prevent Falls and Fractures in Ireland's Ageing Population", June 2008

Ireland's Aging Population



Source : HSE Report "Strategy to Prevent Falls and Fractures in Ireland's Ageing Population", June 2008

Research Goal

- Modeling the components necessary for a nation-wide healthcare strategy on a **population basis**, particularly for fall-related injuries and hip fracture care.

Modeling Approach

- **Clinical Pathways**-driven models in order to provide a multi-perspective modeling approach spanning clinical, demographic and financial aspects of healthcare services.

What is a Clinical Pathway (CP)?

- A **management plan** that displays **goals** for patients and provides the **sequence** and **timing** of actions necessary to achieve these goals with optimal efficiency.

Source: Pearson, Steven D., Dorothy Goulart-Fisher, and Thomas H. Lee. "Critical pathways as a strategy for improving care: problems and potential." Annals of internal medicine 123, no. 12 (1995): 941-948.

What is a Clinical Pathway (CP)? (cont'd)

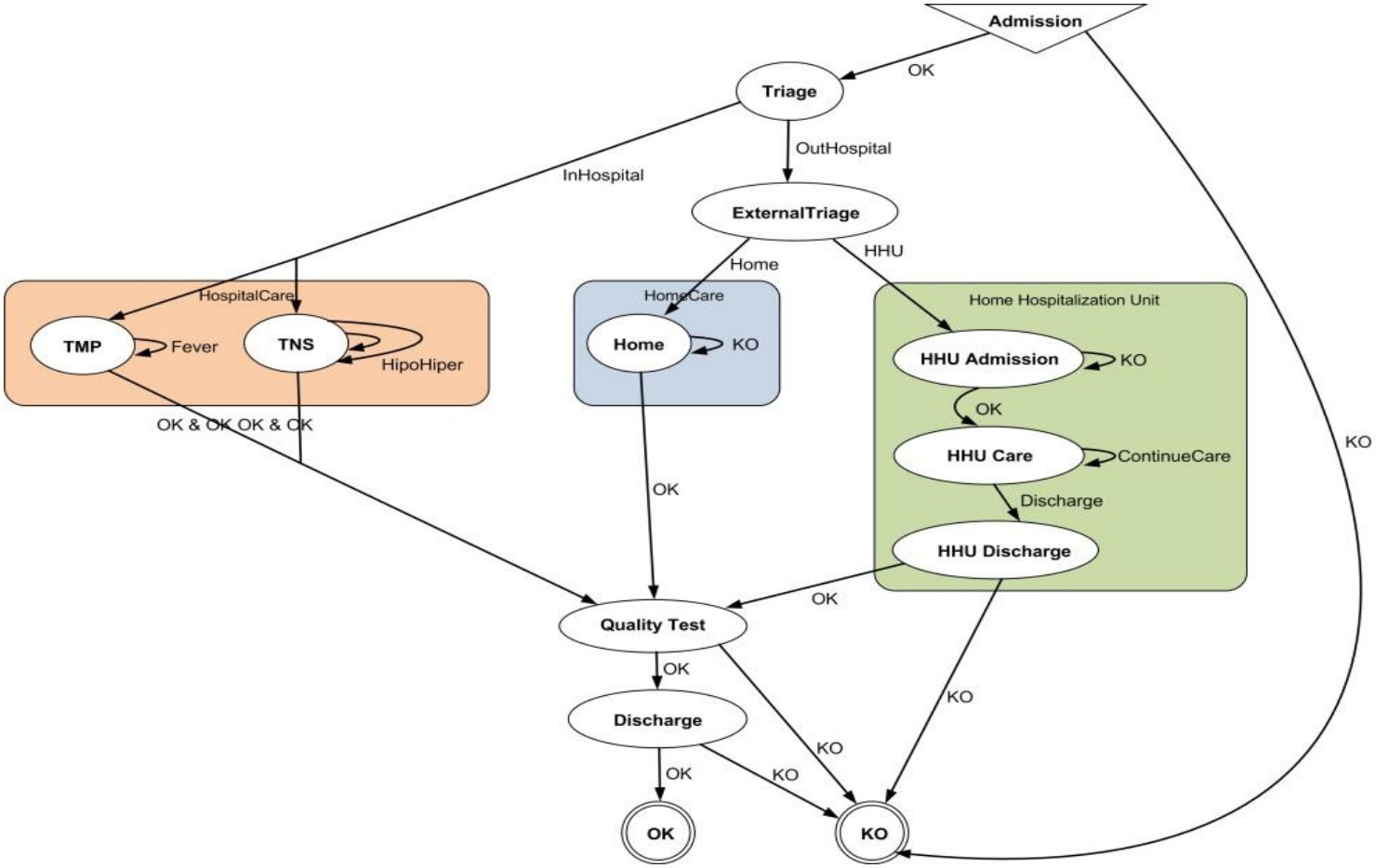


Figure 1: Example of a clinical Pathway

Image Source: http://www.intechopen.com/books/risk-management-current-issues-and-challenges/integrated-and-personalised-risk-management-in-the-sensing-enterprise

Exploratory Questions

1) What are the modeling methodologies used to conceptually model CPs?
2) Are there formal standards for modeling CPs?
3) What types of semantic-based models were developed for CPs?
4) Is there a form of standardised ontology developed for CPs?
5) What are the implications of CPs modeling approaches for building simulation models?

LITERATURE REVIEW METHODOLOGY

Systematic Literature Review on M&S of CPs

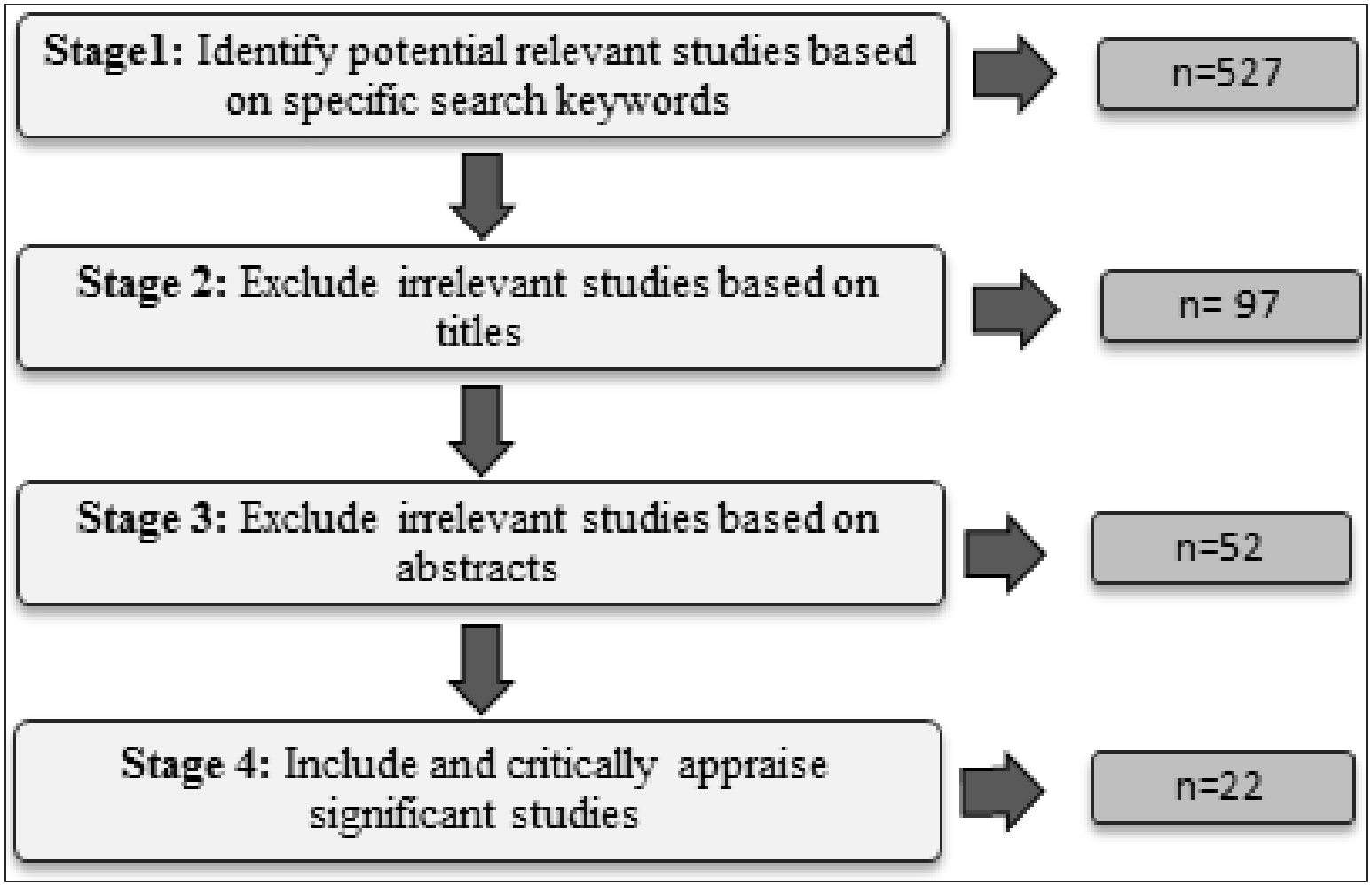


Figure 2: Literature Review Stages

Additional Affirmative Exemplars

- How can CPs modeling avail of potentially applicable approaches or methods from other matured business-oriented sectors?

- Affirmative exemplars from supply chains are invoked in line with some of the proposed directions in line with some of the proposed directions.

PROPOSED DIRECTIONS

1. Development of Conceptual Reference Model

- *"Simulation modeling is both art and science with conceptual modeling lying more at the artistic end"* (Shannon et al.1976).
- Literature obviously lacks a formal modeling structure of CPs.
- Diverse approaches exist in the area of conceptual modeling with respect to CPs.
- Apart from few studies (Michalowski et al.2006; Zhang et al.2008), they are best described as case studies.
- In addition to a pronounced multiplicity of concepts, terms and relationships within developed CPs models,

Shannon, Robert, and James D. Johannes. "Systems simulation: the art and science." Systems, Man and Cybernetics, IEEE Transactions on 10 (1976): 723-724.

Affirmative Exemplar from Supply Chains

- The SCOR (Supply Chain Operations Reference) model (Bolstorff 2007), regarded as one of the most widely accepted and shared reference models for supply chains.

Further Investigation:

- Can the SCOR model be used as a “bridge” for modeling CPs on a standard basis?

2.Multi-Perspective Modeling

- To adequately depict operational and clinical features of CPs, a multi-perspective modeling approach should be embraced.

- Particularly, CPs models should incorporate clinical, operational, financial and demographic information.

- The multi-perspective modeling of CPs can facilitate integration within Clinical Decision Support System (CDSS).

3.Generic Semantic-based Modeling

- The semantic formalisation of CPs knowledge is inevitable to attain CPs-aware healthcare systems.
- Semantic-based models should be able to represent CPs in terms of:
  - Common concepts and terms of the medical domain.
  - Structural and temporal relationships within processes/activities.
  - Variance-related representation.
  - Contextual data that characterise a specific clinical process or activity.

4. Adoption of Linked Data Concepts

- There has always been a dilemma of process multi-ownership and plurality of stakeholders in healthcare.
- Management of a patient's health involves dealing with a number of **inter-related CPs.**
- The presence of "comorbidity" through treatment schemes is an additional challenge for CPs modeling.
- **Can CPs avail of Linked Data practices to tackle above-mentioned challenges?**

Adoption of Linked Data Concepts (cont'd)

- We argue that knowledge within CPs can be best conceptually conceived as Linked Data models.
- Particularly, the **network-based** and **context-intensive** characteristics of CPs information make it feasible to take advantage of the Linked Data concepts and principles.

4. Adoption of Linked Data Concepts (cont'd)

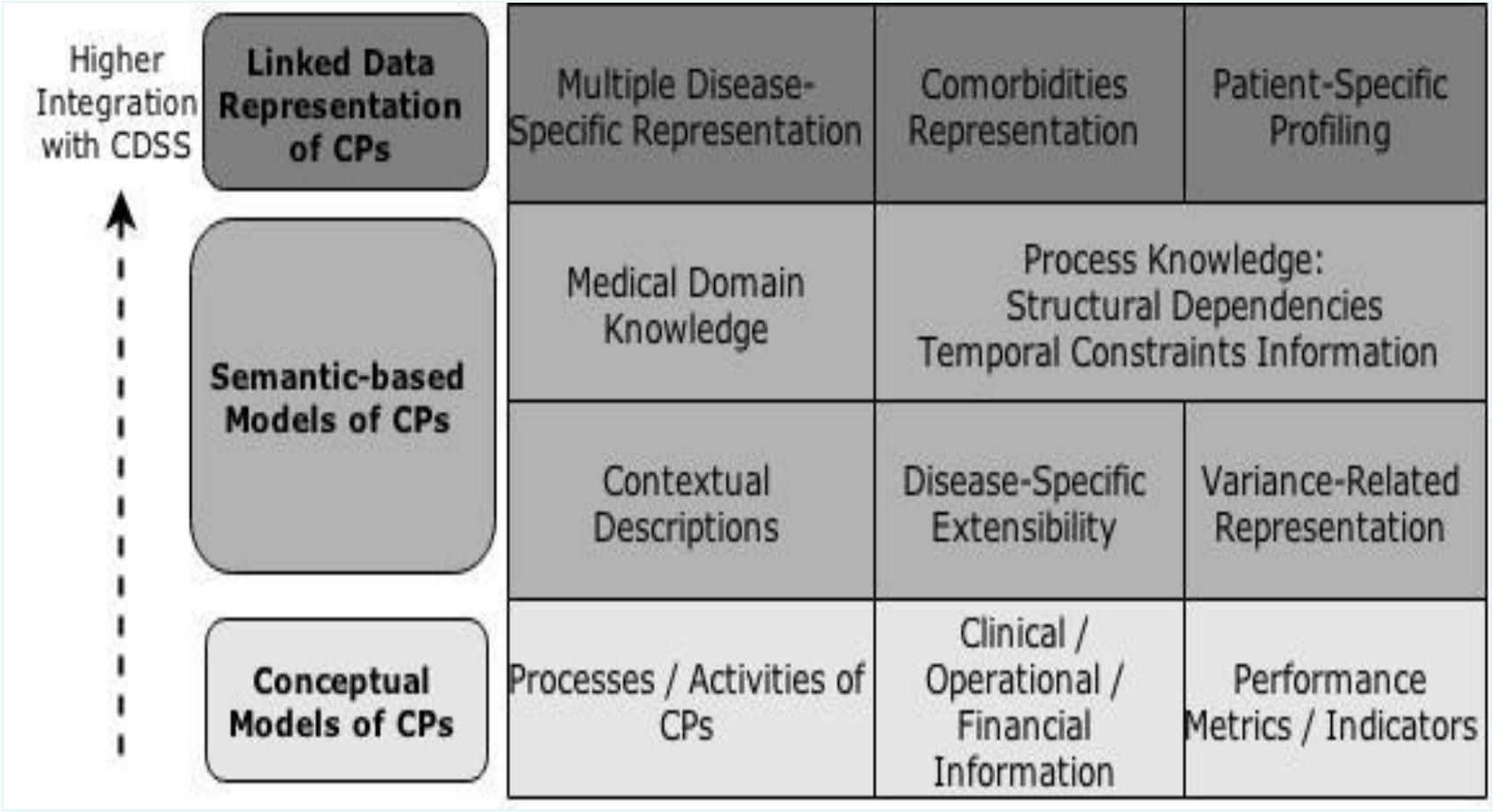


Figure 3: Knowledge stack of CP Models

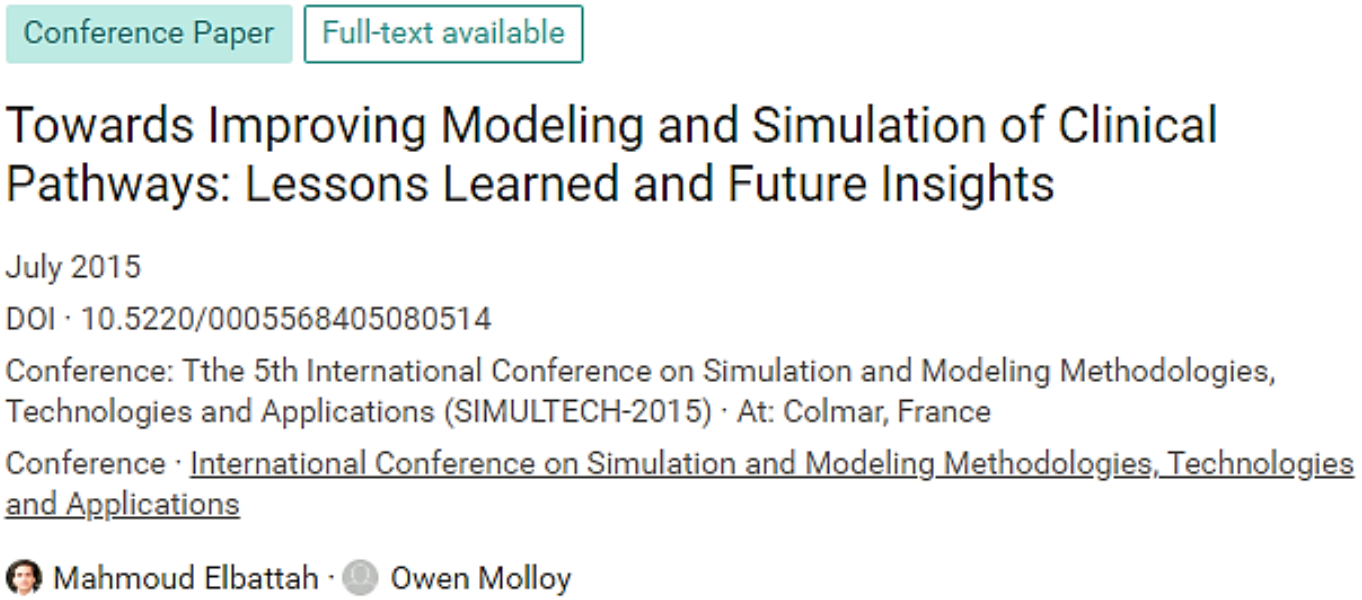
Affirmative Exemplar from Supply Chains

- (Robak et al. 2013) analysed the capabilities of using Linked Data principles in business process management within supply chains to tackle problems of information interchange between independently designed data systems.

Conclusions

- There is a need to establish a common research agenda for modeling and simulation of CPs.
- Future studies are to pay particular attention to fit their research methods to the state of prior work on CPs modeling .
- The proposed directions are thought to considerably boost the integration of CPs within the Clinical Decision Support System (CDSS).

Full-Text Paper



Conference Paper | Full-text available

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- https://www.researchgate.net/publication/284284807_Towards_Improving_Modeling_and_Simulation_of_Clinical_Pathways_Lessons_Learned_and_Future_Insights

THANK YOU!

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