

Ontology-based Integration of Consumer Data and EHR Systems to Fill Gaps in Social Determinants of Health Data

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and Mathias Brochhausen ¹

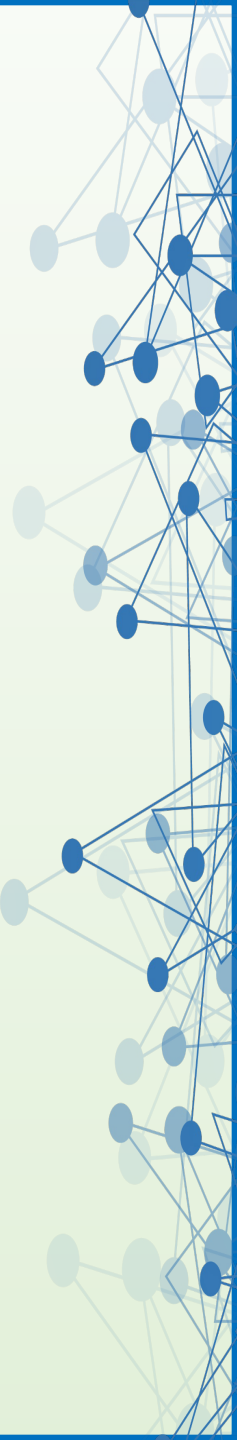
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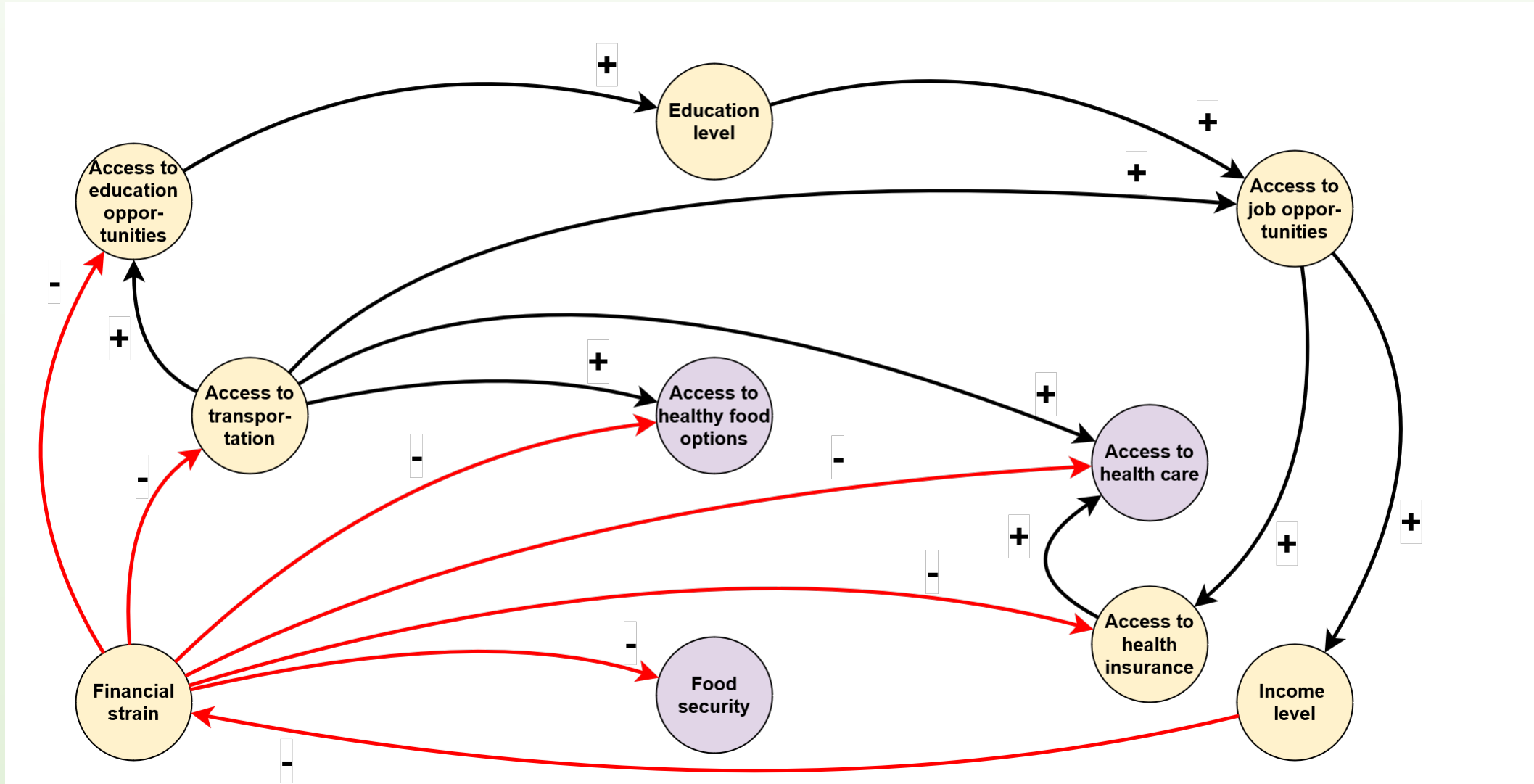
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Social Determinants of Health (SDOH)

- Income level
- Employment status
- Access to job opportunities
- Access to health care
- Adequacy of housing
- Language and literacy skills
- Level of education
- Access to transportation
- Food security
- Access to healthy foods

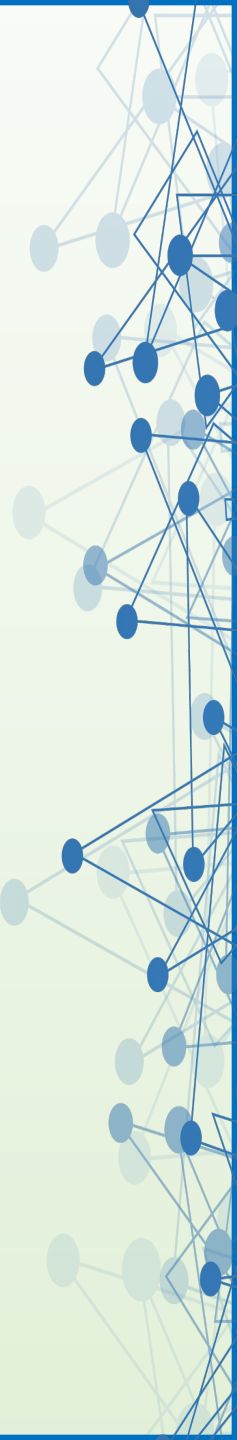


Simple Causal Loop Diagram of SDOH



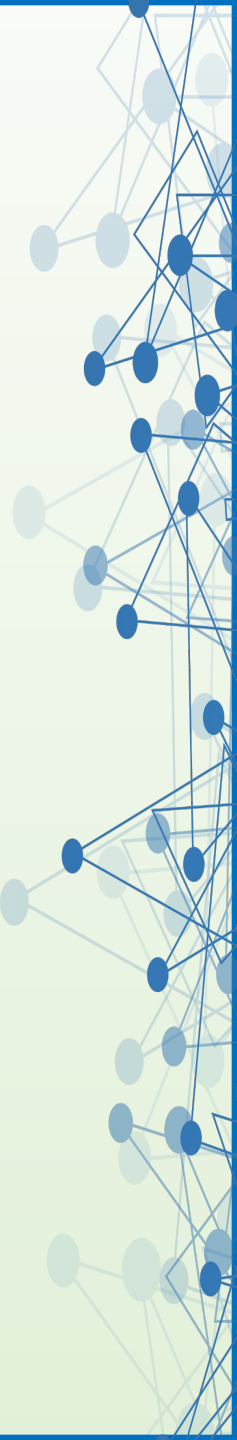
Social Risk Factor Ontology (SRFON)

- From 19 SDOH literature summaries, I extracted 809 assertions about causal relations or correlations between (a) pairs of social conditions, or (b) a social condition and a health condition



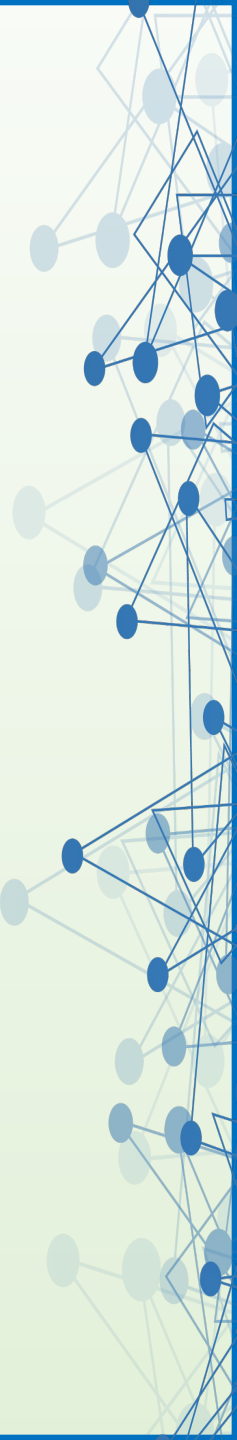
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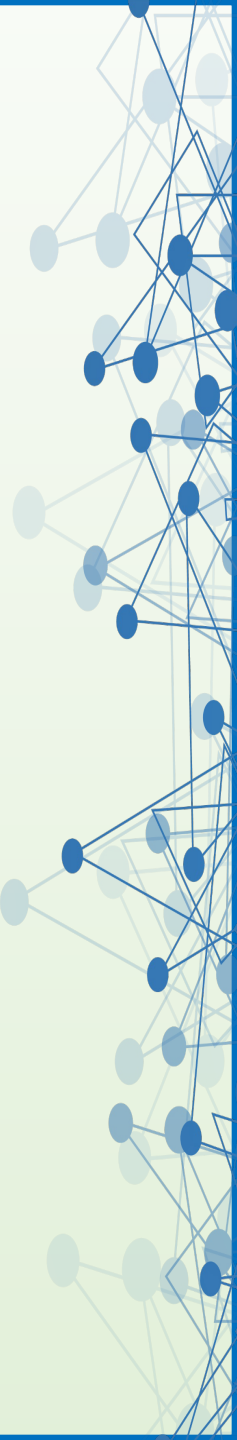
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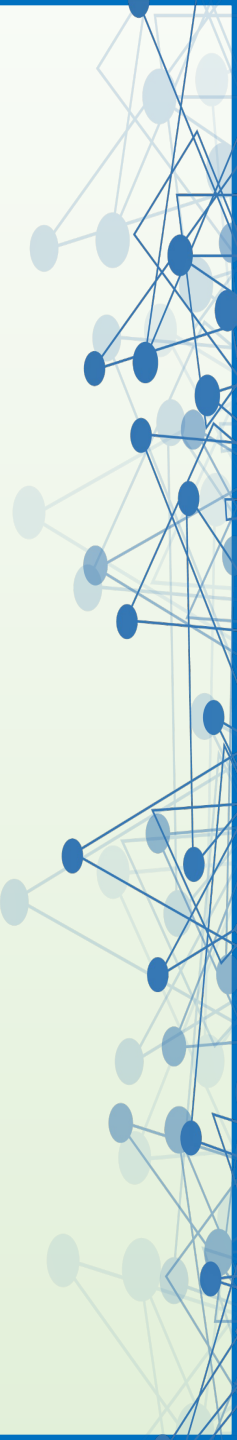
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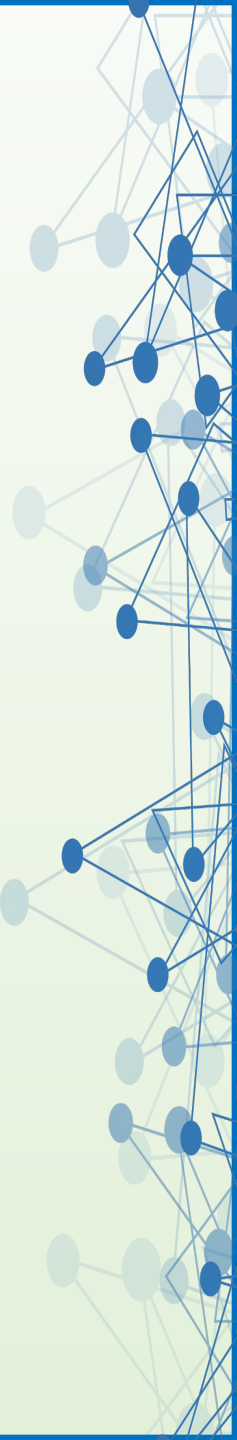
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- **Terms were arranged into a BFO-based hierarchy**



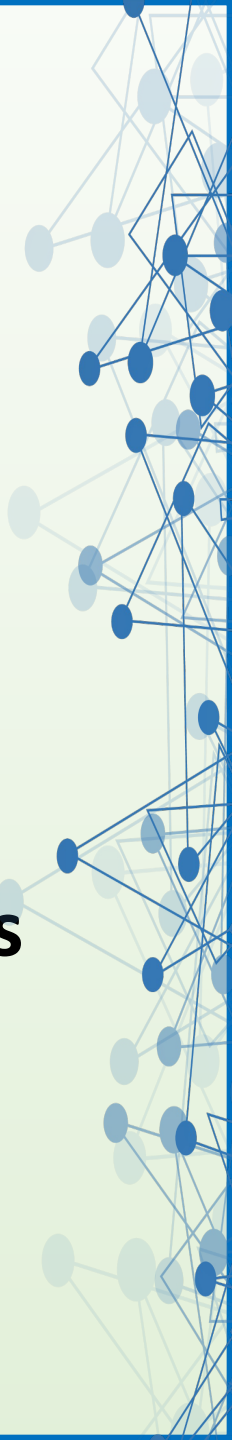
Commercial Consumer Data

- **Gathered for predicting spending habits**
- **Some elements are informative about SDOH**
- **We are reviewing 6,260 data elements from a commercial database marketing company**



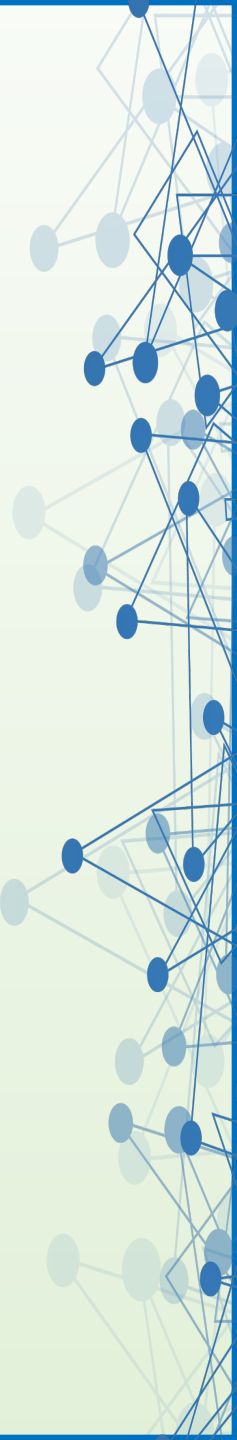
Goals

- **Pipeline from consumer data about SDOH to EHR systems**
 - **Gives providers a more robust picture of a patient's social conditions without additional questioning**
- **More broadly: identify SDOH-relevant consumer data and enable the integration of SDOH data from disparate sources**



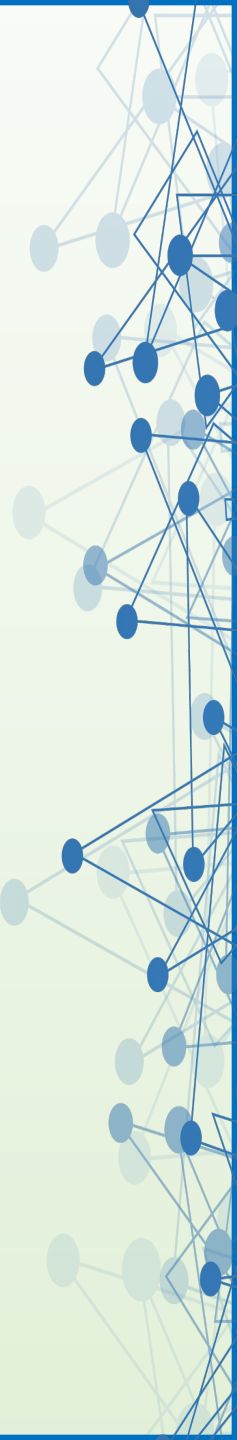
SDOH-related Consumer Data: Examples

- **Employment status**
- **Occupation**
- **Education level**
- **Primary language**
- **Household size**
- **Number of vehicles**
- **Bedroom count**
- **Room count**
- **Home square footage**
- **Home lacks heating**
- **Home lacks cooling**

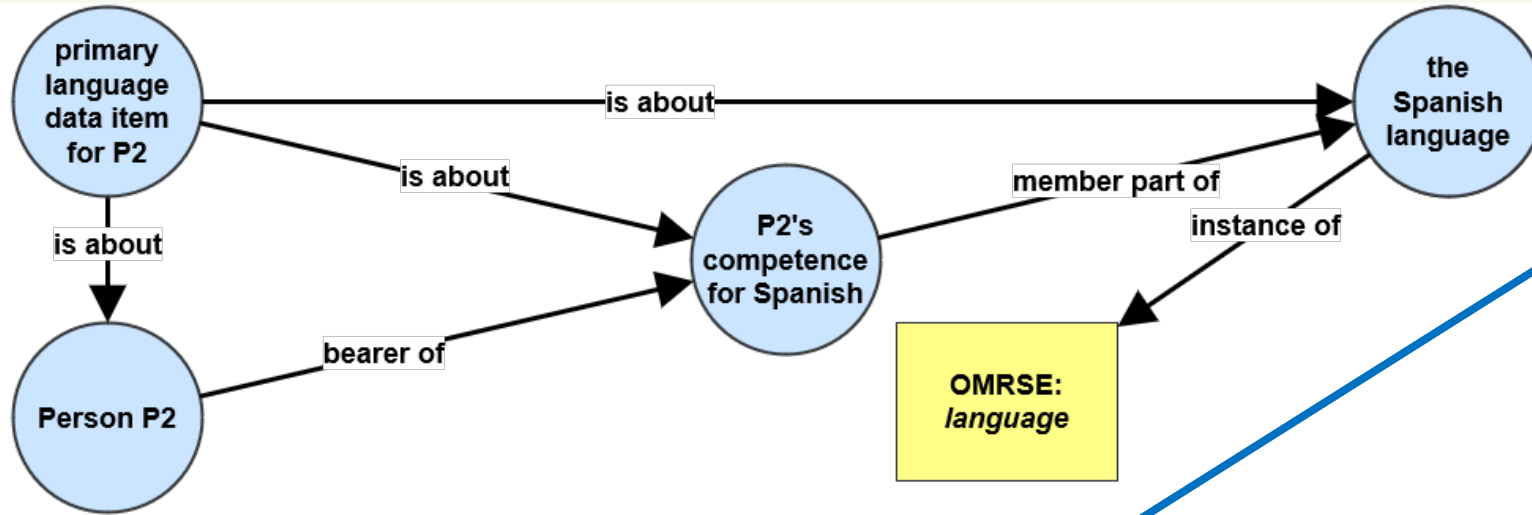


Language Barriers & Limited Linguistic Skills

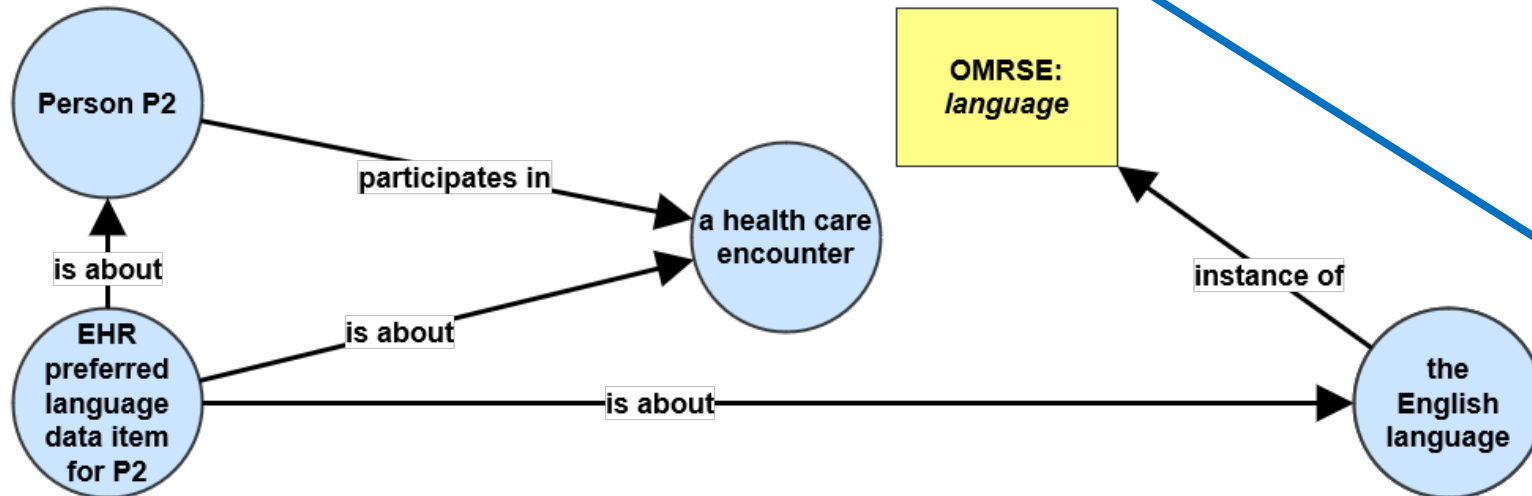
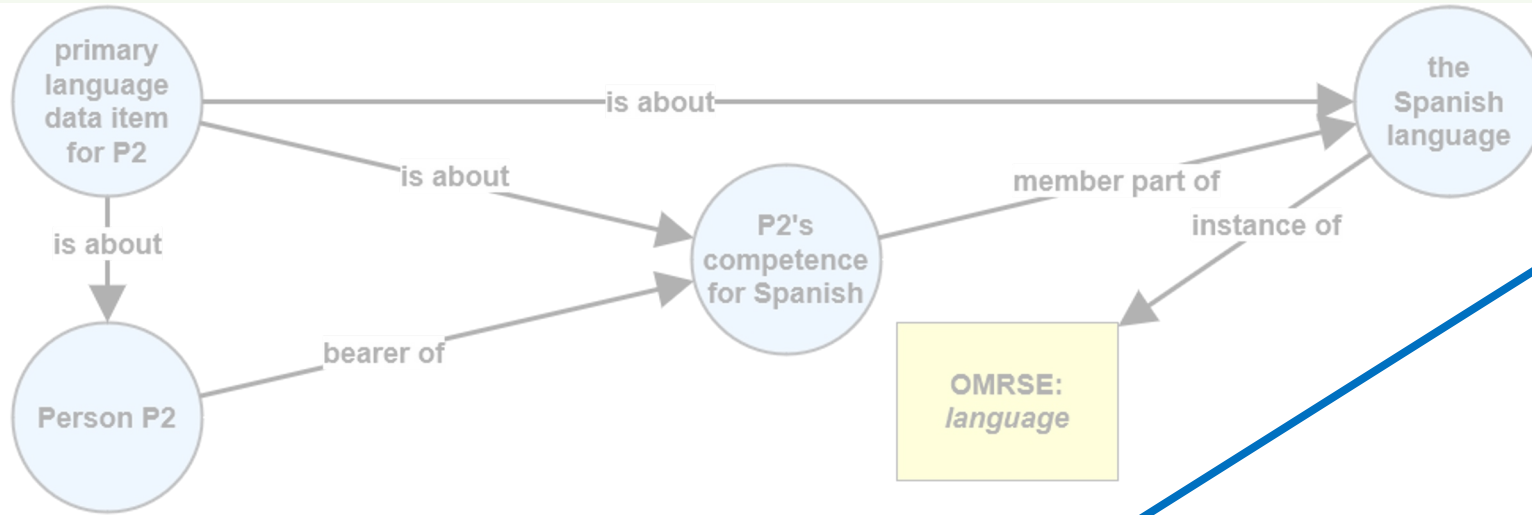
- **Can be obstacles to:**
 - **understanding health care providers' questions and conveying problems to them**
 - **understanding health-related information from:**
 - **health care providers**
 - **public sources**



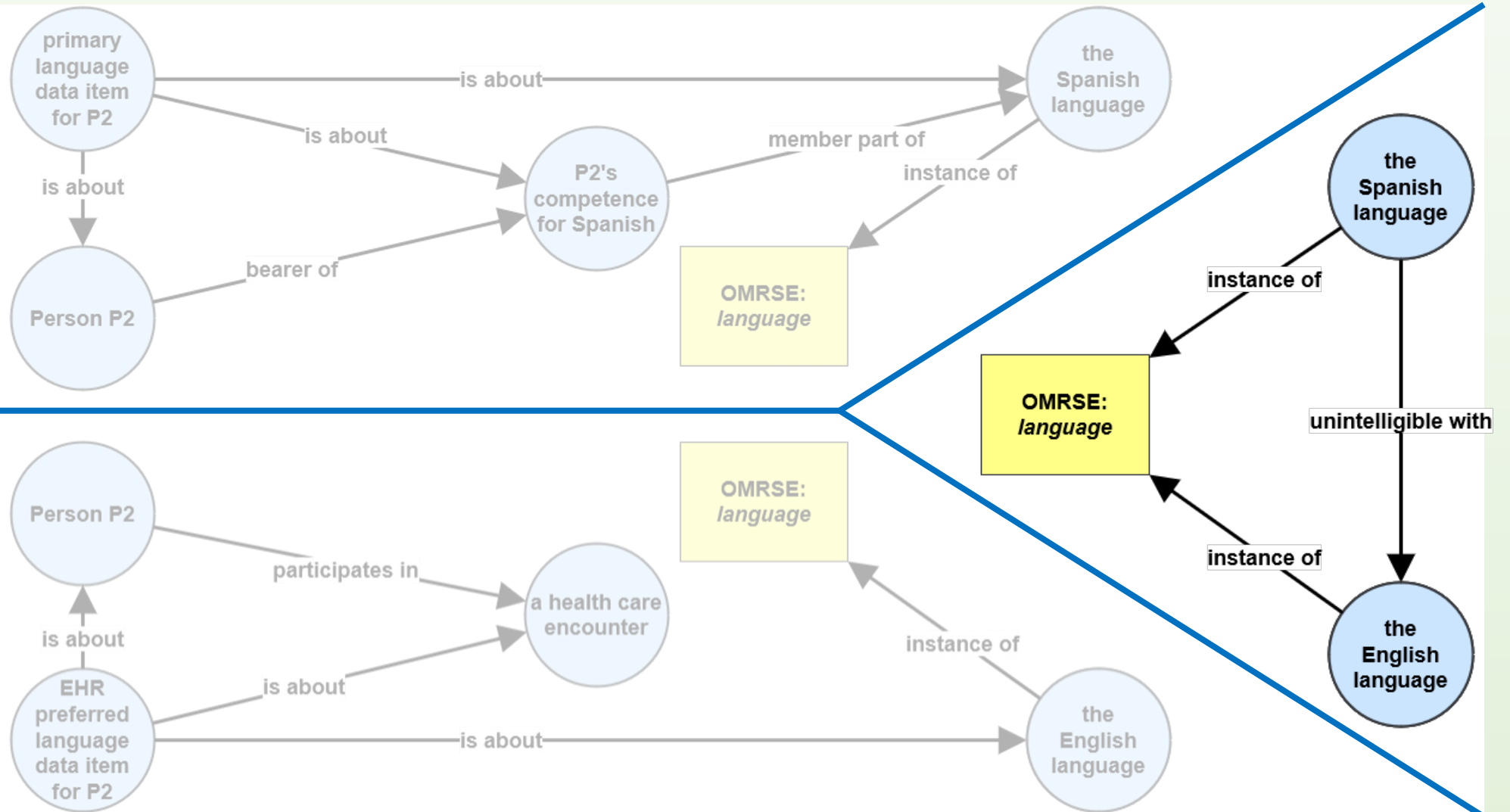
Primary Language from Consumer Data



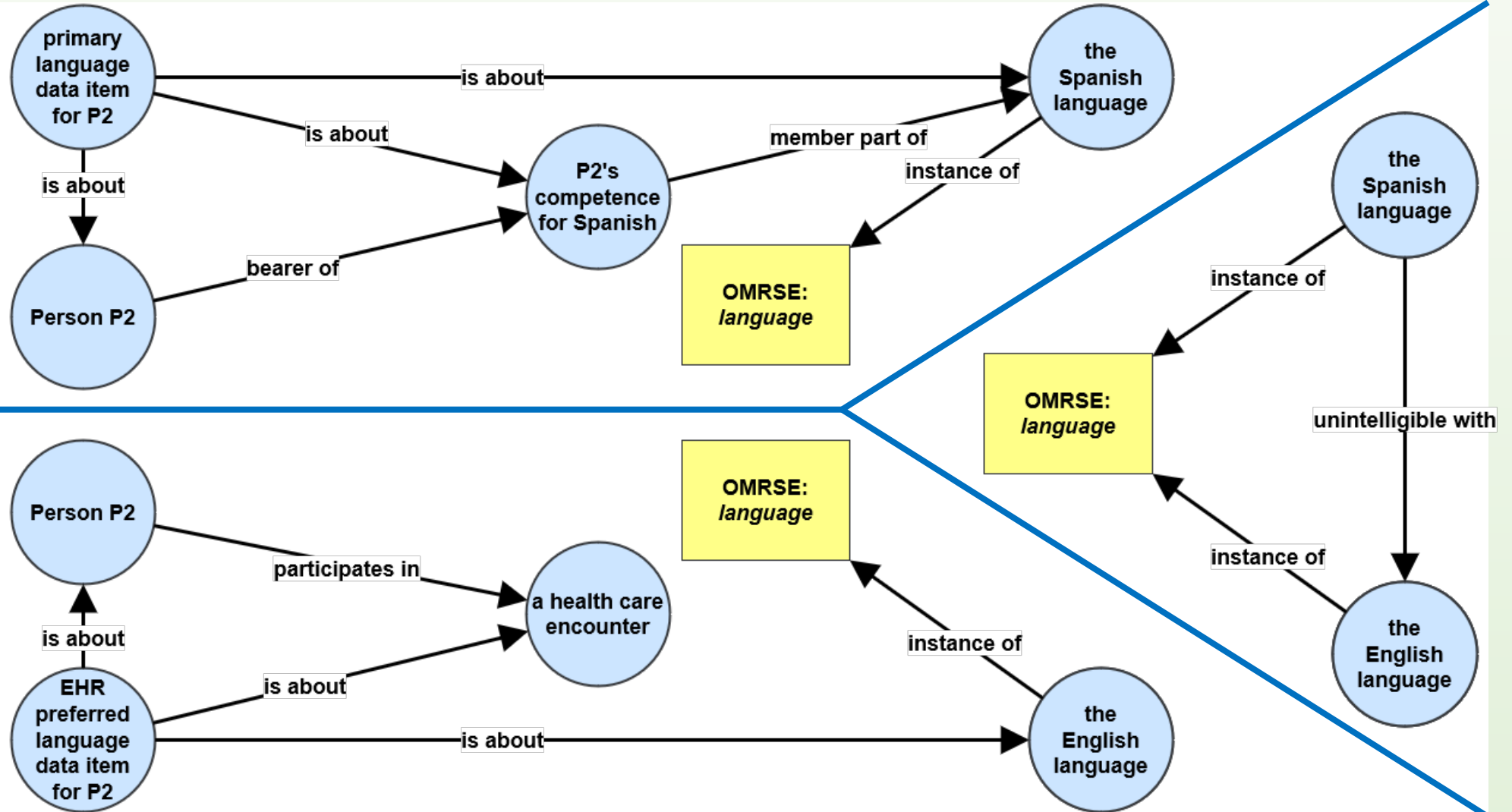
Preferred Language from EHR



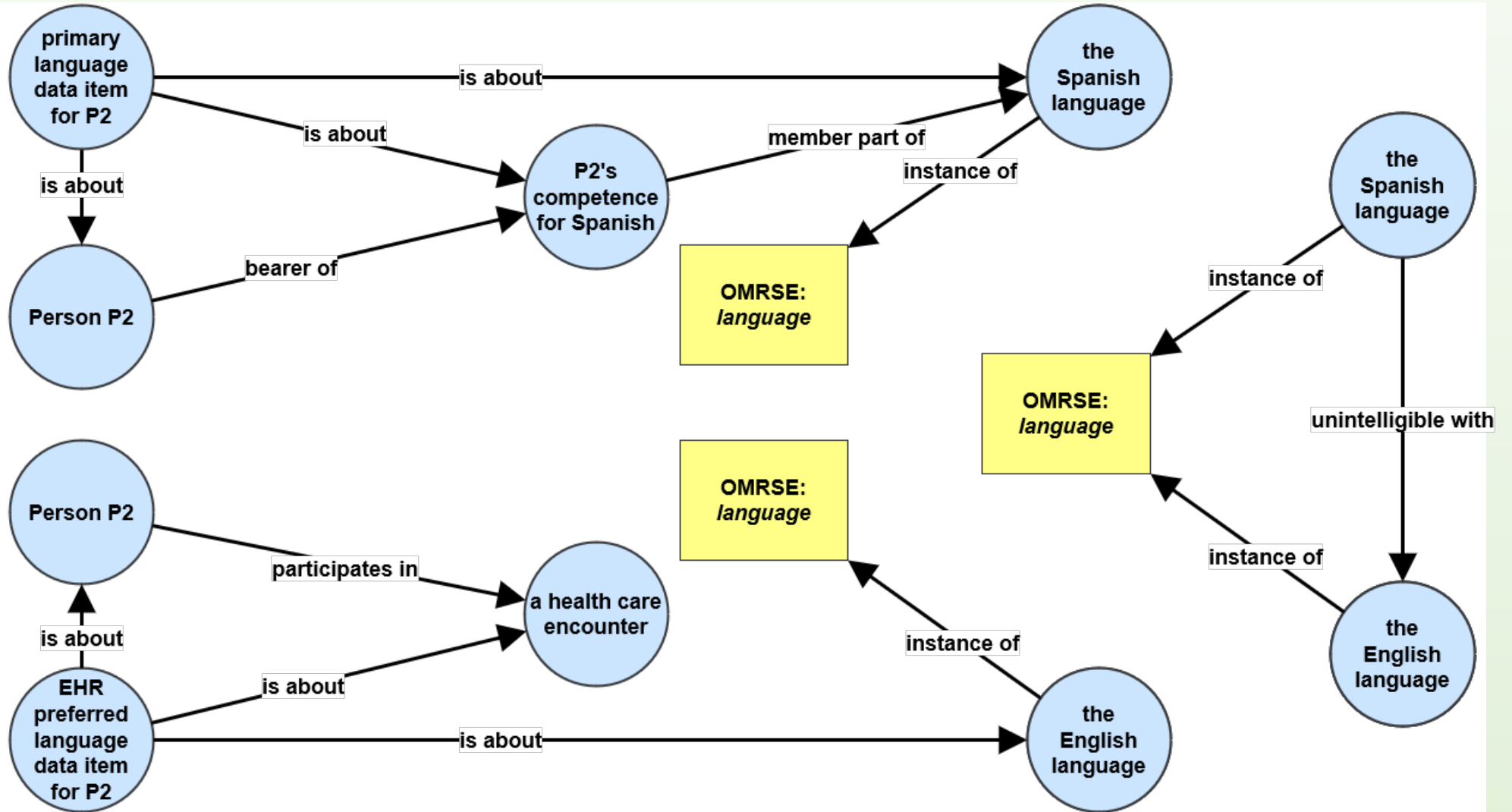
Additional Knowledge in Ontology



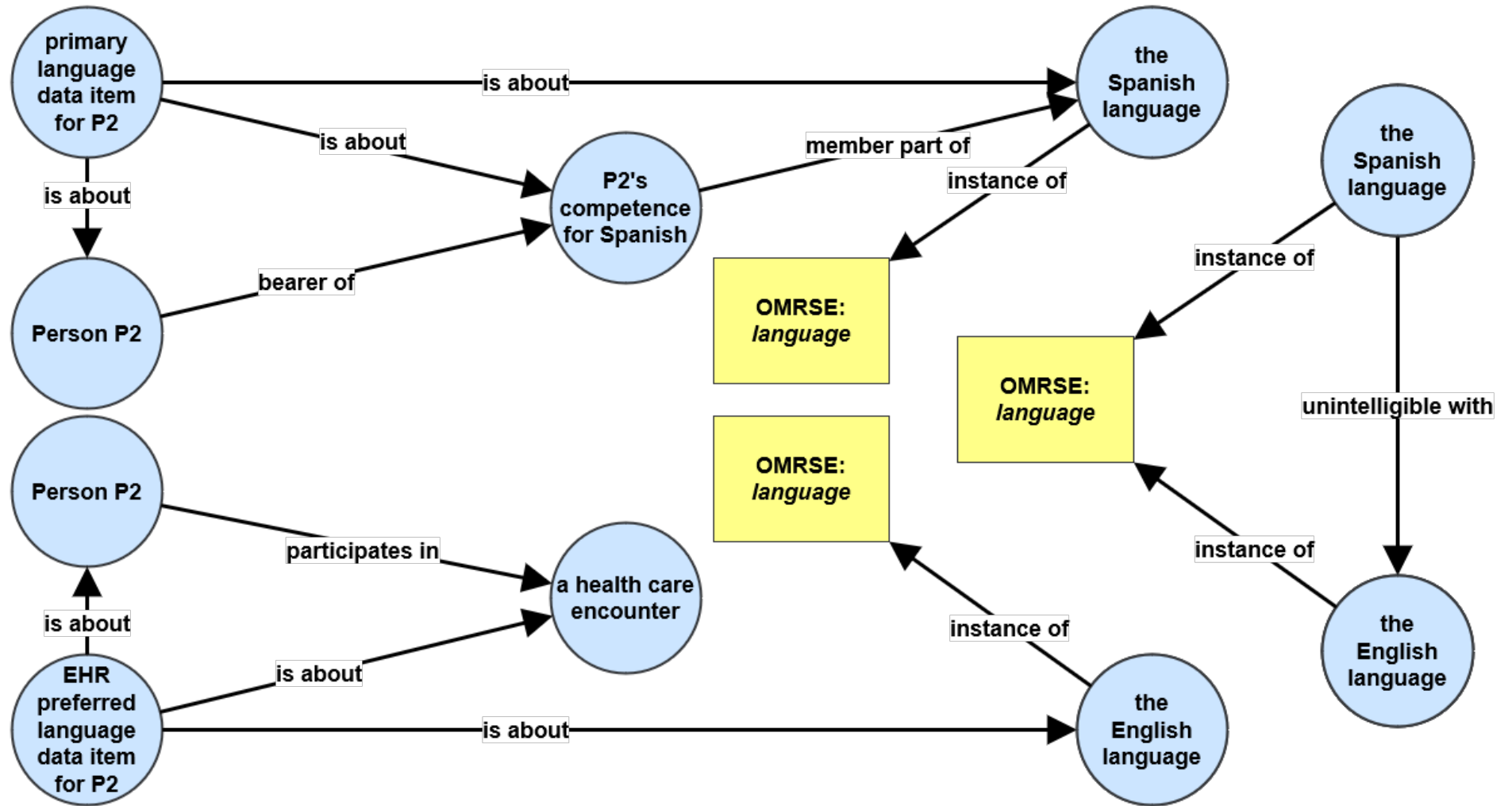
Combined Language Data



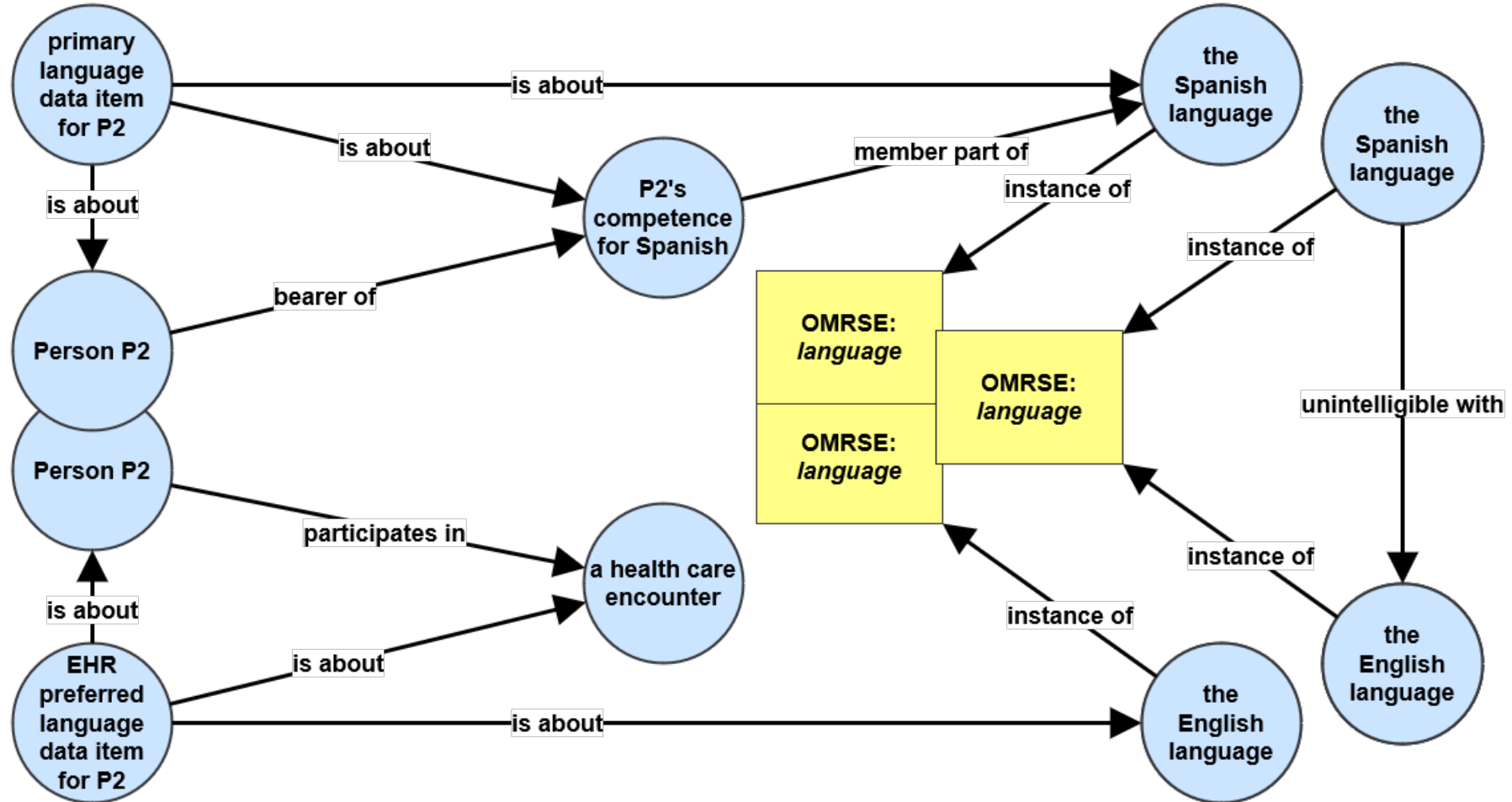
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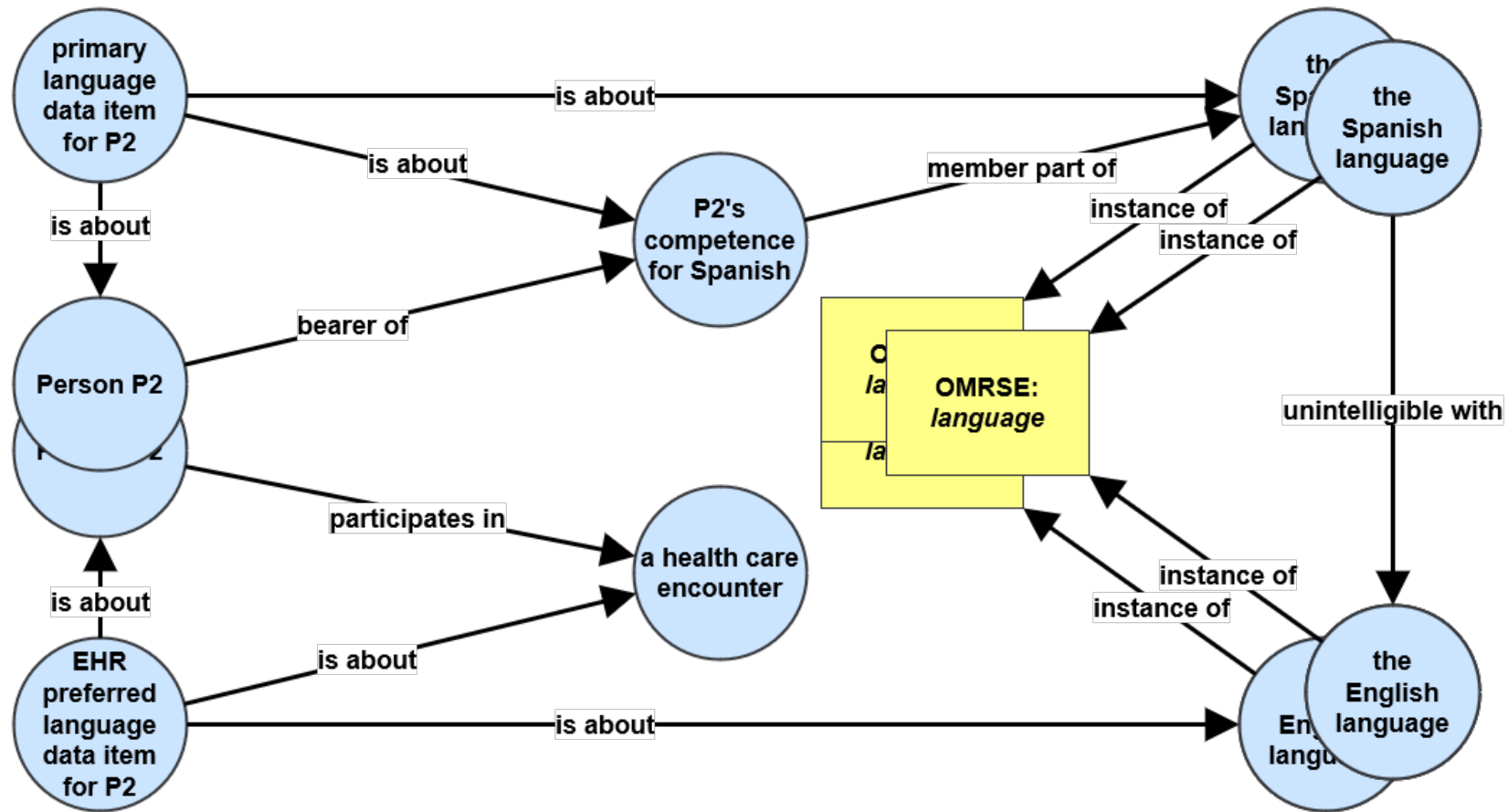
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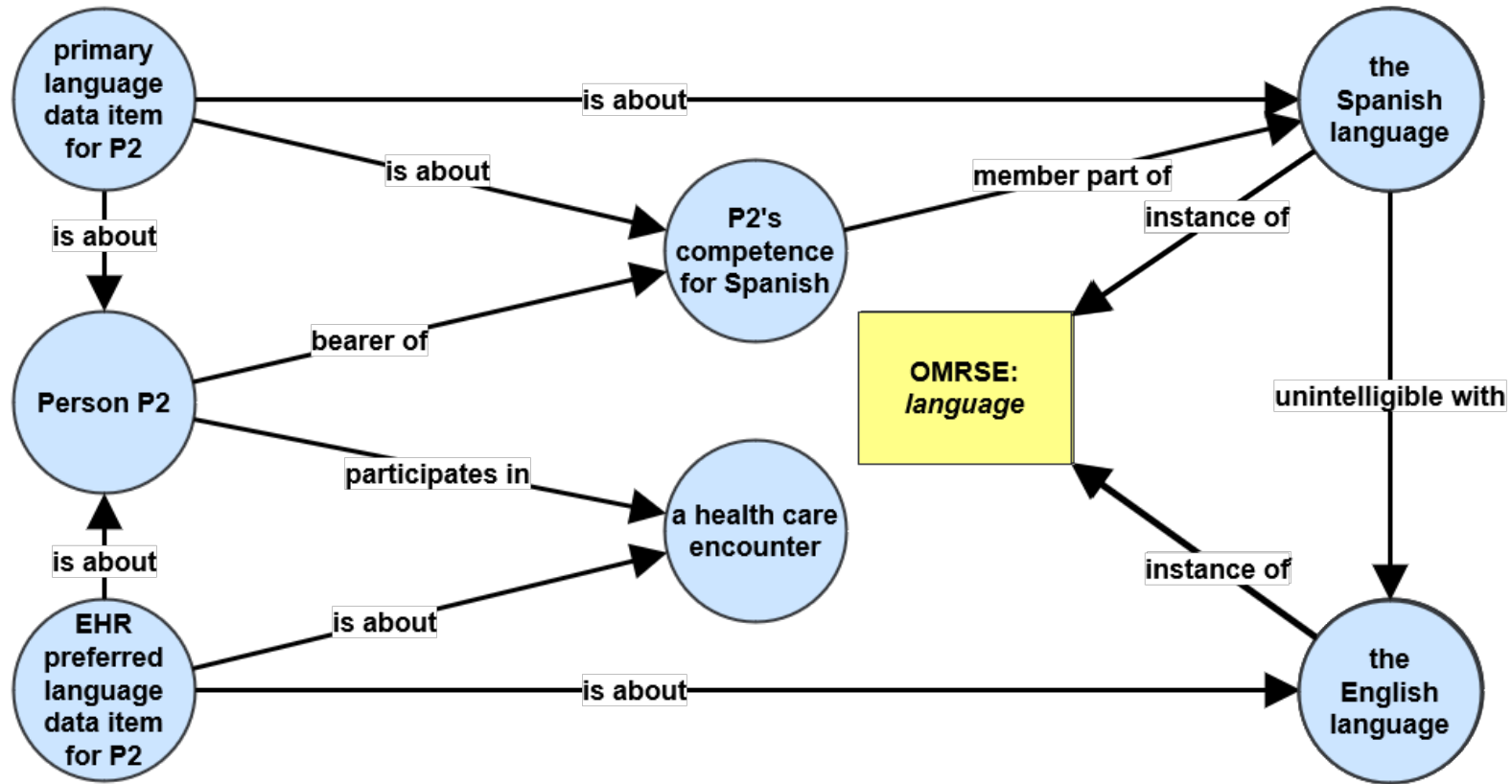
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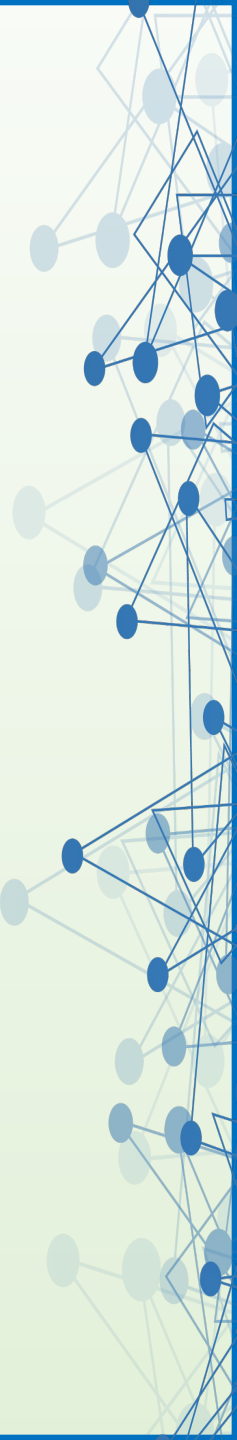


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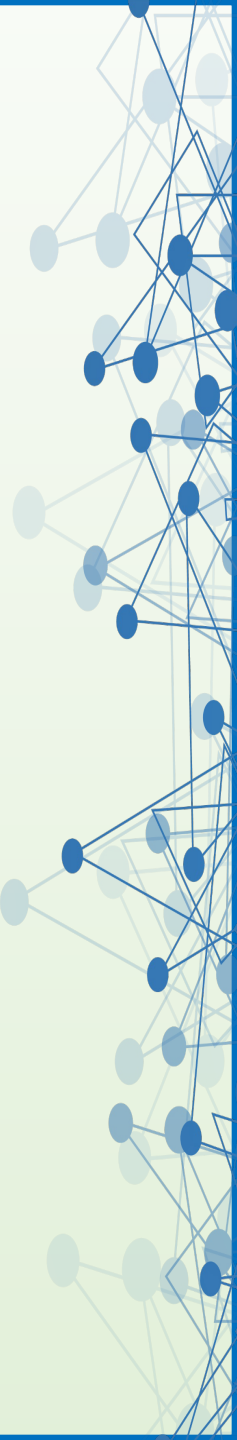
Household Overcrowding

- Too many people sharing insufficient space
- Researchers have measured it different ways, for example:
 - Persons per bedroom (above some threshold)
 - Persons per room (above some threshold)
 - Square feet per person (below some threshold)
- Associated with stress, infectious diseases, and food insecurity

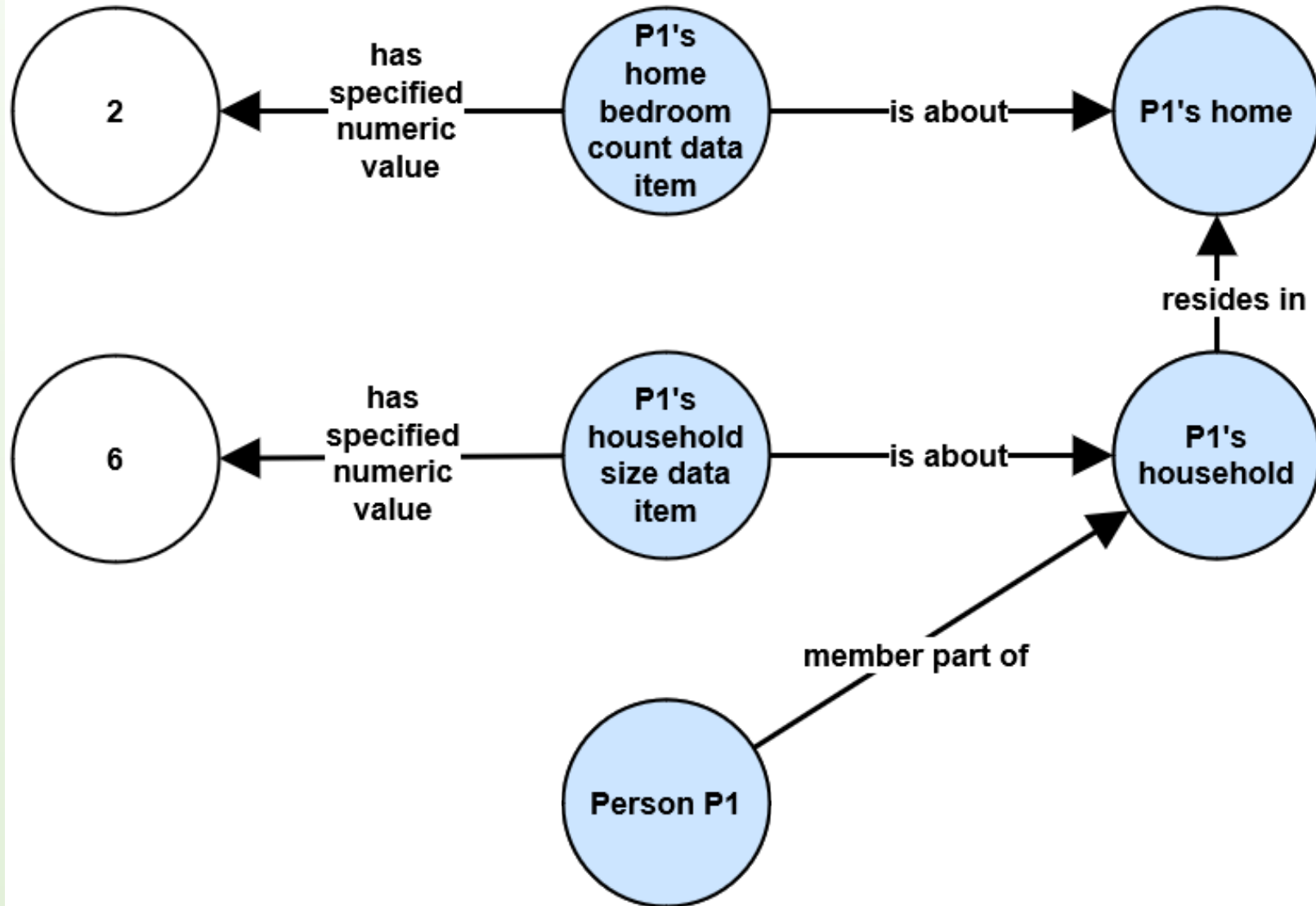


Overcrowding-related Consumer Data

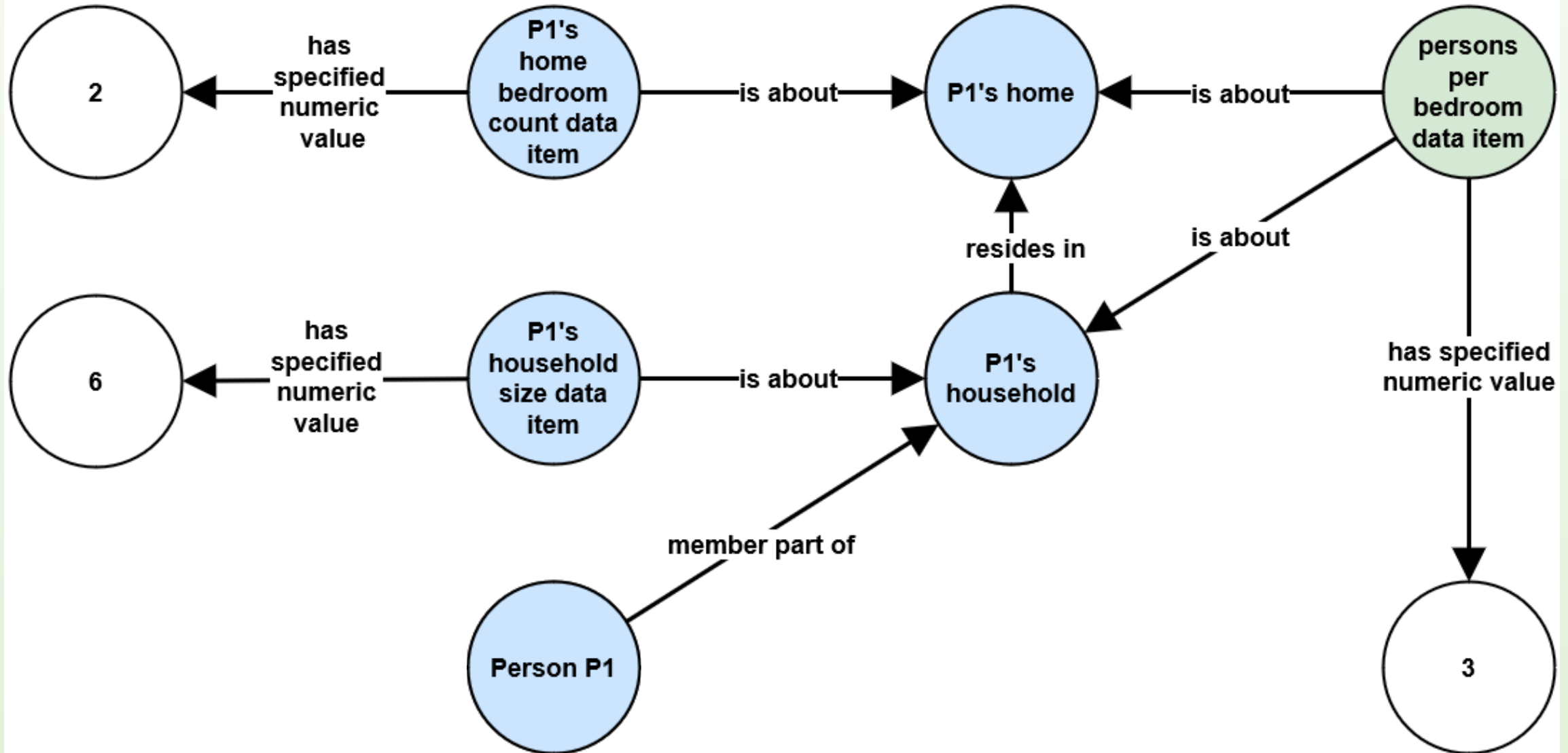
- **Household: number of people**
- **Home: room count**
- **Home: bedroom count**
- **Home: square footage**



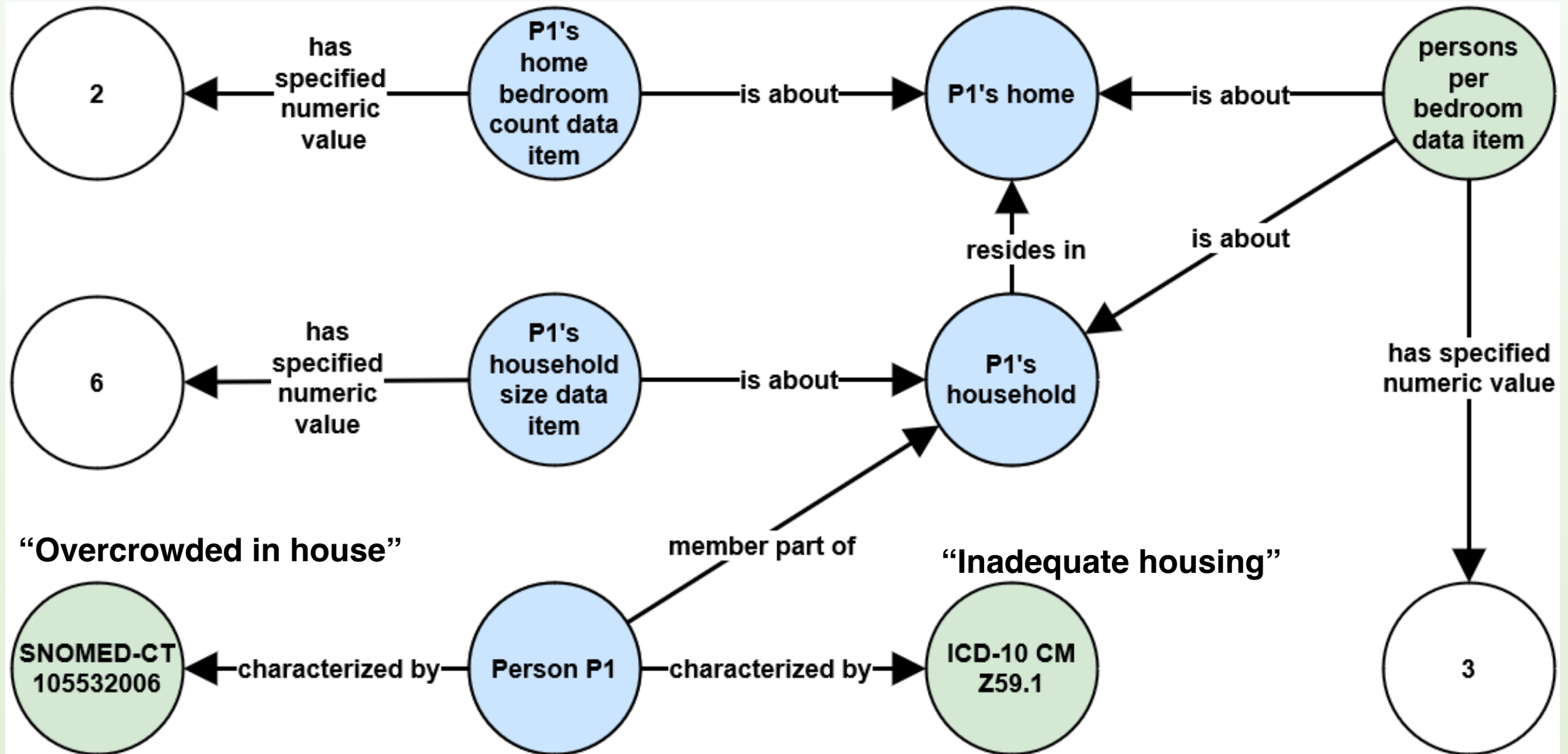
Simple Example of Overcrowding



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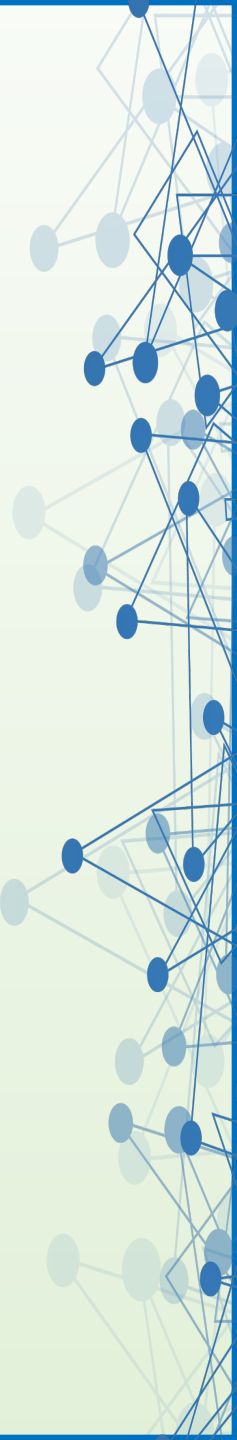


Using 2-persons-per-bedroom threshold



Continuing and Future Work

- **Further developing SRFON and making it accessible**
- **Developing the pipeline of SDOH data to EHR systems**
- **Using SRFON as the basis for an additional ontological representation featuring causal interrelations among SDOH, similar to those in the causal loop diagram but more fine-grained and with more specific relations**



Thank you!

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