Compass Needs Ontology: A Design Pattern for Representing Needs in Social Work

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Abstract

We present a design pattern aimed at supporting the formal representation of information about needs collected in Social Work settings. The framework is designed to integrate with existing information representation frameworks and allow extensions for documenting client progress during social interventions, as well as extensions to support representing information pertinent to activities such as referring clients to services, scheduling appointments, designing individual support plans and evaluating community level needs and service gaps.

Keywords

ontology, knowledge representation, needs, social services, knowledge engineering

1. Motivation

Information that can be machine processed effectively is key to amplifying the success of Social Work interventions. However, existing representational frameworks struggle to fully address the challenge presented by this domain. Many of the terminologies developed and used by the various communities of practice are informal and often incompatible, which hinders the effectiveness of the collection, processing and sharing of information.

Formal information representation frameworks (e.g., ontologies) enable us to represent, organize and store information within a domain of knowledge in ways that allow for automated reasoning and can assist in the decision making processes of the domain practitioners. To our knowledge, the client and community needs have been insufficiently formalized in the context of Social Work, and we are proposing a framework whose key purpose is to address this.

Our framework aims to provide a common terminology that can be used for data storage and access, as well as a methodology for operationalizing client and community information in a way that allows for needs discovery and monitoring. The framework is designed to integrate with existing ones and allow extensions to support representing information pertinent to activities such as scheduling appointments, designing individual service plans, evaluating community level needs and service gaps and documenting client and community progress during social interventions.

Our proposal provides formal definitions, in the form of an ontology, for the concepts that capture core knowledge about needs in the Social Work domain. Besides its application as the data infrastructure in Social Work information systems, this proposal can also help resolve ambiguities and disagreements between the existing terminologies developed by various sub-fields and communities of practice.

2. Background

To date, human needs have been the subject of scholarly investigation in a number of disciplines, including anthropology, economics, psychology, philosophy, sociology and social work, e.g., [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]. A rigorous conceptual analysis is thus warranted, that would enable us to compare the notions of *need* promoted by the existing theories and select the approaches that are amenable to operationalization in the context of Social Work.

Needs can be defined from many different perspectives, such as absolute vs relative, objective vs subjective, normative (externally attributed) vs expressed (self-attributed), etc. There is, for the moment, no consensus across fields on what the exact definition of a need should be. We are taking in this work steps towards formulating a notion of *need* that can constitute the foundation on which to build a principled operationalization of the provision of social services.

Current and past discussions on *human needs* contain several related, but distinct threads. A substantial portion of the conversation is centered around identifying and defining the "basic human needs", their relations to other types of *needs* and their satisfaction, which is predicated on moral desiderata such as respecting the universal human rights (that those needs induce) and ensuring an equitable access to wealth.

Another, considerable, part of the discourse is focused on whether *human needs* are contingent on *(human) goals*. This specific strand of contention is of particular interest to our work, which seeks to support the movement towards grounding social work practice in measurable and actionable evidence, and linking the provision of social services to expressed intentions (and desired outcomes). It has been previously pointed out, e.g., [3], that despite their different opinions, the so-called *instrumentalists* (for whom needs are dependent on goals) and *absolutists* (who consider some needs as instrumental and others as absolute, existing independently from goals) do seem to agree that *needs*, as ontological entities, do exist (and are of different types) and that they are fulfilled by other, distinct, ontological entities, the *need satisfiers*. (A need can be fulfilled by many satisfiers, and a satisfier can meet several different needs. We will come back to this point later in this work.)

An often cited typology of needs is Maslow's hierarchy, e.g., [3]. This hierarchal organization of needs ranks them according to the order in which it is assumed they must be satisfied, with the ones at the bottom needing to be fulfilled before a person can progress to meeting the needs at the higher levels. The well-known pyramid consists of, from base to the top: physiological, security, social, esteem, and self-actualization needs. In a later classification [9], Max-Neef categorizes needs as: subsistence, protection, affection, understanding, participation, idleness, creation, identity and freedom, and introduces the idea that human needs form a network rather than a hierarchy. (He is also one of the first to discusses the role of need satisfiers in the fulfillment of needs.)

More recently, Doyal and Gough advanced a grouping of needs into *basic* (i.e, *physical health*

and *autonomy*) and *intermediate* (akin to satisfiers that contribute to the fulfillment of the *basic needs*). They also explicitly differentiate between *needs* (assumed to be objective) and *wants* (assumed to be subjective perceptions interpreted as needs).

Often, we infer and articulate our (and other's) needs as a result of a cognitive process that also has as outcome a potential satisfier (for the need we are trying to communicate). This leads to expressing needs via proxy, by stating that a potential satisfier ''is needed''. For example, when someone says ''I need a cup of coffee'', we can infer that they may in fact feel a bit sluggish and that getting coffee (a *need satisfier*) would transition them to a (desired) state where they feel alert. The issue with this approach is that stating a need satisfier as the *need* may cloud the true nature of the need.

We also articulate our needs as changes in our situation, e.g., *I need to improve my writing skills* and it is this particular approach that is essential to our ontological framework, and will be expanded upon in the following sections. (In the previous example, it is moving from feeling sluggish to feeling alert, that the person needed, and this can be accomplished in many different ways, not just be ingesting coffee.)

After this brief overview of the state of the art regarding the conceptualization of needs, we will now turn to the presentation of our proposal. Our approach, which also includes representing client *states*, *problems*, and *goals* in addition to *needs* and *need satisfiers* was informed by the use cases provided by the COMPASS project[1] and by those collected during our previous work with local social services agencies.

In agreement with [12], we consider that, from an ontological point of view, needs are closely related to motivational attitudes, while from an epistemological one, they are the outcome of a cognitive process that involves the beliefs of the agents participating in the decision making activity. This cognitive process also includes selecting need satisfiers that could contribute to reaching the goal(s) that were the starting point of the process. In our approach, however, although we introduce a methodology that allows for, and requires, an explicit connection between goals and needs, we **do not** consider that once a need satisfier X is selected, ''the need for X becomes an instrumental goal'', as goals precede the articulation of needs in our framework.

The ontological choices we have made in this work are aimed at enabling a representation of the knowledge in the Social Work domain that supports the structuring of client management and social services provision based explicitly, and traceably, on needs and need satisfiers. (Because of our main focus is on operationalizing needs in the context of social services provisioning, we do not engage at this moment with the debate around distinguishing between *needs* and *wants* that occurs in political and social discourse.) Among those choices we mention that no distinction is made between needs and desires, and that the focus is on ''instrumentalist'' needs. While the formalization of needs in the context of social service has been considered in previous work, e.g., [3], although without an accompanying software artifact (i.e., ontology), open access evidence of conceptual analysis and formalization of client *states*, *problems*, and *goals* is scant.

The intended semantics of the concepts in the proposed representational framework are described in natural language. The framework is axiomatized in the Web Ontology Language

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[1]https://www.digitalsupercluster.ca/projects/compass/

(OWL), with the resulting artifact being part of the COMPASS Ontology[2] The ontology has been designed to facilitate the correct management and exchange of client and services information among the systems operating in the Social Work domain. Among the applications we have considered are social services modeling, matching services to client needs, individual and group service planning (including scheduling appointments and issuing referrals).

3. Ontology Development

The representational design pattern was developed according to the following steps:

- **Requirements gathering**. A clear understanding of the domain and required scope of the ontology was developed by sourcing motivating scenarios, provided as User Stories and specified as Competency Questions, by the partner COMPASS organizations.
- **Reuse of existing ontologies**. Whenever possible, existing ontologies suitable for reuse were identified and incorporated in the development.
- **Ontology design and implementation**. The concepts to be included in the ontology were identified with a combined approach: (1) bottom-up, from the motivating scenarios provided by the partner organizations, as well as (2) top-down, from pertinent literature in the relevant domains, e.g., Social Work, Psychology, Anthropology, and Sociology.
- **Evaluation**. The evaluation of the ontology design pattern is addressed in the following ways:
  - *Competency*: the terminology is assessed for completeness against the competency questions specified in the Requirements gathering stage and for appropriateness by verification by domain experts.
  - *Consistency*: the ontology is verified using an automated reasoner to demonstrate its internal logical consistency

Our approach utilizes the ontology design patterns approach as a semantic device that facilitates the operationalization of needs and the building of technology to support the provisioning of social services. Linking to appropriate concept in upper ontologies will be undertaken in future work.

3.1. Use Cases and Competency Questions

Our COMPASS partner organizations developed a set of Competency Questions based on use cases provided by their domain experts and we supplemented this initial set with questions we developed independently with the help of local providers of social services. Competency Questions are a set of questions that a representational framework must be capable of answering. For example, "What are the needs of client X?" or "What are the problems client X presented with?". (An in-depth discussion of the uses cases provided by the domain experts is beyond the scope of this paper and in the following we will refer directly to the questions developed based on them.)

In the remainder of this section we introduce the main concepts and properties that comprise the proposed design pattern, motivated by the relevant competency questions (CQ, for short).

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[2]available at https://github.com/csse-uoft/compass-ontology

The purpose of this core is to axiomatize a set of intuitive semantic primitives that is adequate for describing the fundamental concepts related to clients of social services. The characterization of basic client related concepts makes few assumptions beyond what is needed to describe them and has, therefore a relatively weak logical expressiveness. The basic ontological commitments of our proposal are based on intuitions that will be detailed before introducing each concept (and property).

3.2. States

CQ: What is the current state of my client?
Ontology classes: $HumanState, ClientState, CurrentState, DesiredState, SocialBarrier$

We define a **human state** as a person's condition with respect to circumstances, often, but not necessarily durable or lasting. Human states range from simple physiological states as feeling full / hungry to complex cognitive constructs, such as feeling successful in one's chosen career. We specialize *human states* by introducing **client states**, which are states that are relevant to the practice of Social Work and we assume that regardless of their *current state*, clients prefer to be in certain states, their **desired states**. (Depending on the community of practice, client states can be further divided into various categories, e.g., survival/existence, welfare, interpersonal relatedness, flourishing. There is no consensus in the field, and many different categorizations of states exist.) Property *hasClientState* links client instances to client states.

$$\forall x, ClientState(x) \rightarrow HumanState(x) \qquad (1)$$

$$\forall x, CurrentState(x) \rightarrow ClientState(x) \qquad (2)$$

$$\forall x, DesiredState(x) \rightarrow ClientState(x) \qquad (3)$$

$$\forall x, y, hasClientState(x, y) \rightarrow Client(x) \land ClientState(y) \qquad (4)$$

In our framework, client states are conceptually connected to client characteristics or features. (In this work, we use the two terms interchangeably.) This can be used to operationalize the connection between the information gathered about a client (e.g., at intake and during various assessments) and that client's states. For example, the state *is of age of majority* is induced by the fulfillment of the condition that the person's age[3] is greater than 18 or 19 in the province the person is assessed in[4]. *Abuses substances* is a state induced by the person having a medical diagnosis of addiction, a history of social services access for help with dependency issues or self-declared substance abuse-related problems. A refugee's lack of English or French language skills render them *unable to communicate in the official languages.* A client's acquiring or changing of *status*[5] also induces a change in the client's state. When the status of a Canadian resident changes, for example, from "temporary worker" to "landed immigrant", this induces a new state in the person, *is immigrant.* This change, in turn, makes the person *eligible to receive settlement services funded by the Ministry of Immigration and Citizenship* (another change in state).

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[3]*Age* is a client's characteristic

[4]18 years of age in Alberta, Manitoba, Ontario, Quebec, Prince Edward Island, and Saskatchewan, and 19 years of age in British Columbia, New Brunswick, Northwest Territories, Nova Scotia, Nunavut, Yukon, and Newfoundland.

[5]A *status* is a standing or position (relative to that of others) in the eyes of the law or some other form of recognized authority. Commonly occurring examples are the various *disability* statuses, as recognized by disability associations and service provider agencies, and immigration statuses, as recognized by a country's government.

We take the opportunity to note that, in general, many different terminologies can co-exist within a field to indicate states, statuses, etc. For example, the Canadian Ministry of Immigration and Citizenship has developed the following methodology to determine the immigration status of a person (and it requires all settlement agencies that it funds to use it):

- ''Non-immigrant'': person who is a Canadian citizen by birth;
- ''Immigrant'':
    - person who is, or who has ever been, a landed immigrant or a permanent resident;
    - person who is a Canadian citizen by naturalization;
- ''Non-permanent resident'': person who resides in Canada and does not have Canadian citizenship and who is not landed immigrant or a permanent resident.

Various local governments and agencies have, however, introduced alternative terminologies to specify the immigration status of a person in ways that better suit their needs[6] and it is therefore desirable for the information systems operating in this space to be able to handle multiple parallel vocabularies. Our proposal supports associating the instances of various ontology classes with multiple such externally defined codes in a traceable way (i.e., each code can be linked to the organization that developed and maintains it). [7]

It must be noted that in practice client states are often inferred manually by social workers and asserted directly in the client files. Nonetheless, supporting mechanisms for defining a client's state based on primary information recorded about that person in an information system allows organizations to link the data they collect to client outcomes[8] in a way that allows them to measure and track their impact throughout their interactions with the client.

Client States as Barriers. Certain human states constitute (social) barriers to achieving other states. A *social barrier* (ontology class *SocialBarrier*) is a condition in which people are born, grow, live, learn, work and age that can contribute to decreased functioning and difficulty in meeting their needs or accessing services, e.g.:

- being homeless is a barrier to becoming employed / achieving sustainable employment
- experiencing (mental) health issues is a barrier to being stably housed
- lacking proficiency in English / French is a barrier to social integration (e.g., for a new-comer to Canada)
- stigmatization / being stigmatized is a barrier to re-integration in society (e.g., for a convict)
- underemployment / being underemployed is a barrier to achieving financial stability

$$\forall x, SocialBarrier(x) \rightarrow ClientState(x) \tag{5}$$

Sometimes barriers are described by social workers in the form of challenges. These challenges can be mapped to client states in our framework, e.g., a person who ''is facing language barriers'' *is unable to communicate effectively in any or both official languages.*

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[6]''Canadian citizen by birth'', ''temporary resident'', ''convention refugee'', ''refugee claimant'', etc..

[7]In our proposal, an instance of most ontology classes can be associated with terminology (i.e., codes) developed by external communities of practice via property *hasCode*

[8]Outcomes are also connected to client characteristics, and therefore to client states

It is worth mentioning that often a social service's goals are stated in terms of reducing or removing barriers, in order to help clients achieve their own goals. For example, one of the goals of a service that provides job skills training is to reduce barriers to employment for its beneficiaries. (The achievement of this service goal can be assessed by measuring the improvement in job-related skills experienced by the clients who completed the program, under the assumption that improvements in clients' job-related skills reduce their employment barriers.)

The basic $ClientState$ class has the following properties:

- $isBarrierFor$: links to instances of type ClientState that specify the other states that could be adversely affected by this state.

$$\forall x, y, isBarrierFor(x, y) \rightarrow ClientState(x) \wedge ClientState(y) \qquad (6)$$

- $hasTimeScale$: specifies the timescale of the state, e.g., ''acute'', ''chronic'', ''short-term'', ''long-term'', ''medium-term''.

$$\forall x, y, hasTimeScale(x) = y \rightarrow ClientState(x) \qquad (7)$$

- $hasCode$: specifies zero or more codes, created by various organizations, to identify a type of state for the client.

$$\forall x, y, hasCode(x, y) \rightarrow ClientState(x) \wedge Code(y) \qquad (8)$$

Properties *hasStatus* and *hasClientState* link instances of clients to instances that specify, respectively, their status and state.

3.3. Risks

CQ: What is my client at risk of?
Ontology classes: $Risk$, $PrivateRisk$, $PublicRisk$

Social workers often perform vulnerability assessments to identify the risks present in a client's life. A client risk describes a situation involving exposure to danger, something that may cause loss or injury, such as the risk of becoming homeless, the risk of becoming unemployed, and the risk of becoming a victim of sexual exploitation. In our framework, risk (class *Risk*) captures the uncertainty with respect to human states. Life events increase/decrease or materialize those risks and may induce changes in client states. For example:

- losing one's housing materializes the risk of becoming homeless. (New client state: *is unhoused.*)
- losing one's job materializes the risk of becoming unemployed. (New client state: *is unemployed.*)
- becoming addicted to methamphetamines increases the risk of becoming unemployed. (New client state *is at risk of becoming unemployed.*)
- falling in with dangerous/antisocial individuals increases the risk of becoming an offender. (New client state: *is at risk of becoming an offender.*)

Two categories of risk are especially relevant in Social Work:

- *private*, i.e. the risk concerns only the client;

- *public*, i.e., the risk concerns not just a client but also the community[9].

Clients are sometimes described as being ''at risk'' of moving into or experiencing a particular state. Being ''at risk'' of moving into / experiencing a state, e.g., *(being) at risk of becoming homeless* is, by itself, a client state. In other words, the risks present in a client's life induces client states. Social workers may associate a likelihood, severity, or potency score with each risk identified[10].

A risk factor is something that increases the risk of a person (to develop or enter a condition or state). For example ''housing precarity'' increases a person's risk of becoming homeless. Risk factors are often divided into categories that are meaningful for a specific community of practice. For example, risk can be categorization according to its perceived source, such as physical, psychosocial or personal:

- physical individual risk factor (e.g., lack or precarity of shelter, lack or precarity of food)
- psychosocial individual risk factor (low social status, loneliness, helplessness, lack of work)
- person's individual risk factor (e.g., addiction to alcohol, two detox treatments over the past 3 years, aggressive behavior, convicted and imprisoned twice for petty theft, etc.)

After a risk or vulnerability assessment, a social worker would typically record in a client's file the risks and risk factors identified during the assessment. At system level, instances of *Client*, *Risk* and *RiskFactor* classes get linked via properties *hasRisk*, *hasRiskFactor*, and *isRiskFactorFor*.

$$\forall x, y, hasRisk(x, y) \rightarrow Client(x) \wedge Risk(y) \tag{9}$$

$$\forall x, y, hasRiskFactor(x, y) \rightarrow Client(x) \wedge RiskFactor(y) \tag{10}$$

$$\forall x, y, isRiskFactorFor(x, y) \rightarrow RiskFactor(x) \wedge Risk(y) \tag{11}$$

Some risks (e.g., risk of being neglected) can be prevented, modified or controlled through interventions, and social services goals are often stated in terms of reducing, eliminating, avoiding, preventing or controlling (client) risks or risk factors, e.g.:

- A service that provides counselling to recently released inmates aims to reduce their risk of reoffending.
- Placing vulnerable minors in foster care aims to avoid them living in inadequate home conditions, a risk factor that increases the risk of abuse and the risk of exploitation.

3.4. Problems

CQ: What are my client's problems?
Ontology classes: $ClientProblem$

We assume that the difference between the actual and the desired client states (or the existence of a risk related to exiting a desired state) is perceived by clients and social workers as a problem

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[9]Timely recognition and designation of relevant client risks as public risks is very important because addressing them may involve complex, coordinated interventions across multiple agencies and government bodies.

[10]Depending on jurisdiction / community of practice, the severity score is assigned a textual value, e.g., "high", "medium", "low" or a numerical value, e.g., 0, 1, 2.

to be solved. A (client) *problem* (class *ClientProblem*) is thus a cognitive representation of the discrepancy between an actual client state and a desired client state.

The use of the term *problem* has a long pedigree in Social Work. Problems are used to identify the key areas related to clients' circumstances (that are relevant for social work practice) and are often recorded in client files as proxies for client needs. We also assume that a problem activates the client's and/or the social worker's motivation to solve it. This, in turn, leads to formulating *goals* for achieving the desired change in state(s), identifying the *needs* related to attaining the goals, picking *satisfiers* for those needs and selecting *services* that provide the satisfiers,

Property *hasProblem* links instances of clients to instances of class *ClientProblem* that specify the problems that the client is facing.

$$\forall x, y, hasProblem(x, y) \rightarrow Client(x) \wedge Problem(y) \tag{12}$$

3.5. Goals

CQ: What are my client's current goals?
Ontology classes: $ClientGoal$

Alleviating, resolving or eliminating a (client) problem is integral to the operationalization of needs. The first step after a problem is identified is to determine the goals associated with solving it. A client's *goal* is the aim of that person's ambition or effort, and is captured via class *ClientGoal*. Property *hasGoal* links clients to their goals.

Goals can be divided based on various criteria, and can be formulated at several levels of abstraction, according to what is suitable for the relevant community of practice. A goal can consist of several sub-goals whose fulfillment contributes to meeting the parent goal. Instances of type *ClientGoal* can be linked to other *ClientGoal* instances via property *hasSubGoal*. Goals reveal a client's needs. Property *inducesClientNeed* links goals to the needs they engender.

$$\forall x, y, hasGoal(x, y) \rightarrow Client(x) \wedge ClientGoal(y) \tag{13}$$

$$\forall x, y, hasSubGoal(x, y) \rightarrow ClientGoal(x) \wedge ClientGoal(y) \tag{14}$$

$$\forall x, y, inducesClientNeed(x, y) \rightarrow ClientGoal(x) \wedge ClientNeed(y) \tag{15}$$

3.6. Needs

What are the unmet needs of client X? What needs are clients presenting to staff?
Ontology classes: $ClientNeed, NormativeNeed, ExpressedNeed$

Needs provide the conceptual focus for social work practice and several theoretical conceptualizations of human needs have been developed to date (reviewed in section 2). In view of Social Work's imperative to act in a concrete manner to alleviate the situations experienced by clients, in our framework,

- a need is explicitly connected to a goal, and through that to the problem that induced it;
- meeting a need has as a consequence the fulfillment or partial fulfillment of the goal that induced it.

In our ontology, a client need (class *ClientNeed*) defines the changes needed in a client's state and relies on two elements: (1) a type of measurable feature that would be changed (or maintained), such as life skills or mental health state, and (2) an action (e.g., *improve, acquire, develop*) that enacts the change (or maintains the status quo).

Operationalizing needs as differences between measurable/observable features allows us to:

- infer a client's current needs
- check the satisfaction of a need via observable client outcomes.

Client needs assessment instruments used in social work collect two types of needs (used for prioritizing services as well as for reporting on client outcomes and client satisfaction):

- *normative needs*, those identified by the social worker or clinician administering the assessment instrument
- *expressed needs*, those described by the client, parent or legal guardian.

A client need can be both normative and expressed. Social workers must also assess the acuity (e.g., intensity, importance, or urgency, depending on the specific context) of each one of a client's needs based on the client's circumstances. The result of the assessment is embodied in an acuity score, which can be associated with client needs as well as with clients themselves, and is used to prioritize (1) the satisfaction of a client' needs when resources are limited and (2) a client's access to services[11]. Property *hasAcquityScore* specifies the acuity level, as assessed by a healthcare/social work practitioner.

3.7. Areas of Concern

CQ: What needs related to housing and homelessness are being referred for?
Ontology classes: $Areaof Concern$

In the practice of Social Work, client needs are often are grouped by reference to areas of concern, e.g. health-related needs, employment-related needs, parenting-related needs, housing-related needs and needs related to (re-)offending. The grouping of needs based on areas of concern aligns well with our conceptualization of need. The *areas of concern*, also referred to as *areas of need*, are defined by each community of practice. A need may belong to several areas of concern. (The areas of concern are also used to categorize the problems from which the client needs arise.)

3.8. Need Satisfiers

CQ: Which (local) services match my client's unmet needs?
CQ: What supports are available (locally) for my client?
CQ: Which services match mental health-related needs?
Ontology classes: $NeedSatisfier$

Needs are met by *need satisfiers*, which include various categories of *beings*, *havings*, *doings* or *interactings*, from concrete resources such as goods and money, to the more abstract laws, mechanisms, tools, processes, opportunities and settings where the needs are met. In our

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[11]Some service eligibility conditions specify that the client's acuity must be, for example, "high" or "medium-high".

framework, need satisfiers, represented by class NeedSatisfier, are provided via social services. This helps define a clear relationship between social services and the target needs, via the ''need satisfier'' being provided. Many communities of practice divide need satisfiers in the following categories:

- resources (e.g., goods, money, facilities, housing)
- knowledge and information (e.g., training, coaching, education, legal advice)
- supports (e.g., companionship, supported transportation)

Property *forNeed* links instances of need satisfiers to instances of *Need* that specify the needs the satisfier (partially) fulfills. Property *changes* links to instances of *ClientState* that specify the client states changed by the satisfier.

3.9. Evaluation

We have evaluated our proposed ontology for correctness and completeness by demonstrating that it meets all the requirements captured in the competency questions provided by our partners. We provided in a recent paper, [13], the details of the evaluation, including translations of the competency questions into SPARQL queries. In this paper we focused on presenting the details the ontological analysis that provided the conceptual underpinning for the proposed formalization of client problems, goals and needs, and need satisfiers.

4. Conclusion

Up to now, in social work practice, client needs have been recorded via proxy as the social services provided, or recommended to be provided to the client. This approach obscures the actual client needs and makes it difficult to properly assess the gap in social services provision as well as the impact of social interventions.

With the work presented in this paper we have contributed towards a deeper understanding of the concept of need (as relevant to Social Work practice) and grounded its operationalization in measurable client features. The core ontology we have proposed allows for the recording of needs in a way that not only illuminates their connection to the client states they are rooted in but also makes clear and traceable the link to the social services provided to meet them (via the satisfiers they supply).

The ontology was evaluated (1) for competency/completeness by demonstrating that it can answer the competency questions provided by subject matter experts via SPARQL queries and (2) for consistency via logical reasoning.

In future work we plan to extend our ontology to encompass community needs and facilitate the analysis of service provisioning at community level, the identification of service gaps and the optimization of the service supply mix. We also plan to analyze and operationalize client satisfaction and its connection with the goals and outcomes achieved.

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