Knowledge Acquisition and RDF

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1 Knowledge Acquisition

The initial phase of the knowledge acquisition process involved a comprehensive analysis of Competency Questions (CQs) presented in Table **??**, which formed the cornerstone of our understanding of the disorder. This analysis led to the systematic categorisation of CQs into distinct concepts, each corresponding to essential aspects of OCD, such as symptoms, triggers, and intrusive thoughts. These concepts served as a blueprint, delineating the ontology's scope and guiding our subsequent knowledge acquisition endeavors. Our approach drew upon authoritative sources including the DSM-5, Yale-Brown Obsessive Compulsive Scale (Y-BOCS) presented in Appendix **??**), Obsessive-Compulsive Inventory (OCI), and the Vancouver Obsessive-Compulsive Inventory (VOCI), enriched by a thorough literature review. Table 1 aligns CQs with their concepts and associated knowledge, demonstrating our methodical approach to understanding OCD. The concepts help to identify parts of ontology that need to be designed or defined. Note: *The knowledge is acquired from DSM-5 book [**?**] from page (235-265)*

After identifying essential concepts derived from our analysis of CQs, we proceeded to articulate this knowledge using RDF (Resource Description Framework) statements. RDF, a foundational web standard for data interchange, employs a graph-based structure to detail information about resources. The transformation from abstract concept identification to concrete RDF statement formulation clarifies and specifies the relationships and entities within our ontology. For example, contemplating the concept of *OCD* and its relationship with *Mental disorder* in RDF, we can represent this relationship with a statement

like: *OCD is type of mental disorder or OCD is sub-class of mental disorder.*
Here, "OCD" and "mental disorder" are entities and "type of" is a relationship.
Note: In the table below, underlined text signifies the RDF formalization of the corresponding entries.

Table 1: Competency Questions (CQs), Knowledge Acquisition and RDF Formalisation of different concepts (Index 1 to 11)

CQs	Knowledge Acquisition	RDF Formalisation
	1. Risk factors	
CQ1	*Temperamental risk factors* include greater internalizing symptoms, *higher negative emotionality*, and *behavioral inhibition in childhood*. *Environmental risk factors*, such as *physical and sexual abuse in childhood* and *exposure to stressful or traumatic events*, have been associated with an increased risk for developing OCD. *Genetic and physiological risk factors* show that the rate of OCD among first-degree relatives of adults with OCD is approximately two times higher than among first-degree relatives of those without the disorder; this rate is increased 10-fold among first-degree relatives of individuals with onset of OCD in childhood or adolescence. *Suicide risk and Gender-Related Diagnostic Issues* are also considered potential risk factors for OCD [DSM-5].	• OCD has risk factors. • Temperamental risk factors are a type of OCD risk factor. • Environmental risk factors are a type of OCD risk factor. • Physical and sexual abuse in childhood is a type of OCD risk factor. • Genetic factors are a type of OCD risk factor. • Suicide risk is a type of OCD risk factor.

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CQs	Knowledge Acquisition	RDF Formalisation
**2. Obsession & Compulsion**		
CQ2	*Obsessions are recurrent and persistent thoughts, urges, or images* that are experienced at some time during the disturbance *as intrusive and unwanted*, and that, in most individuals, *cause marked anxiety or distress.* The affected individuals attempt to ignore or suppress such thoughts, urges, or images or to neutralize them with some other thought or action (i.e., by *performing a compulsion).* *Compulsions are repetitive behaviors or mental acts that an individual feels driven to perform in response to an obsession* or according to rules that must be applied rigidly. The behaviors or mental acts are aimed to prevent or to reduce anxiety or distress or to prevent some dreaded event or situation; however, these behaviors or mental acts are not connected realistically with what they are designed to neutralize or prevent, or they are clearly excessive. *The obsessions or compulsions are time-consuming (e.g., take more than 1 hour per day) or cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.* [DSM-5]	Obsessions are: • intrusive thoughts. • intrusive images. • intrusive urges. • accompanied by Compulsions. • Intrusive thoughts are (recurrent and persistent). Compulsions are: • repetitive behaviours. • repetitive mental acts. • associated negative emotions. • cause for functional impairment. • time-consuming.

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CQs	Knowledge Acquisition	RDF Formalisation
3. OCD, Symptoms, Treatment		
CQ3, CQ4, CQ5	*OCD occupies* a distinct classification within the broader spectrum of *Obsessive-Compulsive and Related Disorders*, delineated by several subordinate categories. These include OCD, *Body Dysmorphic Disorder (BDD)*, *Hoarding Disorder*, *Trichotillomania*, *Excoriation (Skin Picking)* Disorder and *Substance/Medication*-Induced Obsessive-Compulsive and Related Disorder [DSM-5]. *OCD is characterised by the presence of obsessions and/or compulsions* [DSM-5]. The two main *treatments* for OCD are *psychotherapy* (mostly cognitive behavioral therapy) and *medication*. Often, a mix of both treatments is most effective. [DSM-5]	• OCD is a type of OCRDs. • BDD is a type of OCRDs. • Hoarding Disorder is a type of OCRDs. • Trichotillomania is type of OCRDs. • Excoriation (Skin Picking) is a type of OCRDs. • OCD is an obsession. • OCD is a compulsion. • OCD is an obsession or compulsion. • OCD is treatable. • Psychotherapy is a type of OCD treatment. • CBT is a type of psychotherapy. • Medicines are a type of OCD treatment.

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CQs	Knowledge Acquisition	RDF Formalisation
4. Intrusive thought, Intrusive image and Intrusive urge		
CQ6, CQ7, CQ8, CQ9, CQ15, CQ16	*Intrusiveness* is identified by the considerable amount of *time* individuals spend grappling with intrusive thoughts, alongside the *distress* and *functional impairment* these thoughts cause. Although DSM-5 and various assessment tools do not explicitly define intrusive thoughts, Julien et al. [**?**] have elucidated the concept of intrusiveness.	Intrusive thoughts are: • associated time consuming. • associated negative emotions. • associated impairment. Intrusive images are: • a type of mental image. • associated time consuming. • associated negative emotions. • associated impairment. Intrusive urges are: • associated time consuming. • associated negative emotions. • associated impairment.

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CQs	Knowledge Acquisition	RDF Formalisation
	5. Thought	
CQ8, CQ11, CQ12, CQ13, CQ14, CQ21	In addressing Competency Questions 7, 10, 11, 12, and 13, which fall under the concept "Thought", we employ the framework provided by the Y-BOCS to delineate various types of obsession. These include: *Aggressive Thoughts*, characterised by fears of harming oneself or others; Sexual Thoughts, involving distressing, obscene, or inappropriate sexual content; *Contamination Thoughts*, focusing on dirt, germs, or being contaminated by touching objects others have touched; *Symmetry Thoughts*, characterised by an overwhelming need for orderliness and alignment of objects; *Somatic Thoughts*, encompassing concerns with body and health issues; *Religious Thoughts*, entailing obsessive thoughts involving blasphemy or moral dilemmas tied to religious beliefs; *Doubt Thoughts*, characterised by persistent uncertainty or indecision, often manifesting as an excessive need for reassurance or fear of making mistakes. [Y-BOCS]	• Aggressive thoughts are a type of thought. • Somatic thoughts are a type of thought. • Sexual thoughts are a type of thought. • Religious thoughts are a type of thought. • Symmetry thoughts are a type of thought. • Contamination thoughts are a type of thought. • Hoarding thoughts are a type of thought. • Doubt thoughts are a type of thought.

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CQs	Knowledge Acquisition	RDF Formalisation
	6. Thought appraisal	
CQ10	Many individuals affected by OCD exhibit *dysfunctional beliefs* that can manifest as an *inflated sense of responsibility, overestimation of threat, perfectionism, intolerance of uncertainty, over-importance of thoughts* (e.g., believing that having a forbidden thought is as bad as acting on it) and the need to *control thoughts* [DSM-5]. The appraisal model suggests that how individuals interpret their intrusive thoughts, known as thought appraisal, is key to whether these thoughts will *intensify into obsessions*. This model, proposed by several researchers [?] [?], posits that dysfunctional attitudes or longstanding beliefs an individual holds across different situations shape this appraisal process. These underlying beliefs influence the significance they attach to the intrusive thoughts, determining their potential to develop into obsessions.	• Intrusive thoughts are associated appraisal. • Intrusive urges are associated appraisal. • Intrusive images are associated appraisal. • Obsessions are associated appraisal. • Inflated sense of responsibility is a type of thought appraisal. • Perfectionism is a type of thought appraisal. • Overestimate threat is a type of thought appraisal. • Intolerance of uncertainty is a type of thought appraisal. • Over-importance of thoughts is a type of thought appraisal.

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CQs	Knowledge Acquisition	RDF Formalisation
	7. Assessment criteria	
CQ16, CQ17, CQ18	These questions address aspects like the *control over intrusive thoughts or compulsive actions*, the effort to *resist them*, *their impact on daily life*, and the *time they occupy*, as detailed in the Y-BOCS assessment.	• Severity control level is an assessment criterion of obsession and compulsion. Severity distress level is an assessment criterion of obsession and compulsion. • Severity resistance level is an assessment criterion of obsession and compulsion. Severity interference level is an assessment criterion of obsession and compulsion. Intrusive thoughts are associated: • severity control level. • severity distress level. • severity resistance level. • severity interference level. Intrusive urges are associated: • severity control level. • severity distress level. • severity resistance level. • severity interference level. Intrusive images are associated: • severity control level. • severity distress level. • severity resistance level. • severity interference level.

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CQs	Knowledge Acquisition	RDF Formalisation
8. Compulsive behavior/ Behavior/ Activity		
CQ9, CQ13, CQ18, CQ19, CQ20	Compulsions are repetitive behaviors or mental acts that an individual feels driven to perform in response to an obsession or according to rules that must be applied rigidly. The behaviors or mental acts aim to prevent or reduce anxiety or distress or to prevent some dreaded event or situation; however, they are not connected realistically with what they are designed to neutralize or prevent, or are clearly excessive. [DSM-5]	Related RDF statements are provided in index (2).
9. Functional impairment		
CQ22	*OCD* is *associated* with *reduced quality of life* as well as high levels of *social* and *occupational impairment.* Impairment occurs across many different domains of life and is associated with symptom severity [DSM-5].	• OCD has associated impairments. • Social impairment is a type of Functional impairment. • Relationship impairment is a type of Functional impairment. • Occupational impairment is a type of Functional impairment.

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CQs	Knowledge Acquisition	RDF Formalisation
	10. Comorbidity	
CQ23	Individuals with *OCD* often *exhibit other psychopathologies*, contributing to the complexity and heterogeneity of their clinical presentations. Notably, a substantial proportion of adults diagnosed with OCD have a lifetime diagnosis of *anxiety disorders* (76%; e.g., panic disorder, social anxiety disorder, generalized anxiety disorder, specific phobia) or *depressive or bipolar* disorders (63% for any depressive or bipolar disorder, with the most common being major depressive disorder [41%] [**?**]). The onset of OCD typically occurs later in comparison to most comorbid anxiety disorders (with the exception of separation anxiety disorder) and PTSD but often precedes the onset of depressive disorders. Additionally, comorbid *obsessive-compulsive personality disorder* is also common in individuals with OCD, with prevalence rates ranging from 23% to 32% [**?**].	• OCD co-occur with other mental disorders. • Common comorbidities include: Anxiety disorders, Depressive disorders, Bipolar disorders, Post-Traumatic Stress Disorder (PTSD) and Obsessive-Compulsive Personality Disorder.

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CQs	Knowledge Acquisition	RDF Formalisation
	11. Trigger	
CQ24	It is common for individuals affected by *OCD* to avoid *people, places*, and things that *trigger* obsessions and compulsions. For example, individuals with contamination concerns might avoid public situations (e.g., restaurants, public restrooms) to reduce exposure to feared contaminants; individuals with intrusive thoughts about causing harm might avoid social interactions. [DSM-5]	• Intrusive thoughts have triggers. • Intrusive images have triggers. • Intrusive urges have triggers. • Places are a type of trigger. • People are a type of trigger. • Event are a type of trigger.

This structured approach, encompassing the analysis of CQs and the systematic gathering and categorisation of OCD knowledge, serves as the cornerstone of our ontology development process. This methodological framework not only facilitates the compilation of related information but also enables the creation of a cohesive representation of OCD. By organising data in accordance with predefined concepts derived from CQs, we aim to create an ontology that presents a detailed and varied representation of OCD, while being mindful of its complex characteristics.