

Table S1. CDPEO ontology metrics

Metric	Count
Overall Metrics	
Classes	40
Axioms	799
Logical Axioms	630
Declaration Axioms	169
Object Properties	31
Data Properties	67
Individuals	32
SWRL Rules	80
Class Axioms	
SubClassOf Axioms	64
DisjointClasses Axioms	7
Object Property Axioms	
SubObjectPropertyOf Axioms	30
FunctionalObjectProperty Axioms	30
ObjectPropertyDomain Axioms	30
ObjectPropertyRange Axioms	30
Data Property Axioms	
SubDataPropertyOf Axioms	66
FunctionalDataProperty Axioms	66
DataPropertyDomain Axioms	66
DataPropertyRange Axioms	66
Individual Axioms	
ClassAssertion Axioms	32
ObjectPropertyAssertion Axioms	30
DataPropertyAssertion Axioms	33

Table S2. All SWRL Rules in CDPEO

Category	Rule Number	SWRL Rule	Corresponding Vector Item
Demographics	A01	PatientProfile(?p) ^ hasGender(?p, ?g) ^ hasGenderValue(?g, "F") -> vectorItemFemale(?p, 1) ^ vectorItemMale(?p, 0)	Female
	A02	PatientProfile(?p) ^ hasGender(?p, ?g) ^ hasGenderValue(?g, "M") -> vectorItemFemale(?p, 0) ^ vectorItemMale(?p, 1)	Male
	A03	PatientProfile(?p) ^ hasAge(?p, ?a) ^ hasAgeValue(?a, ?v) ^ swrlb:greaterThanOrEqual(?v, 60) -> vectorItemYouth(?p, 0) ^ vectorItemOldAge(?p, 1)	Elderly
	A04	PatientProfile(?p) ^ hasAge(?p, ?a) ^ hasAgeValue(?a, ?v) ^ swrlb:lessThanOrEqual(?v, 60) -> vectorItemYouth(?p, 1) ^ vectorItemOldAge(?p, 0)	Youth
	A05	PatientProfile(?p) ^ hasPregnancy(?p, ?pr) ^ hasPregnancyValue(?pr, true) -> vectorItemPregnant(?p, 1)	Pregnancy
	A06	PatientProfile(?p) ^ hasPregnancy(?p, ?pr) ^ hasPregnancyValue(?pr, false) -> vectorItemPregnant(?p, 0)	Pregnancy
	A07	PatientProfile(?p) ^ hasBMI(?p, ?b) ^ hasBMIValue(?b, ?v) ^ swrlb:greaterThan(?v, 24) -> vectorItemOverWeight(?p, 1)	Overweight
	A08	PatientProfile(?p) ^ hasBMI(?p, ?b) ^ hasBMIValue(?b, ?v) ^ swrlb:lessThanOrEqual(?v, 24) -> vectorItemOverWeight(?p, 0)	Overweight
Disease	B01	PatientProfile(?p) ^ hasHypertension(?p, ?h) ^ hasHypertensionValue(?h, true) -> vectorItemHypertension(?p, 1)	Hypertension
	B02	PatientProfile(?p) ^ hasHypertension(?p, ?h) ^ hasHypertensionValue(?h, false) ->	Hypertension

		vectorItemHypertension(?p, 0)	
B03		PatientProfile(?p) ^ hasCOPD(?p, ?c) ^ hasCOPDValue(?c, false) -> vectorItemChronicObstructivePulmonary Disease(?p, 0)	COPD
B04		PatientProfile(?p) ^ hasCOPD(?p, ?c) ^ hasCOPDValue(?c, true) -> vectorItemChronicObstructivePulmonary Disease(?p, 1)	COPD
B05		PatientProfile(?p) ^ hasCHD(?p, ?c) ^ hasCHDValue(?c, true) -> vectorItemCoronaryHeartDisease(?p, 1)	CHD
B06		PatientProfile(?p) ^ hasCHD(?p, ?c) ^ hasCHDValue(?c, false) -> vectorItemCoronaryHeartDisease(?p, 0)	CHD
B07		PatientProfile(?p) ^ hasDiabetes(?p, ?d) ^ hasDiabetesValue(?d, false) -> vectorItemDiabetes(?p, 0)	Diabetes
B08		PatientProfile(?p) ^ hasDiabetes(?p, ?d) ^ hasDiabetesValue(?d, true) -> vectorItemDiabetes(?p, 1)	Diabetes
B09		PatientProfile(?p) ^ hasHyperlipidemia(?p, ?h) ^ hasHyperlipidemiaValue(?h, true) -> vectorItemHyperlipidemia(?p, 1)	Hyperlipidemia
B10		PatientProfile(?p) ^ hasHyperlipidemia(?p, ?h) ^ hasHyperlipidemiaValue(?h, false) -> vectorItemHyperlipidemia(?p, 0)	Hyperlipidemia
B11		PatientProfile(?p) ^ hasStroke(?p, ?s) ^ hasStrokeValue(?s, false) -> vectorItemStroke(?p, 0)	Stroke
B12		PatientProfile(?p) ^ hasStroke(?p, ?s) ^ hasStrokeValue(?s, true) -> vectorItemStroke(?p, 1)	Stroke
B13		PatientProfile(?p) ^ hasEyeDisease(?p, ?d) ^ hasEyeDiseaseValue(?d, false) -> vectorItemEyeDisease(?p, 0)	Eye Disease
B14		PatientProfile(?p) ^ hasEyeDisease(?p, ?d) ^ hasEyeDiseaseValue(?d, true) -> vectorItemEyeDisease(?p, 1)	Eye Disease
B15		PatientProfile(?p) ^ hasKidneyDisease(?p, ?d) ^ hasKidneyDiseaseValue(?d, true) ->	Kidney Disease

		vectorItemKidneyDisease(?p, 1)	
	B16	PatientProfile(?p) ^ hasKidneyDisease(?p, ?d) ^ hasKidneyDiseaseValue(?d, false) -> vectorItemKidneyDisease(?p, 0)	Kidney Disease
	B17	PatientProfile(?p) ^ hasSkinDisease(?p, ?d) ^ hasSkinDiseaseValue(?d, false) -> vectorItemSkinDisease(?p, 0)	Skin Disease
	B18	PatientProfile(?p) ^ hasSkinDisease(?p, ?d) ^ hasSkinDiseaseValue(?d, true) -> vectorItemSkinDisease(?p, 1)	Skin Disease
	B19	PatientProfile(?p) ^ hasLungDisease(?p, ?d) ^ hasLungDiseaseValue(?d, true) -> vectorItemLungDisease(?p, 1)	Lung Disease
	B20	PatientProfile(?p) ^ hasLungDisease(?p, ?d) ^ hasLungDiseaseValue(?d, false) -> vectorItemLungDisease(?p, 0)	Lung Disease
	B21	PatientProfile(?p) ^ hasLiverDisease(?p, ?d) ^ hasLiverDiseaseValue(?d, false) -> vectorItemLiverDisease(?p, 0)	Liver Disease
	B22	PatientProfile(?p) ^ hasLiverDisease(?p, ?d) ^ hasLiverDiseaseValue(?d, true) -> vectorItemLiverDisease(?p, 1)	Liver Disease
	B23	PatientProfile(?p) ^ hasStomachDisease(?p, ?d) ^ hasStomachDiseaseValue(?d, true) -> vectorItemStomachDisease(?p, 1)	Stomach Disease
	B24	PatientProfile(?p) ^ hasStomachDisease(?p, ?d) ^ hasStomachDiseaseValue(?d, false) -> vectorItemStomachDisease(?p, 0)	Stomach Disease
Lifestyle	C01	PatientProfile(?p) ^ hasMentality(?p, ?m) ^ hasPHQ9Value(?m, ?v) ^ swrlb:lessThanOrEqualTo(?v, 4) -> vectorItemDepression(?p, 0)	Mentality
	C02	PatientProfile(?p) ^ hasMentality(?p, ?m) ^ hasPHQ9Value(?m, ?v) ^ swrlb:lessThanOrEqualTo(?v, 9) ^	Mentality

		swrlb:greaterThanOrEqual(?v, 5) -> vectorItemDepression(?p, 1)	
	C03	PatientProfile(?p) ^ hasMentality(?p, ?m) ^ hasPHQ9Value(?m, ?v) ^ swrlb:lessThanOrEqual(?v, 14) ^ swrlb:greaterThanOrEqual(?v, 10) -> vectorItemDepression(?p, 2)	Mentality
	C04	PatientProfile(?p) ^ hasMentality(?p, ?m) ^ hasPHQ9Value(?m, ?v) ^ swrlb:lessThanOrEqual(?v, 19) ^ swrlb:greaterThanOrEqual(?v, 15) -> vectorItemDepression(?p, 3)	Mentality
	C05	PatientProfile(?p) ^ hasMentality(?p, ?m) ^ hasPHQ9Value(?m, ?v) ^ swrlb:lessThanOrEqual(?v, 27) ^ swrlb:greaterThanOrEqual(?v, 20) -> vectorItemDepression(?p, 4)	Mentality
	C06	PatientProfile(?p) ^ hasSmoking(?p, ?s) ^ hasDailyCigarettes(?s, ?d) ^ swrlb:lessThanOrEqual(?d, 10) ^ swrlb:greaterThan(?d, 0) -> vectorItemSmoking(?p, 1)	Smoking
	C07	PatientProfile(?p) ^ hasSmoking(?p, ?s) ^ hasDailyCigarettes(?s, ?d) ^ swrlb:lessThanOrEqual(?d, 20) ^ swrlb:greaterThanOrEqual(?d, 11) -> vectorItemSmoking(?p, 2)	Smoking
	C08	PatientProfile(?p) ^ hasSmoking(?p, ?s) ^ hasDailyCigarettes(?s, ?d) ^ swrlb:greaterThanOrEqual(?d, 21) -> vectorItemSmoking(?p, 3)	Smoking
	C09	PatientProfile(?p) ^ hasSmoking(?p, ?s) ^ swrlb:equal(?d, 0) ^ hasDailyCigarettes(?s, ?d) -> vectorItemSmoking(?p, 0)	Smoking
	C10	PatientProfile(?p) ^ hasDrinking(?p, ?d) ^ hasDailyDrinking(?s, ?da) ^ swrlb:equal(?da, 0) -> vectorItemDrinking(?p, 0)	Drinking
	C11	PatientProfile(?p) ^ hasDrinking(?p, ?d) ^ hasDailyDrinking(?s, ?da) ^ swrlb:greaterThan(?da, 0) ^ swrlb:lessThanOrEqual(?da, 1) -> vectorItemDrinking(?p, 1)	Drinking

	C12	PatientProfile(?p) ^ hasDrinking(?p, ?d) ^ hasDailyDrinking(?s, ?da) ^ swrlb:lessThan(?da, 3) ^ swrlb:greaterThan(?da, 1) -> vectorItemDrinking(?p, 2)	Drinking
	C13	PatientProfile(?p) ^ hasDrinking(?p, ?d) ^ hasDailyDrinking(?s, ?da) ^ swrlb:greaterThanOrEqual(?da, 3) -> vectorItemDrinking(?p, 3)	Drinking
	C14	PatientProfile(?p) ^ hasDiet(?p, ?d) ^ hasDietLevel(?d, "good") -> vectorItemDiet(?p, 0)	Diet
	C15	PatientProfile(?p) ^ hasDiet(?p, ?d) ^ hasDietLevel(?d, "medium") -> vectorItemDiet(?p, 1)	Diet
	C16	PatientProfile(?p) ^ hasDiet(?p, ?d) ^ hasDietLevel(?d, "poor") -> vectorItemDiet(?p, 2)	Diet
	C17	PatientProfile(?p) ^ hasExercise(?p, ?e) ^ hasIPAQLevel(?e, "high") -> vectorItemExercise(?p, 0)	Exercise
	C18	PatientProfile(?p) ^ hasExercise(?p, ?e) ^ hasIPAQLevel(?e, "moderate") -> vectorItemExercise(?p, 1)	Exercise
	C19	PatientProfile(?p) ^ hasExercise(?p, ?e) ^ hasIPAQLevel(?e, "low") -> vectorItemExercise(?p, 2)	Exercise
Physiological Index	D01	PatientProfile(?p) ^ hasBP(?p, ?b) ^ hasSBPValue(?b, ?sv) ^ swrlb:greaterThanOrEqual(?sv, 180) -> vectorItemBloodPressure(?p, 3)	Blood Pressure
	D02	PatientProfile(?p) ^ hasBP(?p, ?b) ^ hasDBPValue(?b, ?dv) ^ swrlb:greaterThanOrEqual(?dv, 110) -> vectorItemBloodPressure(?p, 3)	Blood Pressure
	D03	PatientProfile(?p) ^ hasBP(?p, ?b) ^ hasDBPValue(?b, ?dv) ^ swrlb:greaterThanOrEqual(?dv, 100) ^ swrlb:lessThan(?dv, 110) -> vectorItemBloodPressure(?p, 2)	Blood Pressure
	D04	PatientProfile(?p) ^ hasBP(?p, ?b) ^ hasSBPValue(?b, ?sv) ^ swrlb:greaterThanOrEqual(?sv, 160) ^ swrlb:lessThan(?sv, 180) ->	Blood Pressure

		vectorItemBloodPressure(?p, 2)	
	D05	PatientProfile(?p) ^ hasBP(?p, ?b) ^ hasDBPValue(?b, ?dv) ^ swrlb:greaterThanOrEqual(?dv, 100) ^ swrlb:lessThan(?dv, 110) -> vectorItemBloodPressure(?p, 2)	Blood Pressure
	D06	PatientProfile(?p) ^ hasBP(?p, ?b) ^ hasDBPValue(?b, ?dv) ^ swrlb:greaterThanOrEqual(?dv, 90) ^ swrlb:lessThan(?dv, 100) -> vectorItemBloodPressure(?p, 1)	Blood Pressure
	D07	PatientProfile(?p) ^ hasBP(?p, ?b) ^ hasDBPValue(?b, ?dv) ^ swrlb:lessThan(?dv, 90) ^ hasSBPValue(?b, ?sv) ^ swrlb:lessThan(?sv, 140) -> vectorItemBloodPressure(?p, 0)	Blood Pressure
	D08	PatientProfile(?p) ^ hasBG(?p, ?b) ^ hasBGValue(?b, ?v) ^ swrlb:lessThan(?v, 6.1) -> vectorItemBloodGlucose(?p, 0)	Blood Glucose
	D09	PatientProfile(?p) ^ hasBG(?p, ?b) ^ hasBGValue(?b, ?v) ^ swrlb:lessThan(?v, 7) ^ swrlb:greaterThanOrEqual(?v, 6.1) -> vectorItemBloodGlucose(?p, 1)	Blood Glucose
	D10	PatientProfile(?p) ^ hasBG(?p, ?b) ^ hasBGValue(?b, ?v) ^ swrlb:greaterThanOrEqual(?v, 7) -> vectorItemBloodGlucose(?p, 2)	Blood Glucose
	D11	PatientProfile(?p) ^ hasLipoprotein(?p, ?l) ^ hasHDLValue(?l, ?h) ^ swrlb:lessThan(?h, 1.2) -> vectorItemLipoprotein(?p, 1)	Lipoprotein
	D12	PatientProfile(?p) ^ hasLipoprotein(?p, ?l) ^ hasLDLValue(?l, ?lv) ^ swrlb:greaterThan(?lv, 3.12) -> vectorItemLipoprotein(?p, 1)	Lipoprotein
	D13	PatientProfile(?p) ^ hasLipoprotein(?p, ?l) ^ hasLDLValue(?l, ?lv) ^ swrlb:lessThanOrEqual(?lv, 3.12) ^ hasHDLValue(?l, ?hv) ^ swrlb:greaterThanOrEqual(?hv, 1.2) -> vectorItemLipoprotein(?p, 0)	Lipoprotein
	D14	PatientProfile(?p) ^ hasTC(?p, ?t) ^ hasTCValue(?t, ?v) ^	Total Cholesterol

		swrlb:lessThanOrEqual(?v, 5.2) -> vectorItemTotalCholesterol(?p, 0)	
	D15	PatientProfile(?p) ^ hasTC(?p, ?t) ^ hasTCValue(?t, ?v) ^ swrlb:greaterThan(?v, 5.2) -> vectorItemTotalCholesterol(?p, 1)	Total Cholesterol
	D16	PatientProfile(?p) ^ hasTG(?p, ?t) ^ hasTGValue(?t, ?v) ^ swrlb:greaterThan(?v, 1.7) -> vectorItemTriglyceride(?p, 1)	Triglyceride
	D17	PatientProfile(?p) ^ hasTG(?p, ?t) ^ hasTGValue(?t, ?v) ^ swrlb:lessThanOrEqual(?v, 1.7) -> vectorItemTriglyceride(?p, 0)	Triglyceride
	D18	PatientProfile(?p) ^ hasUA(?p, ?u) ^ hasUAValue(?u, ?v) ^ swrlb:lessThanOrEqual(?v, 416) ^ hasAge(?p, ?a) ^ hasAgeValue(?a, ?av) ^ swrlb:lessThanOrEqual(?av, 60) ^ hasGender(?p, ?g) ^ hasGenderValue(?g, "M") -> vectorItemUricAcid(?p, 0)	Uric Aid
	D19	PatientProfile(?p) ^ hasUA(?p, ?u) ^ hasUAValue(?u, ?v) ^ swrlb:lessThanOrEqual(?v, 357) ^ hasAge(?p, ?a) ^ hasAgeValue(?a, ?av) ^ swrlb:lessThanOrEqual(?av, 60) ^ hasGender(?p, ?g) ^ hasGenderValue(?g, "F") -> vectorItemUricAcid(?p, 0)	Uric Aid
	D20	PatientProfile(?p) ^ hasUA(?p, ?u) ^ hasUAValue(?u, ?v) ^ swrlb:greaterThan(?v, 416) ^ hasAge(?p, ?a) ^ hasAgeValue(?a, ?av) ^ swrlb:lessThanOrEqual(?av, 60) ^ hasGender(?p, ?g) ^ hasGenderValue(?g, "M") -> vectorItemUricAcid(?p, 1)	Uric Aid
	D21	PatientProfile(?p) ^ hasUA(?p, ?u) ^ hasUAValue(?u, ?v) ^ swrlb:greaterThan(?v, 357) ^ hasAge(?p, ?a) ^ hasAgeValue(?a, ?av) ^ swrlb:lessThanOrEqual(?av, 60) ^ hasGender(?p, ?g) ^ hasGenderValue(?g, "F") -> vectorItemUricAcid(?p, 1)	Uric Aid
	D22	PatientProfile(?p) ^ hasUA(?p, ?u) ^ hasUAValue(?u, ?v) ^	Uric Aid

		swrlb:lessThanOrEqualTo(?v, 434) ^ hasAge(?p, ?a) ^ hasAgeValue(?a, ?av) ^ swrlb:greaterThan(?av, 60) ^ hasGender(?p, ?g) ^ hasGenderValue(?g, "F") -> vectorItemUricAcid(?p, 0)	
	D23	PatientProfile(?p) ^ hasUA(?p, ?u) ^ hasUAValue(?u, ?v) ^ swrlb:lessThanOrEqualTo(?v, 476) ^ hasAge(?p, ?a) ^ hasAgeValue(?a, ?av) ^ swrlb:greaterThan(?av, 60) ^ hasGender(?p, ?g) ^ hasGenderValue(?g, "M") -> vectorItemUricAcid(?p, 0)	Uric Aid
	D24	PatientProfile(?p) ^ hasUA(?p, ?u) ^ hasUAValue(?u, ?v) ^ swrlb:greaterThan(?v, 476) ^ hasAge(?p, ?a) ^ hasAgeValue(?a, ?av) ^ swrlb:greaterThan(?av, 60) ^ hasGender(?p, ?g) ^ hasGenderValue(?g, "M") -> vectorItemUricAcid(?p, 1)	Uric Aid
Medication	E01	PatientProfile(?p) ^ hasAntiHypertensiveDrug(?p, ?d) ^ hasAntiHypertensiveDrugValue(?d, ?v) -> vectorItemAntiHypertensiveDrug(?p, ?v)	Anti- hypertensive Drug
	E02	PatientProfile(?p) ^ hasHypoglycemicDrug(?p, ?d) ^ hasHypoglycemicDrugValue(?d, ?v) -> vectorItemHypoglycemicDrug(?p, ?v)	Hypoglycemic Drug
	E03	PatientProfile(?p) ^ hasHypolipidemicDrug(?p, ?d) ^ hasHypolipidemicDrugValue(?d, ?v) -> vectorItemHypolipidemicDrug(?p, ?v)	Hypolipidemic Drug
	E04	PatientProfile(?p) ^ hasHypoglycemicDrug(?p, ?d) ^ hasInsulinValue(?d, true) -> vectorItemInsulin(?p, 1)	Insulin
	E05	PatientProfile(?p) ^ hasHypoglycemicDrug(?p, ?d) ^ hasInsulinValue(?d, false) -> vectorItemInsulin(?p, 0)	Insulin