A METAONTOLOGY FOR MEDICAL DIAGNOSTICS OF ACUTE DISEASES. PART 2. A FORMAL DESCRIPTION OF CAUSE-AND-EFFECT RELATIONS

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Abstract: This article is the continuation of the formal description of the metaontology for medical diagnostics in the language of applied logic. It contains a description of interrelations between terms of knowledge and reality in the form of ontological agreements.

Keywords: Medical Diagnostics, ontology model, metaontology.

Introduction

This article is the continuation of [1] and contains a description of all the classes of cause-and-effect relations which take place in the situations, a description of knowledge about them, and also ontological agreements on their correspondence.

1. The terms of knowledge and reality which describe normal reactions and ontological agreements on correspondence between them

1.1. "*Knowledge about normal reactions*" is a set of structural values with attributes *effect*, *variants and acting factors.* Each of these values is knowledge about a particular normal reaction. The value of the first attribute is the name of a sign, the value of the second one is a set of variants of the normal reaction for this sign, and the value of the third one is a set of features.

knowledge about normal reactions ≡ (effect→signs, variants→{}variants of norm, acting factors→{}features)

1.2. "*Variants of norm*" is a term of knowledge. It is a set of structural values with attributes *range of effect* and *condition on acting factors.* Every value is knowledge about a particular variant of the normal reaction. The value of the first attribute is the set of values of the sign in this variant, and the value of the second one is a condition.

variants of norm ≡ (range of effect→sets of values, condition on acting factors→conditions)

1.3. For any variant of norm the range of the effect is a proper subset of possible values of the sign that is the effect of this normal reaction.

(knowledge: *knowledge about normal reactions*) (variant: *variants*(knowledge))

range of effect(variant) ⊂ *possible values*(*effect*(knowledge))

1.4. "*Normal reactions*" is a term of reality. It is a set of structural values with attributes *effect* and *variant.* Each of these values is a normal reaction that takes place in a situation. The value of the first attribute is the name of a sign, and the value of the second one is a variant of norm.

normal reactions ≡ (effect→signs, variant→ variants of norm)

1.5. If in a situation there is a normal reaction then in the set of *knowledge about normal reactions* there is such an element that its effect coincides with the effect of the normal reaction, the variant of norm for this normal reaction belongs to the set of variants of norm for this element, and for this variant of norm the condition on acting factors is fulfilled.

(reaction: *normal reactions*) ($\vee$ (knowledge: *knowledge about normal reactions*)

effect(knowledge) = *effect*(reaction)&*variant*(reaction) $\in$ *variants*(knowledge)&

&*fulfilled*(*condition on acting factors*(*variant*(reaction))))

2. The terms of knowledge and reality which describe responses to event's influence, and ontological agreements on correspondence between them

2.1. "*Knowledge about responses to event's influences*" is a set of structural values with attributes *cause-event*, *effect*, *variants*, *acting factors*, *necessary condition* and *modality*. Every value is knowledge about a particular response to event's influence. The value of the cause-event is the name of an event, the value of the effect is the name of a sign, the value of variants is a set of rei-variants, the value of the acting factors is a set of features, the value of the necessary condition is a condition, and the value of modality (hereafter) is *necessity* or *possibility*.

knowledge about responses to event's influences $\equiv$ (*cause-event*$\to$*events*, *effect*$\to$*signs*, *variants*$\to${}*rei-variants*, *acting factors*$\to${}*features*, *necessary condition*$\to$*conditions*, *modality*$\to${*possibility*, *necessity*})

2.2. "*Rei-variants*" is a set of structural values with attributes *range of cause-event*, *number of dynamics periods*, *description of dynamics* and *condition on acting factors*. Every value is knowledge about a particular variant of a response to event's influence. The value of the first attribute is a set of event's values. The value of the second one is a positive integer. The value of the third one is a function that takes the number of a dynamics period and returns the dynamics period. The value of the forth attribute is a condition.

rei-variants $\equiv$ (*range of cause-event*$\to$*sets of values*, *number of dynamics periods*$\to$I[1, ∞), *description of dynamics*$\to$(I[1, *number of dynamics periods*]$\to$*dynamics periods*), *condition on acting factors* $\to$ *conditions*)

2.3. "*Responses to event's influence*" is a term of reality. It is a set of structural values with attributes *cause-event*, *effect*, *variant*, *dynamics of values* and *modality*. Every value is a response to an event's influence that takes place in the situation. The value of the cause-event is the name of an event, the value of the effect is the name of a sign, the value of the variant is a rei-variant, and the value of the dynamics of values is a partition.

responses to event's influence $\equiv$ (*cause-event*$\to$*events*, *effect*$\to$*signs*, *variant*$\to$*rei-variants*, *dynamics of values*$\to$*partitions*, *modality*$\to${*possibility*, *necessity*})

2.4. If in a situation there is a response to an event's influence then the beginning of its dynamics of values belongs to the set of the time moments when the cause-event took place.

(response: *responses to event's influences*)

element(*dynamics of values*(response), 0) $\in$ *moments*(*cause-event*(response))

2.5. If in a situation there is *a response to an event's influence*, and this event happens to the patient at a moment then an element of the set of *knowledge about responses to event's influence* belongs to the model of knowledge. For this element the cause-event is the event, the effect is the same as the effect of the response to the event's influence, the necessary condition is fulfilled, the modality is the same as the modality of the response to the event's influence, the rei-variant of the response to the event's influence belongs to the set of rei-variants, and the value of the cause-event of this rei-variant belongs to the range of the cause-event of this variant, the number of intervals for the dynamics of values of the response to the event's influence is equal to the number of dynamics periods of this variant, and the condition on the acting factors is fulfilled.

(response: *responses to event's influences*)($\vee$ (knowledge: *knowledge about responses to event's influences*)

cause-event(knowledge)=*cause-event*(response)& *effect*(knowledge) = *effect*(response) &

& *fulfilled*(*necessary condition*(knowledge)) & *modality*(knowledge) = *modality*(response)&

& *variant*(response) $\in$ *variants*(knowledge)&*cause-event*(response)(*element*(*dynamics of values*(response), 0))$\in$ *range of cause-event*(*variant*(response)) & *length*(*dynamics of values*(response)) – 1 =

= *number of dynamics periods*(*variant*(response)) & *fulfilled*(*condition on acting factors*(*variant*(response))))

3. The terms of knowledge and reality which describe clinical manifestations of diseases, and ontological agreements on correspondence between them

3.1. "Knowledge about clinical manifestations" is a set of structural values with attributes cause, development period of disease, effect, variants, acting factors, necessary condition and modality. Every value is knowledge about a particular clinical manifestation of a disease. The value of the cause is the name of a disease, the value of the development period of the disease is the number of a development period of the disease, the value of the effect is the name of a sign, the value of the variants is a set of cm-variants, the value of the acting factors is a set of features, the value of the necessary condition is a condition.

knowledge about clinical manifestations $\equiv$ (*cause* $\rightarrow$ *diseases, development period of disease* $\rightarrow$

$\rightarrow$ I[1, *number of development periods*(*cause*)], e*ffect* $\rightarrow$ *signs, variants* $\rightarrow$ {}*cm-variants*,

acting factors $\rightarrow$ {}*features, necessary condition* $\rightarrow$ *conditions, modality* $\rightarrow$ {*possibility, necessity*})

3.2. "*Cm-variants*" is a set of structural values with attributes *number of dynamics periods*, *description of dynamics* and *condition on acting factors*. Every value is knowledge about a particular variant of a clinical manifestation of a disease. The value of the first attribute is a positive integer. The value of the second attribute is a function that takes the number of a dynamics period and returns the dynamics period. The value of the third attribute is a condition.

cm-variants $\equiv$ (*condition on acting factors*$\rightarrow$*conditions, number of dynamics periods*$\rightarrow$I[1, ∞),

description of dynamics$\rightarrow$ (I[1, *number of dynamics periods*]$\rightarrow$*dynamics periods*))

3.3. "*Clinical manifestations*" is a term of reality. It is a set of structural values with attributes *cause*, *development period of disease*, *effect*, *variant*, *dynamics of values* and *modality.* Every value is a clinical manifestation of a disease which took place in a situation. The value of the cause is the name of a disease from the diagnosis, the value of the development period of the disease is the number of a development period of the disease, the value of the effect is the name of a sign, the value of the variant is a cm-variant, the value of the dynamics of values is a partition.

clinical manifestation $\equiv$ (*cause* $\rightarrow$ *diagnosis, development period of disease* $\rightarrow$

$\rightarrow$ I[1, *number of development periods*(*cause*)], *effect* $\rightarrow$ *signs, variant* $\rightarrow$ *cm-variants*,

dynamics of values$\rightarrow$*partitions, modality*$\rightarrow${*possibility, necessity*})

3.4. If in a situation there is a clinical manifestation of a disease from the patient's diagnosis during a development period of this disease then the beginning of its dynamics of value is the same as the moment of the beginning of the development period of the disease, and its end is the same as the end of this period.

(manifestation: *clinical manifestations*) *element*(*dynamics of values*(manifestation), 0) =

= *element*(*development*(*cause*(manifestation)),*development period of disease*(manifestation) –1) &

& *element*(*dynamics of values*(manifestation), *length*(*dynamics of values*(manifestation))) =

= *element*(*development*(*cause*(manifestation)), *development period of disease*(manifestation))

3.5. If in a situation there is a clinical manifestation of a disease from the patient's diagnosis during a development period of this disease then the model of knowledge contains such an element of the set *knowledge about clinical manifestations* for which the following takes place: its cause is the same disease with the same development period, its effect coincides with the effect of the clinical manifestation, its necessary condition is fulfilled, its modality coincides with the modality of the clinical manifestation, and the cm-variant of the clinical

manifestation for which the number of intervals in the dynamics of values is equal to the number of dynamics periods for this variant and the condition on the acting factors is fulfilled belongs to the set of cm-variants.

(manifestation: *clinical manifestations*) ($\lor$ (knowledge: *knowledge about clinical manifestations*)

cause(knowledge) = *cause*(manifestation) & *development period of disease*(knowledge) =

= *development period of disease*(manifestation) & *effect*(knowledge) = *effect*(manifestation) &

& *fulfilled*(*necessary condition*(knowledge)) & *modality*(knowledge) = *modality*(manifestation) &

& *variant*(manifestation) $\in$ *variants*(knowledge) & *length*(*dynamics of values*(manifestation)) – 1 = *number of*

dynamics periods(*variant*(manifestation)) & *fulfilled*(*condition on acting factors*(*variant*(manifestation))))

4. The terms of knowledge and reality which describe clinical manifestations modified by event's influence and ontological agreements on correspondence between them

4.1. "Knowledge about clinical manifestations modified by event's influence" is a set of structural values with attributes cause, cause-event, effect, variants, acting factors, necessary condition and modality. Every value is knowledge about a particular clinical manifestation modified by event's influence. The value of the cause is the name of a disease, the value of the cause-event is the name of an event, the value of the effect is the name of a sign, the value of the variants is a set of cmmei-variants, the value of the acting factors is a set of features, and the value of the necessary condition is a condition.

knowledge about clinical manifestations modified by event's influence $\equiv$ (*cause* $\rightarrow$ *diseases, cause-event* $\rightarrow$

$\rightarrow$ *events, effect* $\rightarrow$ *signs, variants* $\rightarrow$ {}*cmmei-variants, acting factors* $\rightarrow$ {}*features, necessary condition* $\rightarrow$

$\rightarrow$ *conditions, modality* $\rightarrow$ {*possibility, necessity*})

4.2. "*Cmmei-variants*" is a set of structural values with attributes *range of cause-event*, *number of dynamics periods*, *description of dynamics* and *condition on acting factors*. Every value is knowledge about a particular variant of a clinical manifestation modified by event's influence. The value of the first attribute is a set of values of the event, the value of the second one is a positive integer, the value of the third one is a function that takes the number of a dynamics period and returns the dynamics period, the value of the forth one is a condition.

cmmei-variants $\equiv$ (*range of cause-event* $\rightarrow$ *sets of values, number of dynamics periods* $\rightarrow$ I[1, ∞),

description of dynamics $\rightarrow$ (I[1, *number of dynamics periods*] $\rightarrow$ *dynamics periods*),

condition on acting factors $\rightarrow$ *conditions*)

4.3. If knowledge contains the definition of a clinical manifestation of a disease modified by an event's influence then for all the development periods of the disease must be defined a clinical manifestation having the same sign as the effect.

(knowledge1: *knowledge about clinical manifestations modified by event's influence*)

(number: I[1, *number of development periods*(*cause*(knowledge))])

($\lor$ (knowledge2: *knowledge about clinical manifestations*)

cause(knowledge2) = *cause*(knowledge1) & *effect*(knowledge2) = *effect*(knowledge1) &

& *development period*(knowledge2) = number)

4.4. "*Clinical manifestations modified by event's influence*" is a term of reality. It is a set of structural values with attributes *cause*, *cause-event*, *effect*, *variant*, *dynamics of values* and *modality*. Every value is a clinical manifestation modified by an event's influence which takes place in a situation. The value of the cause is the name of a disease from the patient's diagnoses, the value of the cause-event is the name of an event, the value of the effect is the name of a sign, the value of the variant is a cmmei-variant, and the value of the dynamics of values is a partition.

clinical manifestations modified by event's influence $\equiv$ (*cause* $\rightarrow$ *diagnosis, cause-event* $\rightarrow$ *events, effect* $\rightarrow$

$\rightarrow$ *signs*, *variant* $\rightarrow$ *cmmei-variants*, *dynamics of values* $\rightarrow$ *partitions*, *modality* $\rightarrow$ {*possibility, necessity*}})

4.5. If in a situation there is a clinical manifestation of a disease from the patient's diagnosis modified by an event's influence then the beginning of its dynamics of values belongs to time moments when the cause-event happened.

(manifestation: *clinical manifestations modified by event's influence*)

element(*dynamics of values*(manifestation), 0) $\in$ *moments*(*cause event*(manifestation))

4.6. If in a situation there is a clinical manifestation of a disease from the patient's diagnosis modified by an event's influence and this event happened to the patient at a time moment then the model of knowledge contains such an element of the set *knowledge about clinical manifestations modified by event's influence* for which the following takes place: its cause is this disease, its cause-event is this event, its effect is the same as the effect of the clinical manifestation modified by the event's influence, its necessary condition is fulfilled, its modality is the same as the modality of the clinical manifestation modified by the event's influence, and its set of cmmei-variants contains the cmmei-variant of the clinical manifestation modified by the event's influence and the value of the cause-event of this cmmei-variant belongs to the range of the cause-event for this variant, the number of intervals of the dynamics of values for the clinical manifestation modified by the event's influence is equal to the number of dynamics periods for this variant, and the condition on acting factors is fulfilled.

(manifestation: *clinical manifestations modified by event's influence*)

($\vee$ (knowledge: *knowledge about clinical manifestations modified by event's influence*)

cause(knowledge) = *cause*(manifestation) & *cause-event*(knowledge) = *cause-event*(manifestation) &

& *effect*(knowledge) = *effect*(manifestation) & *fulfilled*(*necessary condition*(knowledge)) &

& *modality*(knowledge) = *modality*(manifestation) & *variant*(manifestation) $\in$ *variants*(knowledge) &

& *cause-event*(manifestation)(*element*(*dynamics of values*(manifestation), 0)) $\in$ *range of cause-event*(*variant*(

manifestation)) & *length*(*dynamics of values*(manifestation)) – 1 = *number of dynamics periods*(*variant*(

manifestation)) & *fulfilled*(*condition on acting factors*(*variant*(manifestation))))

5. The terms of knowledge and reality which describe etiologies and ontological agreements on correspondence between them

5.1. "*Knowledge about etiologies*" is a set of structural values with attributes *cause-event*, *effect*, *variants*, *modality*, *necessary condition* and *acting factors*. Every value describes knowledge about a particular etiology. The value of the cause-event is the name of an event, the value of the effect is the name of a disease, the value of the variants is a set of variants of etiology, the value of the acting factors is a set of features, the value of the necessary condition is a condition, the value of the modality is *necessity* or *possibility*.

knowledge about etiologies $\equiv$ (*cause-event* $\rightarrow$ *events*, *effect* $\rightarrow$ *diseases*, *variants* $\rightarrow$ {}*variants of etiology*,

acting factors $\rightarrow$ {}*features*, *necessary condition* $\rightarrow$ *conditions*, *modality* $\rightarrow$ {*possibility, necessity*})

5.2. "*Variants of etiology*" is a set of structural values with attributes *range of cause-event*, *description of dynamics*, and *condition on action factors*. Every value describes knowledge about a particular variant of etiology. The value of the first attribute is a set of values of the event, the value of the second one is an interval, and the value of the third one is a condition.

variants of etiology $\equiv$ (*range of cause-event* $\rightarrow$ *sets of values*, *description of dynamics* $\rightarrow$ *interval*,

condition on acting factors $\rightarrow$ *conditions*)

5.3. "*Etiologies*" is a term of reality. It is a set of structural values with attributes *cause-event*, *moment*, *effect*, *variant* and *modality*. Every value describes the etiology that takes place in a situation. The value of the cause-event is the name of an event, the value of the moment is the time moment when the event happened, the value

of the effect is the name of a disease from the patient's diagnosis, the value of the variant is a variant of the etiology, and the value of the modality is *necessity* or *possibility*.

etiologies ≡ (*cause-event* → *events*, *moment* → *moments*(*cause-event*), *effect* → *diagnosis*,

variant → *variants of etiology*, *modality* → {*possibility, necessity*})

5.4. If in a situation there is the etiology caused by an event that happened to the patient at a time moment and the effect of the etiology is a disease from the patient's diagnosis then the model of knowledge contains an element of the set *knowledge about etiology* for which the following takes place:

- its cause-event is this event,

- its effect is this disease,

- its necessary condition is fulfilled,

- its modality is the same as the modality of the etiology,

- its set of variants of etiology contains the variant of this etiology for which: the value of the cause-event belongs to the range of the cause-event of this variant; the duration of the interval between the moment when the cause-event happened and the beginning of the disease is included between the lower and upper bounds of the interval from the dynamics description of this variant; its condition on acting factors is fulfilled.

(etiology: *etiologies*) (∨ (knowledge about etiology: *knowledge about etiologies*)

cause-event(knowledge about etiology) = *cause-event*(etiology) & *effect*(knowledge about etiology) = *effect*(

etiology) & *fulfilled*(*necessary condition*(knowledge about etiology)) & *modality*(knowledge about etiology) =

= *modality*(etiology) & *variant*(etiology) ∈ *variants*(knowledge about etiology) & *cause-event*(etiology)

(*moment*(etiology)) ∈ *range of cause-event*(*variant*(etiology)) & *moment*(etiology) – *element*(*development*(

effect(etiology)), 0)∈ I[*lower bound*(*description of dynamics* (*variant*(etiology)), *upper bound*(*description of

dynamics*(*variant*(etiology))]) & *fulfilled*(*condition on acting factors*(*variant*(etiology))))

6. The terms of knowledge and reality which describe complications and ontological agreements on correspondence between them

6.1. "*Knowledge about complications*" is a set of structural values with attributes *cause*, *effect*, *variants*, *acting factors*, *necessary condition* and *modality*. Every value describes knowledge about a particular complication. The values of the cause and effect are diseases, the value of variants is a set of variants of a complication, the value of the acting factors is a set of features, the value of the necessary condition is a condition, and the value of the modality is *necessity* or *possibility*.

knowledge about complications ≡ (*cause* → *diseases*, *effect* → *diseases*, *variants* → {}*variants of complica-*

tion, *acting factors* → {}*features*, *necessary condition* → *conditions*, *modality* → {*possibility, necessity*})

6.2. "*Variants of complication*" is a set of structural values with attributes *description of dynamics* and *condition on acting factors*. Every value describes knowledge about a particular variant of a complication. The value of the first attribute is an interval, and the value of the second one is a condition.

variants of complication ≡ (*description of dynamics* → *interval*, *condition on acting factors* → *conditions*)

6.3. "*Complications*" is a term of reality. It is a set of structural values with attributes *cause*, *effect*, *variant* and *modality*. Every value describes a complication of a disease by another one which takes place in a situation. The values of the cause and effect are diseases from the diagnosis, the value of the variant is a variant of the complication, and the value of the modality is *necessity* or *possibility*.

complication ≡ (*cause* → *diagnosis*, *effect* → *diagnosis*, *variant* → *variants of complication*,

modality → {*possibility, necessity*})

6.4. If in a situation there is a complication and its effect and cause are diseases from the diagnosis then the model of knowledge contains an element of the set *knowledge about complications for which the following takes place*:

- its cause is the disease that is the cause of the complication,

- its effect is the disease that is the effect of the complication,

- its necessary condition is fulfilled,

- its modality is the same as the modality of the complication,

- its set of variants of complication contains the variant of the considered complication and the duration of the interval between the beginning of the disease-cause and the beginning of the disease-effect is included between the lower and upper bounds of the duration of the interval from the description of dynamics of this variant; its condition on acting factors is fulfilled.

(complication: *complications*) ($\vee$ (knowledge1: *knowledge about complications*)

cause(knowledge1) = *cause*(complication) & e*ffect*(knowledge1) = *effect*(complication) & *fulfilled*(*necessary condition*(knowledge1)) & *modality*(knowledge1) = *modality*(complication) & *variant*(complication) $\in$ *variants*(knowledge1)&*element*(*development*(*effect*(complication)),0)−*element*(*development*(*cause*(complication)),0)$\in$ $\in$I[*lower bound*(*description of dynamics*(*variant*(complication)), *upper bound*(*description of dynamics*(*variant*(complication))]) & *fulfilled*(*condition on acting factors*(*variant*(complication))))

6.5. "*Connection*" is the predicate that corresponds to the transitive closure of the relation *complication*.

connection $\equiv$ (λ (disease1: *diseases*) (disease2: *diseases*)

 ($\vee$ (knowledge about complication: *knowledge about complications*)

cause(knowledge about complication)= disease1 & *effect*(knowledge about complication)= disease2) $\vee$

$\vee$ ($\vee$ (disease: *diseases*) *connection*(disease1, disease) & *connection*(disease, disease2)))

6.6. A disease can be its complication neither directly nor indirectly.

(disease: *diseases*) $\neg$ *connection*(disease, disease)

7. General terms and ontological agreements which are used for describing cause-and effect relations

7.1. A feature that is a part of the condition on acting factors of a variant of a cause-and-effect relation is an acting factor of this relation.

(knowledge1: *knowledge about normal reactions* $\cup$ *knowledge about responses to event's influence* $\cup$

$\cup$ *knowledge about clinical manifestations* $\cup$ *knowledge about clinical manifestations modified by event's influence* $\cup$ *knowledge about etiologies* $\cup$ *knowledge about complications*)

(variant: *variants*(knowledge1)) (CAF: *condition on acting factors*(variant))

feature(CAF) $\in$ *acting factors*(knowledge1)

7.2. The range of the cause-event for any element of the sets *knowledge about etiologies, knowledge about responses to event's influence*, *knowledge about clinical manifestations modified by event's influence* for any its variant is a proper subset of possible values of the event that is the cause-event.

(knowledge1: *knowledge about responses to event's influence* $\cup$ *knowledge about clinical manifestations modified by event's influence* $\cup$ *knowledge about etiologies*) (variant: *variants*(knowledge1))

range of cause-event(variant) $\subset$ *possible values*(*cause-event*(knowledge1))

7.3. For every element of the sets *knowledge about clinical manifestations*, *knowledge about clinical manifestations modified by event's influence*, *knowledge about responses to event's influence* for any its variant and for every its dynamics period the range of the effect is a subset of possible values of the sign that is the effect of this element of knowledge.

(knowledge1: *knowledge about responses to event's influence* ∪ *knowledge about clinical manifestations* ∪

∪ *knowledge about clinical manifestations modified by event's influence*)

(variant: *variants*(knowledge1))

(number of dynamics period: I[1, *number of dynamics periods*(variant))

(dynamics period: *description of dynamics*(variant)(number of dynamics period))

range of effect(dynamics period) ⊆ *possible values*(*effect*(knowledge1))

7.4. The auxiliary term *cause-and effect relations* is the set of values for the terms from *normal reactions*, *responses to event's influence*, *clinical manifestations* and *clinical manifestations modified by event's influence*.

cause-and effect relations ≡ *normal reactions* ∪ *responses to event's influence* ∪

∪ *clinical manifestations* ∪ *clinical manifestations modified by event's influence*

7.5. If in a situation there is a *response to event's influence*, *clinical manifestation* or *clinical manifestation modified by event's influence* then the duration of every dynamics period from *dynamics of values* of this cause-and-effect relation belongs to the interval of admissible durations of this dynamics period for the variant of this cause-and effect relation.

(cause-and-effect relation: *cause-and-effect relations* \ *normal reactions*)

(number of dynamics period: I[1, *number of dynamics periods*(*variant*(cause-and-effect relation))])

element(*dynamics of values*(cause-and-effect relation), number of dynamics period) – *element*(*dynamics of*

values(cause-and-effect relation), number of dynamics period –1) ∈ I[*lower bound*(*duration*(*description of*

dynamics(*variant*(cause-and-effect relation))(number of dynamics period))), *upper bound*(*duration*(

description of dynamics(*variant* cause-and-effect relation))(number of dynamics period)))]

Conclusion

In this article the next part of the metaontology model for medical diagnostics is presented. This part includes the description of interrelations between knowledge about cause-and-effect relations and these relations in reality.

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