

DOI: [https://doi.org/10.18524/2410-2601.2025.2\(44\).354276](https://doi.org/10.18524/2410-2601.2025.2(44).354276)

UDC 111.1:165.8:61:001.8

Dmitriy Lyashenko

ORCID: 0000-0002-5043-6211

Viktoriia Lyashenko

ORCID: 0000-0002-1099-2512

TRUTHMAKERS AND ABOUTNESS IN MEDICAL KNOWLEDGE: LOGIC, SEMANTICS, AND ONTOLOGY

In this paper we propose a logical-metaphysical framework for analyzing the structure of medical knowledge. Medical research operates with models that represent a complex target system – the patient, whose biological, psychological, and socio-cultural dimensions resist reduction to a single explanatory level. To clarify this structure, we distinguish three complementary levels of analysis: structural, semantic, and ontological. At the structural level, relations between models and the target system are represented through morphisms that capture relevant correspondences between medical descriptions and the multifaceted reality of the target system. At the semantic level, the notion of aboutness explains how medical statements and models are directed toward particular aspects or variations of the target system. At the ontological level, truthmaker metaphysics is introduced in order to specify the grounding conditions under which medical statements are true in specific empirical or clinical contexts. The proposed framework makes it possible to interpret contemporary paradigms of medical research not as mutually exclusive approaches but as emphasizing different structural, semantic, or ontological dimensions of medical knowledge. In this way, the paper offers a preliminary philosophical account of how diverse medical paradigms can remain jointly about the same complex target system.

Keywords: *philosophy of science, philosophy of medicine, scientific modeling, aboutness, truthmakers, modal logic, ontological grounding, medical ontology, medical knowledge, medical paradigms, evidence-based medicine, relevance.*

Introduction. In contemporary philosophy of science, debates continue concerning the metaphysical, epistemological, and semantic status of scientific knowledge – debates closely connected with the problem of the relation between scientific models and reality (e.g., see: [Curd & Psillos 2014; Frigg 2022]). At the center of these discussions lies the standard distinction between the object and the subject matter of research, which functions as a way of representing reality through modeling, namely as a relation between a target system and its models, a framework discussed in various forms by philosophers ranging from early analytic philosophers such as Rudolf Carnap, or W. V. Quine, through such important figures as Hilary Putnam, Frederick Suppe, or Bas van Fraassen, to more recent thinkers including Nancy Cartwright, Roman Frigg, Steven French, James Ladyman, and Anjan Chakravartty among others.

A particular interest for these discussions should have such non-monotonic cases as represented by medical knowledge, which serves as a paradigmatic example of multi-level and pluralistic modeling. The object of medicine is

investigated through a plurality of models that are often methodologically and ontologically incompatible. The list of which includes biological, psychological, and socio-cultural models (see, e.g., [Solomon et al. 2017]). As a simple illustration compare the biochemical and the narrative models of disease (e.g. [Spencer 2017: 372–382]). Such models may be logically, methodologically, or even ontologically incompatible, while remaining directed toward the same target system, thereby creating a persistent possibility of tension or contradiction between different approaches and their subject matters.

Just as the working paradigm of mathematics is often one or another form of realism (e.g., Platonism), the typical physician tends to accept some version of realism with respect to disease. In everyday medical practice or biomedical research, an implicit ontological realism typically prevails: disease is conceived as an objective entity independent of the observer. This conception underwrites the very possibility of diagnosis, investigation, and treatment. If diseases were not stable, objective entities, the consistency of clinical judgments across practitioners and over time would be inexplicable. By contrast, philosophical and socio-cultural analyses of medicine typically adopt an ‘external’ standpoint, within which the categories of disease are treated as historically, socially, and normatively conditioned constructs. From an ‘internal’ standpoint (characteristic of clinical practice and biomedical research) these same categories are treated as tracking real features of patients and their pathologies. The tension between these perspectives motivates an ontological analysis of the grounds of truth of medical statements (e.g. [Simon 2017: 90–100]). This tension reinforces an already existing disciplinary tension within medical science itself, namely between theory (or meta-theory) and practice.

At the same time, clinical practice requires an integrated, or at least sufficiently comprehensive, understanding of the patient, such that can accommodate both biomedical facts and the lived experience of illness (see [Upshur & Chi-Yee 2017: 363–371]). Meeting this requirement calls for an analysis of what medical statements are about and what makes them true. In such cases, the philosophical task is not merely to determine whether a given model is true or false, but to clarify the semantic structure of its directedness (aboutness) toward the target system and the ontological conditions under which its claims may be grounded. Thus, there arises a need for a logical and ontological apparatus capable of integrating the structural correspondence of models to their targets, their counterfactual directedness (aboutness), and the ontological grounds of the truth of statements, while avoiding premature metaphysical commitments. In particular, the framework must allow models to be about the same target system even when they are not mutually reducible or jointly satisfiable, which is a common scenario in medical practice and research, where biochemical, phenomenological, and epidemiological models may coexist without consensus.

The *aim* of our paper is to conceptually clarify the conditions under which a set of partially incompatible models can be directed toward the same target system without requiring prior commitment to any particular substantive metaphysics

(nominalism, Platonism, Aristotelianism, etc.). Nevertheless, we outline an ontological perspective beginning with the notion of aboutness, which in our interpretation is not purely semantic but functions as a pre-ontological ‘filter’ that selects which aspects of the target system are relevant to the model’s representational content, without yet determining what kind of entities those aspects are. The distinction between aboutness and truthmakers allows tensions between models to be interpreted not as incompatibilities of truth but as differences in representational sensitivity to different aspects of the target system. In this sense, different models may track different structures or states of affairs within the same domain of investigation, even when their underlying ontological grounds (truthmakers) ultimately belong to the same target system. (Throughout this paper we occasionally speak of entities that ground the truth of propositions. The notion of grounding is used here in an informal explanatory sense, indicating that the truth of a statement is *accounted for* by certain features of the target system, without commitment to a full-fledged theory of metaphysical grounding. In this sense, truthmaking may be understood as a specific form of metaphysical grounding restricted to truths (cf. [Jago 2018]).)

The present paper continues a line of inquiry reported in our earlier conference paper and develops its formal and metaphysical framework in greater detail [Lyashenko & Lyashenko 2026].

Structural Representation of the Target System. The object of medical science may be represented as a target system T_S , containing a set of elements, relations, and functional dependencies that reflect different aspects of reality: natural processes, social and cultural contexts, and individual as well as collective subjective states. That is, the target system may correspond to different dimensions of medical investigation (organism, disease process, clinical situation, etc.).

At the first level of description, a model M_S is constructed that corresponds structurally to the target system T_S (usually not via strict isomorphism, but through weaker, partial forms of morphism). Formally, this correspondence is given by the morphism

$$(1) \quad f: T_S \rightarrow M_S$$

which establishes a mapping between the elements and relations of the target system and those of the model (intended or unintended) (see: [Frigg 2022: 54–63]). In the case of an isomorphism, the existence of $f: T_S \rightarrow M_S$ automatically guarantees the existence of the inverse $f^{-1}: M_S \rightarrow T_S$. However, this inverse is merely a mathematical artifact of the isomorphism; it does not by itself confer any particular representational significance. In scientific practice, models are not simply ‘read off’ from targets, nor do they merely ‘reflect’ a pre-given structure (as Platonic realism or certain versions of structural realism might suggest; cf. [Lyashenko 2023]). Rather, models are actively constructed instruments of representation (cf. [Frigg 2022: 393–420]). In real scientific modeling, a partial morphism is usually sufficient, preserving structure only with respect to relevant aspects and mapping only those elements and relations of the target system that are significant for the research aims (cf. [Bueno, French & Ladyman 2002] on partial structures). Such

structural correspondence allows the analysis of complex or directly unobservable aspects of the target system.

Crucially, however, structural mapping alone does not yet explain in what sense the model M_S is about the target system T_S . The morphism f functions as a ‘too-powerful filter’: it selects which elements of T_S correspond to elements of M_S , but it does not capture the semantic directedness that makes a model representational. Two models may be structurally isomorphic to the same target yet be about entirely different aspects of it, if their truth-values respond to different possible variations in T_S . Structural representation thus provides conditions for correspondence and adequacy, but not for aboutness.

This limitation motivates the need for a richer framework, one including the aboutness condition and truthmaker relation. Together, aboutness and truthmakers capture what structural mapping alone cannot: the directedness of models toward reality and the conditions under which their claims are made true.

The Problem of Aboutness of Medical Statements. Any scientific statement (including a medical one) does not merely claim structural correspondence with its object. Rather, it is directed toward the object independently of its truth value, that is, it is *about* some aspect of the target system. This relation of *being about* (aboutness) captures the semantic directedness of knowledge. In this sense, aboutness is compatible with both true and false representation; what it fixes is the topic or subject matter of a statement rather than its correctness. Following the semantic approach of Stephen Yablo [Yablo 2014], we treat aboutness not as a theory of truth but as a ‘filter’ for representational sensitivity. For Yablo, this filter is defined by the distinction between *truth simpliciter* and truth relative to a subject matter. In Yablo’s terms:

(i) A statement A is true with respect to a subject matter SM in a world w iff A is true in some world w' that is SM -equivalent to w , that is, a world that differs from w only in aspects unrelated to SM [Yablo 2014: 41].

That is, a statement is true about a given subject matter if it holds in any world that matches the actual world with respect to that subject matter, regardless of how else it differs. This allows a statement to be, strictly speaking, not true simpliciter, yet still partially true (or correct) with respect to a given subject matter. For scientific modeling this distinction is crucial: models are rarely true simpliciter, but they may nevertheless be true relative to the relevant aspects of the domain they are intended to represent.

Unlike Yablo’s application of aboutness to the analysis of “inclusive entailment”, where it determines containment relations between linguistic statements [Yablo 2014: 59], our framework assigns aboutness an ontological orientation. We use it not merely to analyze sentences, but to determine the domain of relevance within complex medical target systems prior to ontological grounding, as a pre-ontological filter that selects which aspects of the target are candidates for truthmaking. To operationalize this, we adapt Yablo’s definition to the relation between models and their targets:

(ii) A model M_s is about a target system T_s iff there exist possible variations of T_s such that the truth-values of the model's statements vary across those variations of T_s .

Whereas structural mapping ($f: T_s \rightarrow M_s$) establishes a correspondence between elements, the aboutness condition establishes a semantic sensitivity: the model is genuinely about the target only if changes in the target make a difference to what the model says.

Thus, the aboutness of a model cannot be reduced to its truth-conditions: a statement may be about a certain object or structure even when it is false, idealized, or fictional (cf. [Yablo 2014; Berto 2018]). The reason is that through aboutness we distinguish between truth simpliciter and truth relative to a subject matter. A model does not have to be strictly true in order to be scientifically relevant; it is sufficient that it be true with respect to subject matter, that is, correct with respect to the relevant aspects of the target system T_s . The semantic directedness of medical knowledge does not depend on the complete ontological specification of its object. We do not claim that the interpretation of aboutness we used here is the only possible one, but we consider it as a convenient minimal framework for analyzing semantic directedness prior to ontological commitments, one that corresponds to our aim of providing a preliminary metaphysically neutral analysis of medical knowledge. At this level, the morphism provides structural correspondence, while aboutness provides semantic directedness. Together they form a basic representation of the object of medical science.

Let us illustrate this with a simple example. The same object (e.g., the heart) may be the subject of different aboutness relations depending on which variations of the target system T_s are considered relevant. In a physiological model, the statement 'The heart increases cardiac output during physical exertion' is about the heart as a pump: variations in hemodynamic parameters change its truth-value, whereas morphological features unrelated to pumping function remain semantically irrelevant. In a clinical context, the statement 'The patient's heart exhibits signs of ischemia' is about the heart as bearer of pathological states; its truth is sensitive to variations in coronary blood supply, but not, for instance, to changes in physical exertion in the preceding cases (provided these do not affect the pathology). Alongside such non-fictional cases, consider the statement 'Harry Potter's heart accelerated when he approached Voldemort.' This sentence is likewise semantically about the heart as a physiological object, despite the fictional status of the agent. In the corresponding fictional world, variations in physiological aspects of the target system would affect the truth of this statement, whereas irrelevant variations would not. Thus, even in fiction, the aboutness condition (ii) is satisfied: there exist possible variations (within the fiction) that change the statement's truth-value. This demonstrates that aboutness captures directedness toward an aspect of an object rather than its natural-ontological status.

In all three cases, the morphism secures the structural correlation between the model and the target system, whereas aboutness determines the domain of relevance within which this correlation acquires semantic significance. Aboutness

fixes the semantic directedness of a model toward a particular aspect of a target system independently of whether the corresponding statements are strictly true simpliciter or even ontologically grounded.

In contrast to the classical referential approaches associated with Bertrand Russell and Willard van Orman Quine, where being 'about something' would primarily mean standing in a relation of denotation to an existing object, aboutness allows directedness toward idealized, partial, or even fictional objects, provided that variations in the target system are reflected in the truth-values of the relevant statements. Of course, within the referential tradition many strategies have been developed to circumvent these limitations: from free logics and substitutional quantification to Meinongianism, modal realism, ontological pluralism, and fictionalism, but they address the problem by refining or complicating ontological and logical-semantic commitments (see: [Berto & Plebani 2015]).

By contrast, the apparatus of aboutness, in our view, allows the analysis of semantic directedness to be placed at a prior, methodologically and ontologically neutral level. This level aligns with the structural ontology and is crucial for the conceptual analysis of medical knowledge prior to the application of specific research strategies with their explicit or implicit ontological commitments. In this way, morphism and aboutness together provide a representational framework that remains neutral with respect to deeper metaphysical questions about the ontological commitments of medical statements.

The Problem of Intentional States and Logic. The analysis of aboutness has shown that medical statements can be directed toward objects independently of their truth or ontological status. But statements do not float free in the air; they are produced and entertained by cognitive agents. This brings us to the next question: how is this directedness realized through the intentional states of particular agents of medical knowledge? Answering this requires examining intensional contexts and the limits of the applicability of classical logic. Intentional states generate intensional contexts in which classical extensional principles fail.

Medical knowledge involves the epistemic states of physicians, researchers, or clinical communities, which have an intentional character and therefore require a specialized logical apparatus. Epistemic relations of this kind describe not only states of the world but also states of consciousness directed toward certain contents. For illustration, let us consider the following proposition:

(2) Alice believes that over-the-counter drugs are safe.

If we want to model how mental states (thinking, believing, wanting, etc.) are directed toward intentional content, then such relations are almost impossible to express within the framework of classical propositional logic. To clarify this difficulty, it is useful to introduce the distinction between a statement and a quasi-statement. A statement is a proposition about objects or states of affairs that has an unambiguous and precise content; such statements can be evaluated as either true or false. By contrast, quasi-statements are sentences, whose logical form is not adequately captured by the resources of classical logic, typically because they embed other sentences in ways that create intensional contexts. In everyday

reasoning, it may seem natural that the truth of the statement ‘Over-the-counter drugs are safe’ follows from the truth of the statement ‘Alice believes that over-the-counter drugs are safe.’ However, when attempting to formalize such a situation within classical propositional logic, serious problems arise.

Let us introduce the following statements: A – ‘Alice believes that over-the-counter drugs are safe.’ B – ‘Over-the-counter drugs are safe.’ A natural attempt at a formalization might involve the implication $A \rightarrow B$, which would read: ‘If Alice believes that over-the-counter drugs are safe, then over-the-counter drugs are safe.’ In classical propositional logic, an implication is false if and only if the antecedent is true while the consequent is false. However, our antecedent A does not simply assert a fact about the world; it reports a relation between an agent and a proposition. Classical logic, which treats all atomic propositions as simple truth-bearers, has no way to represent this internal structure. The problem is not merely the possible falsity of B ; it is that the logical form of A is misrepresented when treated as an atomic proposition.

A further difficulty becomes evident when we consider *substitutio salva veritate* principle. An extensional context can be characterized by the principle of substitution of identicals preserving truth.

Let $C(A)$ denote a linguistic context containing the expression A .

(iii) The context is extensional iff for every expression B such that $A = B$, then $C(A) = C(A/B)$.

That is, if A and B refer to the same entity, replacing A with B in the context C does not change the truth value of the statement. By contrast, a context is intensional if such substitution may fail.

(iv) The context $C(A)$ is intensional iff there exists an expression B such that $A = B$ and $C(A) \neq C(A/B)$.

In other words, even when A and B refer to the same object, substituting one for the other within the context may change the truth value of the whole statement. Suppose we introduce the statement:

(3) Over-the-counter drugs are non-prescription medications.

Even if the expressions ‘over-the-counter drugs’ and ‘non-prescription medications’ refer to the same class of objects, from (2) and (3) it does not follow that

(4) Alice believes that non-prescription medications are safe.

Though expressions ‘over-the-counter drugs’ and ‘non-prescription medications’ may have the same extension, their intensions may differ, especially from the perspective of the believing subject. Alice may associate different meanings, background knowledge, or connotations with these expressions. This example demonstrates a fundamental difference between statements about the world and statements about mental states. Classical logic operates with extensional contexts, in which the truth of complex formulas is determined entirely by the truth values of their components. Intentional relations, such as belief contexts, are intensional and therefore violate this principle. But maybe the problem is just with the expressive abilities of the classic propositional logic?

Using a more expressive classical system such as first-order logic does not solve the problem either. Let us define a structure $S = \langle D, \Sigma \rangle$, where D is a domain containing at least Alice and objects that belong to the class of over-the-counter drugs. The signature Σ includes the unary predicates $OTC(x)$ – ‘ x is an over-the-counter drug’, $Safe(x)$ – ‘ x is safe’, as well as the binary predicate $Believ(x, y)$ – ‘ x believes that y ’. Using this vocabulary, one might attempt to represent the content of statement (2) by the formula:

$$(5) \exists x (OTC(x) \wedge Safe(x) \wedge Believ(Alice, x)).$$

However, this formula still fails to represent the content of (2). The reason is that (5) models Alice's belief as directed toward an individual object x , rather than toward the propositional content B (‘over-the-counter drugs are safe’). This reduction fails because believing that all over-the-counter drugs are safe is not equivalent to believing of some particular over-the-counter drug that it is safe. Alice might believe the general proposition without having any specific drug in mind. Moreover, and more importantly, classical first-order logic does not treat propositions as objects in the domain toward which cognitive attitudes may be directed. The intentional relation expressed in (2) thus remains unmodeled.

For this reason, the logical analysis of epistemic relations in medical knowledge requires more expressive frameworks, such as epistemic or intensional logics, which explicitly represent the relation between an agent and the propositional content of their beliefs. In what follows, we introduce some resources of epistemic and doxastic logic as a first step toward such a framework.

Its semantics can be defined using Kripke models $M = \langle W, Ra, \Vdash \rangle$ where: W is a set of possible worlds; $Ra \subseteq W \times W$ is an accessibility relation representing the epistemic alternatives compatible with the beliefs of agent a ; and \Vdash is the satisfaction relation between worlds and formulas. Within this framework we introduce the belief operator $Ba(\varphi)$, which reads: ‘agent a believes that φ .’ Using this notation, statement (2) can be represented as:

$$(6) \quad Ba(p)$$

where p is the proposition expressed by ‘over-the-counter drugs are safe’. Here the operator Ba explicitly represents the intentional relation between the agent (Alice) and the propositional content p , thereby preserving the internal structure of the original statement.

The semantics of belief is defined as follows.

For a model M with frame $\langle W, Ra \rangle$:

$$(7) M, w \Vdash Ba(\varphi) \Leftrightarrow \text{for all } w' \text{ such that } \langle w, w' \rangle \in Ra, M, w' \Vdash \varphi.$$

In other words, if agent a believes that φ is true in world w , then φ is true in all worlds w' compatible with a 's beliefs. This shows that, at the epistemic level, medical reasoning can be captured using a standard modal logic of belief, such as KD45, which is the normal modal logic characterized by seriality, transitivity, and Euclideanity of the accessibility relation, corresponding to consistent belief and positive/negative introspection (see: [Fitting & Mendelson 2023: 99]).

However, a well-known limitation of standard possible-worlds semantics is the problem of *logical omniscience*. In this framework, propositions are identified

with sets of possible worlds. Consequently, if φ and ψ are logically equivalent, they are true in exactly the same worlds and therefore denote the same proposition. For example:

(8) Over-the-counter drugs are safe.

(9) Over-the-counter drugs are safe and first-order logic is not negation-complete.

Since the second conjunct in (9) is a logical truth, (8) and (9) are logically equivalent and thus express the same proposition in possible-worlds semantics. Yet cognitively, Alice may believe (8) without believing (9). Possible-worlds semantics therefore collapses distinctions that may be cognitively relevant; this is the problem of logical omniscience. Hyperintensional frameworks address this difficulty by allowing logically equivalent propositions to remain distinct objects of belief (see: [Jago 2014] for a detailed treatment).

Nevertheless, for the purposes of the present analysis a standard epistemic modal framework is sufficient. A KD45 formalization allows us to distinguish between the truth of propositions and the intentional stance of clinicians or researchers, thereby representing the aboutness of medical statements without presupposing their actual truth. Within this framework, the truth of statements such as (2) or (6) depends not on the actual safety of over-the-counter drugs but on the structure of epistemic possibilities accessible to the agent.

This example illustrates how modal logic allows us to distinguish between the truth of a proposition and an agent's epistemic attitude toward it. However, even a KD45-style formalization does not exhaust the notion of aboutness. In the logical representation, the object of belief is modeled as a proposition φ , whereas the intentional content of belief is not fully reducible to its truth conditions. As noted earlier, an agent may stand in an intentional relation to idealized, false, or fictional objects independently of whether the corresponding states of affairs obtain. This indicates that the modeling of intentional states logically precedes the question of the ontological grounds of truth: we must first understand what agents believe (including false or fictional contents) before asking what in the world makes those beliefs true when they are true. It follows that the logical representation captures the epistemic stance of the agent, but it does not yet explain what in reality makes the corresponding propositions true.

Truthmakers as the Ontological Grounds of Truth. While the KD45-style modal logic formalizes the epistemic and intentional stance of agents, it remains largely indifferent to the truth of medical statements. At certain stages of analysis, research, or clinical practice this may suffice. However, when the aim is to explain why a medical statement is true, rather than merely believed or asserted, a further ontological layer becomes necessary. This layer is provided by the notion of truthmakers.

For the purposes of this analysis, we adopt a working distinction between truthmaking and grounding. Truthmaking is a relation between an entity and a proposition, whereas grounding is a relation between entities expressing metaphysical dependence or explanation (cf. [Lyashenko 2023; Lyashenko 2024]). Truthmaking connects the world to what our statements assert, while grounding

concerns the internal structure of reality. Here we focus primarily on truthmaking in the relation between medical models and the target systems they represent; grounding per se becomes relevant when analyzing the internal structure of those systems. As noted earlier, we interpret truthmaking as a particular type of metaphysical grounding that is truth-related. For a detailed analysis of the relations between grounding and truthmaking, see [Jago 2018: 184–206].

Up to this point, our analysis has relied on ontologically neutral tools. However, a distinctive feature of medicine is that it also operates at an empirical level of modeling, which necessarily relies on specific ontological commitments. Thus, in addition to structural correlations, intentional states, and aboutness, medical statements also possess ontological grounds of truth, or truthmakers, that is, specific entities or states of affairs within the complex target system T_s of medical knowledge that determine the truth of medical statements (for discussion of truthmakers, see, e.g., [Armstrong 2004; Yablo 2014; Jago 2018; Asay 2023]).

Aboutness determines which aspects of the target system a model is sensitive to, whereas truthmakers specify the portions of reality that must obtain for the corresponding medical statements to be true. While our approach adopts (broadly) the “vertical” necessitarian relation that Yablo critiques as purely metaphysical [Yablo 2014: 55], we address this concern by layering aboutness over that relation. By layering aboutness over the necessitarian truthmaking relation, we ensure that truthmakers are only sought for aspects of the target system that the model is genuinely about. This prevents the ontological apparatus from overreaching while preserving its explanatory power. Thus, we achieve ontological rigor, where truthmakers necessitate truth, while retaining the semantic and ontological flexibility of Yablo’s “horizontal” approach [Yablo 2014: 54–76].

In a certain sense, our framework proceeds in the direction opposite to Yablo’s strategy: from semantics to metaphysics. Yablo starts with aboutness as a semantic notion and uses it to analyze linguistic phenomena; we start with aboutness as a pre-ontological filter. This filter determines which aspects of the target system are relevant before ontological commitments are specified (it orients aboutness toward reality, not language), and only then do we ask about truthmakers for those aspects. (The modeling of the target system is always partial and selective.)

That being said, we do not presuppose that truthmakers must be natural (physical) rather than, for example, social or abstract (cf. [Asay 2023]). We mean only that such grounds must exist, or become available, at some stage of medical research or clinical practice. As Jamin Asay says: “[L]iterally everything in the universe is a truthmaker. For any object φ , it is a truthmaker for at least one sentence, namely, ‘ φ exists’. Truthmakers, then, are not a distinctive subset of what there is. One advantage of this perspective is that it demonstrates that the notion of a truthmaker is ontologically neutral. Regardless of what kinds of objects you have in your ontology, you have an ontology filled with truthmakers. Truthmaking can thus be utilized regardless of one’s antecedent ontological views. All are invited to the truthmaking table: realists and anti-realists, nominalists and Platonists,

rationalists and empiricists. Signing up for truthmaking is not signing up for distinctive, theoretically optional entities called ‘truthmakers’” [Asay 2023: 3–4].

In the following, we adopt a *maximalist* and *necessitarian* conception of the truthmaking relation, according to which every true statement has an ontological ground whose existence necessitates its truth. Maximalism and necessitarianism in truthmaking are conceptually simpler than many alternative approaches, and for the purposes of ontological grounding in medical modeling this simplicity makes them a convenient framework to adopt. By “conceptually simpler” we mean the following. First, maximalism provides a uniform treatment of all truths without requiring exception principles. Second, necessitarianism captures truthmaking as a relation of modal necessitation, thereby avoiding the introduction of unexplained or ‘brute facts’. This simplicity is methodological rather than metaphysical. We adopt maximalism and necessitarianism as a working framework for analyzing medical models, not as a thesis about the ultimate structure of reality. For detailed discussions of these positions see [Armstrong 2004], [Jago 2018], and [Asay 2023].

In order to define a truthmaking relation we now introduce a minimal formal apparatus.

Let $M = \langle W, R, D, I, E, Tm, Pr, \Vdash \rangle$ be a model structure, where:

W – a set of possible worlds;

$R \subseteq W \times W$ – an accessibility relation between worlds (metaphysical possibility);

D – a domain of individuals;

I – an interpretation function for constants, where $I(t) \in D$;

$E: W \rightarrow 2^D$ – an existence function, where $E(w)$ is the set of entities that exist in world w ;

Exist: existence predicate. The expression $Exist(t)$ is an atomic formula that is true in world w iff $I(t) \in E(w)$; (we treat existence without committing to any specific metaphysical interpretation);

Pr – the set of propositions expressible in the language;

$Tm: W \rightarrow 2^{(D \times Pr)}$ – a truthmaker function; in particular, $\langle I(t), p \rangle \in Tm(w)$ means that in world w the entity $I(t)$ is a truthmaker for proposition p ;

$\Vdash \subseteq W \times Pr$ – the truth relation.

The semantics of necessity is defined in the standard way:

$M, w \Vdash \Box \phi \Leftrightarrow$ for all $v: \langle w, v \rangle \in R, M, v \Vdash \phi$.

Thus, we say that t is a truthmaker for proposition p in world w iff the following conditions are satisfied.

1. $I(t) \in E(w)$.
2. $\langle I(t), p \rangle \in Tm(w)$.
3. $\forall v (\langle w, v \rangle \in R \wedge I(t) \in E(v) \rightarrow M, v \Vdash p)$.
4. $M, w \Vdash p$.

In other words,

(v) In every possible world in which the entity $I(t)$ exists, the proposition p is true.

The condition $I(t) \in E(v)$ in clause (3) tells us that truthmaking is evaluated only in worlds where the entity exists; but if we were dealing with a constant-domain semantics, this condition would be redundant. Thus, we obtain not merely a correlation but a modally necessary dependence between the entity and the truth of the proposition, which is essential for analyzing the ontological grounds of medical statements. For example, the statement

(10) The patient has died
has as its truthmaker a complex state of affairs (not necessarily Armstrongian), which includes both a structured physiological configuration of the patient's bodily state and the corresponding legal act of its certification. The formal schema does not predetermine whether this state is to be described purely biologically, legally, or narratively; it requires only that some structure or state of affairs exists that necessitates the truth of (10). Thus, aboutness determines the intentional target of a statement, whereas truthmakers determine the ontological grounds of its truth. These distinctions allow coherent modeling of risks, syndromes, and functional states without requiring their reduction, for example, to the molecular level.

Though the proposed definition captures a necessitarian conception of truthmaking broadly related to the approach developed by David Armstrong, we do not adopt the specific metaphysical commitments of Armstrongian truthmaking, in particular its physicalist ontology. Instead, our framework presupposes a maximalist but ontologically neutral conception of truthmaking (cf. [Asay 2023]), according to which any entity within the ontology of the target system may serve as a truthmaker, provided that it grounds the truth of the relevant proposition. In a certain sense, our framework develops a hybrid Yablo-Armstrongian approach articulated across different layers of analysis. Yablo provides the semantic tools for analyzing aboutness; Armstrong provides the metaphysical template for truthmaking as necessitation. Our framework combines these by using aboutness to determine relevance at the semantic level and truthmakers to ground truth at the ontological level, all within a neutral modal framework. Accordingly, the notion of existence employed here is structural-ontological rather than metaphysically substantive: the function E specifies which entities of the domain exist in a given world while leaving open their ontological nature. The formal schema therefore does not replace possible-world semantics with a truthmaker semantics but introduces a truthmaker relation within a standard modal framework.

Naturalism and Normativism as Strategies of Ontological Grounding.

At the level of structural representation, the morphism $f: Ts \rightarrow Ms$ establishes correspondence between model and target. At the level of aboutness, definition (ii) determines the semantic directedness of statements toward specific aspects of Ts . It is only at the level of truthmakers that the ontological grounds of medical statements are specified as the entities or states of affairs that make them true.

In contemporary philosophy of medicine, different theoretical approaches identify these grounds in different ways. Let's consider such approaches as naturalism and normativism (for these and related approaches see: [Kazem Sadegh-Zadeh 2015: 165–212]). By 'naturalism' we mean the view that medical

truthmakers are ultimately biological or physiological facts. By ‘normativism’ we mean the view that social, evaluative, and functional conditions may also serve as truthmakers, independently of or in addition to biological facts.

Consider the statement:

(11) The patient has not eaten for six days.

Within a naturalistic framework, its truth is grounded in physiological conditions such as dehydration, metabolic disturbances, or muscular weakness. Within a normativist framework, by contrast, the assessment may also incorporate social circumstances, practices of care, and behavioral expectations.

To illustrate this contrast, consider an anecdotal situation from the post-Soviet context of the 1990s. Two former classmates meet about twenty years after finishing school. One of them is living on the street, while the other has become a successful businessman. When asked how he is doing, the former replies: “I have not eaten for six days”. After a pause, the businessman responds: “You shouldn’t do that – listen, you have to pull yourself together!”

Despite the identical linguistic form of the statement, the situation involves different ontological configurations of truthmakers. In the first interpretation, the statement refers to a condition of physiological vulnerability and lack of access to resources; its truth is grounded in bodily states largely beyond the subject’s control. The truthmaker is a complex of physiological states: dehydration, metabolic disturbance, muscular weakness, that satisfy condition (v) – wherever such states exist, the proposition is true. In the second interpretation, the same statement is implicitly reframed in normative terms, shifting attention from biological condition to agency, self-control, and social expectations. Here the truthmaker includes not only physiological states but also social facts about agency, expectations, and the absence of caring intervention.

This contrast illustrates the difference between naturalistic and normativist strategies of ontological grounding. Naturalism locates the truthmakers of the statement (11) in biological facts that are independent of social interpretation, whereas normativism allows that the truthmaking base of a medical statement may also include social conditions and normative expectations. More generally, the example shows that the same sentence, even when tokened by the same words, may rely on different configurations of truthmakers depending on the theoretical framework and context of interpretation. Such pluralism about truthmaking is particularly relevant for complex, multilayered target systems such as medicine, where different levels may each provide distinct ontological grounds for the same proposition.

Comparison of Some Contemporary Paradigms in Medical Research.

The multilevel framework developed above allows us to specify similarities and differences among several contemporary paradigms of medical research (see [Tompson & Upshur 2017: 170–174] for discussion of these models).

The *biomedical model* focuses primarily on what we have called structural correspondence between the target system and the model of the organism. In terms of our framework, it operates at the level of morphism, emphasizing accurate

structural mapping of biological reality. At this level, research evaluates how the functional dependencies and anatomical and physiological correlations represented in the model match those of the target system. The relevant truthmakers are explicitly identified with concrete biochemical states, tissue damage, disruptions of regulatory mechanisms, and so forth. Thus, the biomedical model is not reducible merely to morphism; however, structural correspondence to biological reality functions here as the dominant and fundamental level of justification. For example, in the case of a patient who has not eaten for six days, the key indicators would be physiological: muscular weakness, dehydration, and metabolic disturbances, etc.

Precision medicine, by contrast, emphasizes the semantic directedness of knowledge (aboutness), focusing on individual variations within the target system – the patient. Genetic, biochemical, epidemiological, and metabolic factors, as well as the condition of organs and even predispositions to stress responses, become central elements of the model. The model *Ms* here captures an individualized configuration of *Ts*, and medical conclusions are drawn with these variations in view. Precision medicine treats the patient not as an instance of a universal class but as a unique configuration of variables; hence the aboutness of medical statements must be sensitive to individual variations in *Ts*. In this sense, the relevant truthmakers are determined relative to the specific profile of the individual patient rather than as a single universal class.

Evidence-based medicine places emphasis on empirically confirmed data as a form of epistemic access to the truthmakers of medical statements. Statistical studies, clinical observations, and standardized protocols are therefore central, together with the social and behavioral conditions under which medical statements are evaluated. This approach makes it possible to integrate physiological facts with the context of clinical practice, treating truthmakers as intersubjectively verifiable grounds of medical conclusions. EBM does not itself specify what the truthmakers are (biological, social, or otherwise); it provides methods for reliably identifying them across contexts.

Appendix: Evidence-Based Medicine and the Ontology of Evidence. A natural question arises: what is the ontological status of the ‘evidence’ used in evidence-based medicine (EBM)? Are the truthmakers of EBM statements the empirical data themselves: the results of randomized controlled trials and statistical analyses, or rather the biological mechanisms underlying these data? The latter interpretation would treat evidential data merely as epistemic indicators of deeper biological truthmakers.

To test this, consider a thought experiment that holds evidential data fixed while varying the underlying ontology of the patients. Imagine three patients who present exactly the same clinical profile and whose cases generate identical clinical data within a randomized controlled trial. The first patient has the ordinary biological constitution assumed in medicine: an organism composed of cells, molecules, and biochemical processes. The second patient, however, is not biological at all but consists entirely of digital structure, for example, a simulated

organism that is a “pure sim” in the sense of David Chalmers’ Reality+, i.e., an entity existing entirely within a computational simulation [Chalmers 2022: 30–31]. The third patient is even more exotic: suppose the ‘patient’ exists only as a complex mental construct in the consciousness of a meditating ascetic in a state of deep samādhi, whose experiences generate a detailed phenomenological structure corresponding to the same clinical description, including all the sensations and behaviors that would produce identical data.

Despite the radically different ontological constitutions of these three ‘patients’ (biochemical, digital, and purely mental) they generate the same diagnostic and statistical profile within a clinical trial. From the perspective of evidence-based medicine, the resulting medical statement, for example, ‘Treatment *T* reduces symptom *S* in patients with condition *C*’, would be equally supported in all three cases, provided that the same evidential configuration is obtained.

This thought experiment suggests that the truthmakers of statements in evidence-based medicine are not the underlying substances from which patients are composed (molecules, bits of information, or mental structures) but rather the structured configuration of empirical evidence produced by standardized methods of observation and comparison – including randomization, blinding, statistical hypothesis testing, and replication by independent investigators. In other words, what grounds the truth of such statements is the pattern of data obtained through controlled experimental procedures.

In this sense, evidence-based medicine operates with a distinctive level of ontological grounding. Its truthmakers are not biological states themselves but empirically established evidential states of affairs, constituted by reproducible data patterns within a regulated epistemic framework. Biological mechanisms may explain these patterns, but they are not required for the evidential statements themselves to be justified or true within the methodological framework of EBM.

Thus, the metaphysical grounding of evidence-based medicine cannot simply be reduced to biological ontology. While *biomedical* and *precision* approaches ultimately interpret medical statements as grounded in biological processes, evidence-based medicine shifts the level of grounding toward evidential structures produced by controlled experimental procedures. A possible way to see this difference is to consider the role of background scientific knowledge. *Biomedical* and *precision* models evaluate their claims in light of established theories of biological mechanisms and laws of nature. Evidence-based medicine, by contrast, treats systematically generated evidence as the primary criterion of validation.

In this sense, EBM operates with a distinctive form of truthmaking: the relevant truthmakers are configurations of empirical evidence established within a regulated methodological framework. These evidential structures remain largely indifferent to the deeper metaphysical constitution of the entities that generate the data. Biological mechanisms may explain the observed patterns, but the evidential claims themselves are grounded primarily in the reproducible structure of the data.

Conclusion. Medical knowledge constitutes a complex multidimensional system that resists linear reduction to purely biological, social, cultural, or individual-psychological aspects. The logical-metaphysical analysis proposed in our paper performs a preliminary integrative function in which each aspect of analysis (structural, semantic, and ontological) is directed toward a coherent understanding of the object.

The structural level grasps the relation between models and the target system through morphisms that represent relevant correlations between descriptions and the multifaceted reality of the patient – biological, social, psychological, and other relevant aspects. At the semantic level, aboutness determines the directedness of medical statements and models toward particular aspects or variations of the target system. At the ontological level, truthmakers provide the grounding conditions that make such statements true within specific empirical and clinical contexts.

This multilevel framework makes it possible to overcome the apparent fragmentation of medical models by interpreting them not as mutually contradictory descriptions but as complementary perspectives on the same complex target system. In this way, diverse paradigms of medical research can remain jointly directed toward the patient while emphasizing different structural, semantic, or ontological aspects of medical knowledge.

Such an approach also provides a conceptual foundation for the further application of specialized methodologies, such as systems theory or other approaches designed for the analysis of complex systems, which are particularly suited to the domain of medical knowledge.

References

- Armstrong, D. (2004) *Truth and Truthmakers*, Cambridge, Cambridge University Press.
- Asay, J. (2023) *Truthmaking*, Cambridge, Cambridge University Press.
- Berto, F. (2018) *Aboutness in imagination*, in: *Philos Stud* 175:1871–1886. <https://doi.org/10.1007/s11098-017-0937-y>.
- Berto, F., and Plebani, M. (2015) *Ontology and Metaontology: A Contemporary Guide*, London, Bloomsbury Academic.
- Bueno, O., French, S., Ladyman, J. (2002) *On Representing the Relationship Between the Mathematical and the Empirical*, in: *Philosophy of Science*, vol. 69, № 3, pp. 497–518.
- Chalmers, D. (2022) *Reality+: Virtual Worlds and the Problems of Philosophy*, London, Allen Lane.
- Curd, M., Psillos, S. (ed.) (2014) *The Routledge Companion to Philosophy of Science*, 2nd ed., New York, Routledge.
- Fitting, M., Mendelsohn, L. (2023) *First-Order Modal Logic*, 2nd ed., Cham, Springer.
- Frigg, R. (2022) *Models and Theories: A Philosophical Inquiry*, New York, Routledge.

- Jago, M. (2014) *The Impossible: An Essay on Hyperintensionality*, Oxford, Oxford University Press.
- Jago, M. (2018) *What Truth Is*, Oxford, Oxford University Press.
- Lyashenko, D. (2023) *Some Metaphysical Problems Concerning the Subject Matter of Medical Knowledge*, in: *Liudyna yak tsilisnist: tradytsii ta innovatsii*, Odesa, Odesa National Medical University, pp. 52–64.
- Lyashenko, D. (2024) *Metafizyka systemnosti u rekonstruktsii hylomorfizmu A. Uyomova [The Metaphysics of Systemicity in the Reconstruction of A. Uyomov's Hylomorphism]*, in: *Дóца / Doxa. Zbirnyk naukovykh prats z filosofii ta filolohii*, вип. 2(42), pp. 83–100.
- Lyashenko, D., Lyashenko, V. (2026) *Aboutness and Truthmakers in Medical Knowledge*, in: *Lyudyna yak tsilisnist: filosofiya, nauka i mystetstvo zsilennya*, Odesa, Odesa National Medical University. – *Forthcoming*
- Sadegh-Zadeh, K. (2015) *Handbook of Analytic Philosophy of Medicine*, 2nd ed., Berlin, Springer.
- Simon, J (2017) *Realism and Constructivism in Medicine*, in: *The Routledge Companion to Philosophy of Medicine*, New York, Routledge, 90–100.
- Solomon, M, Simon, J, Kincaid, H. (ed.) (2017) *The Routledge Companion to Philosophy of Medicine*, New York, Routledge.
- Spencer, D. (2017) *Narrative Medicine*, in: *The Routledge Companion to Philosophy of Medicine*, New York, Routledge, pp. 372–382.
- Thompson, P., Upshur, R. (2017) *Philosophy of Medicine: An Introduction*, London, UK, Taylor & Francis.
- Upshut, R., Chi-Yee, B. (2017) *Clinical Judgement*, in: *The Routledge Companion to Philosophy of Medicine*, New York, Routledge, pp. 363–371.
- Yablo, S. (2014) *Aboutness*, Princeton, Princeton University Press.

**Дмитро Ляшенко,
Вікторія Ляшенко**

ТРУСМЕЙКЕРИ ТА НАПРЯМЛЕНІСТЬ МЕДИЧНОГО ЗНАННЯ: ЛОГІКА, СЕМАНТИКА ТА ОНТОЛОГІЯ

У цій статті ми пропонуємо логіко-метафізичний апарат для аналізу структури медичного знання. Медичні дослідження оперують моделями, які репрезентують складну цільову систему — пацієнта, чії біологічні, психологічні та соціокультурні аспекти не піддаються редукції до одного рівня пояснення. Для уточнення цієї структури ми виділяємо три взаємодоповнюючі рівні аналізу: структурний, семантичний та онтологічний.

На структурному рівні відносини між моделями та цільовою системою репрезентуються через морфізми, що фіксують релевантні відповідності між медичними описами та багатогранною реальністю цільової системи. На семантичному рівні поняття напрямленості (*aboutness*) пояснює, як медичні твердження та моделі спрямовані на певні аспекти або варіації цільової системи. На онтологічному рівні вводиться метафізика

трусмейкерів (*truthmakers*), щоб уточнити умови, за яких медичні твердження є істинними в конкретних емпіричних або клінічних контекстах. Запропонований апарат дозволяє інтерпретувати сучасні парадигми медичних досліджень (біомедичну модель, точну медицину та доказову медицину) не як взаємовиключні підходи, а як такі, що акцентують різні структурні, семантичні або онтологічні аспекти медичного знання. Таким чином, пропонується попереднє філософське осмислення того, як різноманітні медичні парадигми моделюють ту ж саму складну цільову систему.

Ключові слова: філософія науки, філософія медицини, моделювання, напрямленість (*aboutness*), трусмейкери (*truthmakers*), модальна логіка, онтологічне підґрунтування (*grounding*), медична онтологія, медичне знання, медичні парадигми, доказова медицина, релевантність.

Список використаної літератури

- Armstrong, D. (2004) *Truth and Truthmakers*, Cambridge, Cambridge University Press.
- Asay, J. (2023) *Truthmaking*, Cambridge, Cambridge University Press.
- Berto, F. (2018) *Aboutness in imagination*, in: *Philos Stud* 175:1871–1886. <https://doi.org/10.1007/s11098-017-0937-y>.
- Berto, F., and Plebani, M. (2015) *Ontology and Metaontology: A Contemporary Guide*, London, Bloomsbury Academic.
- Bueno, O., French, S., Ladyman, J. (2002) *On Representing the Relationship Between the Mathematical and the Empirical*, in: *Philosophy of Science*, vol. 69, № 3, pp. 497–518.
- Chalmers, D. (2022) *Reality+: Virtual Worlds and the Problems of Philosophy*, London, Allen Lane.
- Curd, M., Psillos, S. (ed.) (2014) *The Routledge Companion to Philosophy of Science*, 2nd ed., New York, Routledge.
- Fitting, M., Mendelsohn, L. (2023) *First-Order Modal Logic*, 2nd ed., Cham, Springer.
- Frigg, R. (2022) *Models and Theories: A Philosophical Inquiry*, New York, Routledge.
- Jago, M. (2014) *The Impossible: An Essay on Hyperintensionality*, Oxford, Oxford University Press.
- Jago, M. (2018) *What Truth Is*, Oxford, Oxford University Press.
- Lyashenko, D. (2023) *Some Metaphysical Problems Concerning the Subject Matter of Medical Knowledge*, у: *Людина як цілісність: традиції та інновації*, ред. В. Б. Ханжі, Одеса, Одеський національний медичний університет, сс. 52–64.
- Lyashenko, D. (2024) *Metafizyka systemnosti u rekonstruktsii hilomorfizmu A. Ujomova* [The Metaphysics of Systemicity in the Reconstruction of A. Ujomov's Hylomorphism], in: *Дóжca / Докca. Збірник наукових праць з філософії та філології*, вип. 2(42), сс. 83–100.

- Lyashenko, D., Lyashenko, V. (2026) *Aboutness and Truthmakers in Medical Knowledge* в: *Людина як цілісність: філософія, наука та мистецтво зцілення*, Одеса, Одеський національний медичний університет. – Подано до друку.
- Sadegh-Zadeh, K. (2015) *Handbook of Analytic Philosophy of Medicine*, 2nd ed., Berlin, Springer.
- Simon, J (2017) *Realism and Constructivism in Medicine*, in: *The Routledge Companion to Philosophy of Medicine*, New York, Routledge, 90–100.
- Solomon, M, Simon, J, Kincaid, H. (ed.) (2017) *The Routledge Companion to Philosophy of Medicine*, New York, Routledge.
- Spencer, D. (2017) *Narrative Medicine*, in: *The Routledge Companion to Philosophy of Medicine*, New York, Routledge, pp. 372–382.
- Thompson, P., Upshur, R. (2017) *Philosophy of Medicine: An Introduction*, London, UK, Taylor & Francis.
- Upshur, R., Chi-Yee, B. (2017) *Clinical Judgement*, in: *The Routledge Companion to Philosophy of Medicine*, New York, Routledge, pp. 363–371.
- Yablo, S. (2014) *Aboutness*, Princeton, Princeton University Press.

Стаття надійшла до редакції 20.06.2025

Стаття прийнята 14.07.2025