THE EPISTEMOLOGICAL BASES THAT SUPPORT REASONING OF CLINICAL DIAGNOSIS

Raul I Chullmir

Department of Postgraduate Education. Philosophy of Science. Universidad Nacional de Tres de Febrero (UNTREF), Buenos Aires Argentina

ABSTRACT

We find difficulties when defining disease in relation to a set of sufficient and necessary characters that we can see repeated uniformly in every instance of this term or under the principle in which all its members have identical properties as they have a common nature. In studying the term disease, we have to explore other principles which could help us categorize it.

In this work, we analyze other alternatives. Following the epistemologist Cesar Lorenzano, we claim that each disease is a clinical theory, and each patient is an example of that theory. How we learn is through exemplary demonstrations that teachers practically show. It is what we call paradigmatic exemplars necessary for doctors to incorporate the theoretical structure of each disease, which, together with the clinical case models, instructs how the patient can present himself to the consultation.

How do the doctors select from all the diseases the one that best fits as a hypothesis for their patient? How does the doctor elaborate and epistemically justify his diagnosis?

We can explain this subject through Pierce's abductive reasoning, with the elements of structuralist metatheory and the use of paradigmatic exemplars.

KEYWORDS

Medical epistemology, Diagnosis, Health & Disease, Theory of Disease, Medicine by Exemplars.

1. INTRODUCTION

From a naturalistic perspective, "health" is a state of normality that leaves disease as something abnormal. It is a deviation from what is considered "natural" in the species, from what is publicly acceptable, considering disease as something objective, devoid of values, a phenomenon that exists in the real world. For the naturalistic view, "health" is to be within a range of statistical values of what occurs most frequently. From this vision, "health" would be the absence of disease, which can be clinically proven.

A *contrary vision* is a normative perspective, which says that the criterion of "abnormality" does not constitute a sufficient condition to define the disease, given that the criterion itself contains a value judgment. In this case, objectivity passes through the concept of damage. For normativism, the state of health of a person is a positive concept; it is determined not only with quantitative or statistical data; it requires a holistic diagnosis and an evaluation of the person's general state to himself, others, and society. There needs to be more than simply describing the disease using empirical data because such descriptions always contain subjective, cultural, or ethical

assessments. Rather than the absence of disease, the idea of "health" refers to the human being's ability to achieve vital goals [1].

For WHO[1], "health" is a state of complete physical, mental, and social well-being and not merely the absence of infirmity or disease. The problem with such broad definitions is that if medicine is concerned with maintaining health, it should avoid suffering, but not all suffering is an object of medicine. Although necessary, poverty, loneliness, political, economic, or social exclusion cannot be part of medical knowledge.

When discussing disease, the term does not include a set of necessary and sufficient characters that we see repeated in each of its instances uniformly. Myocardial infarction, hearing loss, alopecia, cancer, and gambling addiction are all diseases. However, what do they have in common? Regarding the Austrian philosopher Ludwig Wittgenstein's "games," what do all games, all chairs, or "all" diseases have in common?

In The Tractatus[2], Wittgenstein refers to the multiple and diverse discursive possibilities that language offers us. It moves away from the scientific and rationalist claim to represent or objectify the world. It delimits what can be said in a usual way (referential function of language) but analyzes other alternatives in communication, such as the exercise of "showing." More than with a definition, what Wittgenstein seeks is to enter the pragmatic sphere of the action of communicating through the use we make of words. Thus, the meaning of an expression no longer resides in its capacity to represent something of reality but instead in questions derived from the use of words within a context or way of life. And what he says is that the use of a term is learned by pointing to the specific object in which it is applied [3].

There is a yearning to find something familiar in all the entities we usually subsume under a general term. We believe there must be something in common in all games, chairs, or diseases. The idea of a general concept that is a property of all its particular instances connects with other simple and primitive ideas that structure language. It is comparable to the idea that properties are ingredients of things with those properties. For example, that beauty is the property of all beautiful things, as alcohol is the property of beer and wine so that we can get the pure, unadulterated beauty of something that is beautiful.

It is similar to the idea of treating words as if they were proper names and then confusing the name bearer with the meaning of the name. Wittgenstein exposes it as how plants are taxonomically classified. We can classify a series of objects by their reference to the presence or absence of characteristics that make them familiar. In all cases, we have the idea that there is a common element or ingredient, and Wittgenstein tells us there is no such element or element, only specimens that form a family. It is impossible to define each term without defining each term of the definition itself, and so on to infinity.

Bambrough [4] [5]acknowledges the importance of Wittgenstein's proof that at least some general terms can be justifiably applied by his exemplars, even though those exemplars have nothing in common. For nominalists, what all games have in common is that they have nothing in common except that they are "called" games. For realists, games would have something in common apart from being called games, which is that they "are" games. The problem is that due to the form of the question "What do three chairs or three books have in common," the answer

[1] https://www.who.int/about/governance/constitution

should be that they have something in common. However, if we talk about what "all" books or "all" chairs have in common, that is a philosophical question we should be able to answer, but we cannot find an all-encompassing answer. The simple answer is that what all games have in common is that they are all games, and we call them games. There is nothing immanent, transcendent, or subsistent.

There is no objective justification for the realist or nominalist position for applying a general term, be it games, chairs, or books, but rather that they are exemplars of the term. The specimens have something in common that they are specimens of something. For Wittgenstein, neither the nominalists are right in justifying naming the general term nor are the realists right in thinking that the term has some elements in common.

When defining, we use language to represent the real world, and although language allows us to represent the objects of reality, they do not "are" realities. The world is populated by individual objects that we group under the same term called "universal." "Bird" is one universal, "fruit" is another, and "disease" is another universal. We talk about birds, fruits, or diseases, but the universal is not identical to any particular species. In the world of birds, there is the sparrow, the raven, or the ostrich. The word "bird" includes all its members but is not any of them[2]. Also, the term sparrow becomes universal because it represents all the sparrows we can know, but it is not any in particular unless we point to a bird and say, "I mean that sparrow in particular."

We need examples to be shown to learn about a disease. They are the paradigmatic examples, models that belong to the practical knowledge that doctors will use from the first contact with a patient, which will help him to postulate, in the face of a set of determined signs and symptoms (semiology) that said the combination could be explained as caused by disease X, as you have learned during the training.

For Wittgenstein, knowledge is not learning by memorization; knowledge can be acquired in the closed space of a classroom; it is achieved through experience and observing examples. Wittgenstein and Kuhn [6] refer to the importance of learning through exemplars. They were talking about a seeing-like experience that captures in a glance a totality that goes beyond mere perception, organizes the way of thinking, and helps understand and see relationships. This appreciation is interpreted and organized when a complex unified perceptual structure (Gestalten) is projected onto it, which interrelates the parts in an organized whole [7][8].

Learning to see is learning to interpret. Wittgenstein related this integral way of perceiving with the musical ear, which allows the expert to quickly recognize a melody [9] or the ability to observe that a detective has when discovering an enigma [10], Cesar Lorenzano relates it to the talent of an art expert when he recognizes different styles in a painting with a glance, and interprets that experience with medical knowledge [11], an art that, in the manner of Wittgenstein, needs teachers, who warn us what happens with the patient: "look how his voice trembles," "look at the color of his skin," "see the dryness of his eyes." it has to have a good eye to be a doctor; however, different from music, it is not necessary to be born with that gift; it can be learned through multiple experiences through practice and learning. That is formed during professional training from the recognition and internalization of similar structures, thanks to the training that the doctor acquires during his training in the hospital environment when clinical cases are discussed in the room. In this intersubjective exercise, the Gestalten acquire its constituent elements, allowing it to be related to a first paradigmatic example, which is consolidated and perfected thanks to the analysis of new examples that, by differing from the

[2] K. Sadegh-Zadeh, "Handbook of analytic philosophy of medicine," 2012.:171

original, show the range of variability that each case of the same illness can acquire in an endless process of acquiring perceptive experience.

In Wittgensteinian manner, what diseases have in common is that they have nothing in common except that we call them all diseases. What they have are similarities and relationships that intersect. There is nothing immanent, transcendent, or subsistent.

While the student is learning the theoretical structure of each disease, his teachers help him to unite that conceptual information with the perceptual recognition of each patient. The text defines, and the expert shows. During his training, the doctor sees more than 60,000 patients; this sum of experiences and rigorous theoretical training ensures the quality of medical learning.

We should avoid assuming that diseases do not have determining characteristics. Pulmonary tuberculosis is a well-defined disease characterized by the existence of pulmonary lesions caused by a specific germ, Koch's bacillus. The finding of pulmonary lesions and Koch's bacillus is a sufficient and necessary condition for its diagnosis. Nevertheless, we must not confuse the disease's mental representation with a particular individual's complaint. Diabetes is not "seen"; what is seen is a patient, "Pedro," who is an example of an empirical application of a clinical theory called diabetes. The doctor's job is to "translate" what the individual refers to and turn his story into diabetes[12].

A frequent mistake is to need clarification on both levels. When one says, "Pedro has diabetes," diabetes is considered a category in itself, a universal that brings together all patients whose disease state is classified by the same nosological predicate. Diabetes represents a condition, and if we use the term "diabetes," it is because we understand that what happens to Pedro corresponds to the case and justifies using the term.

The disease is the set of all patients who share the same condition, which we label with the same name, for example, diabetes, as an economical way of referring to the case. In it, semiological phenomena are united, which are those that are perceived, together with anatomo-physiopathological alterations that are in the depth of the organism and that the doctor must interpret. We follow Lorenzano [13] when he says that each disease is a clinical theory and each patient is an example of that theory. Without the specimen and actual patient, the disease would be no more than an abstract entity. Although theoretical constructs serve to represent the world, they are not part of the world except in words. If we accept that disease is an immutable, transcendent, or abstract "something," we could never have full knowledge of it, and that is contrary to science.

2. LEARN BY EXEMPLARS

Diabetes, like any other disease, is learned through ostensible demonstrations that teachers teach in practice. They are the paradigmatic examples, those that are described in textbooks canonized by the medical community, which is the epistemic subject that orders the current paradigm and groups the sign-symptoms (semiological disease) under the same term, disease, in which it synthesizes its structural peculiarities. They are also the first patients with whom the doctor learned, allowing him to distinguish one disease from another since they resemble the one he learned about. Medical knowledge is the use of these paradigmatic exemplars plus the application of the structures of clinical theory.

In classical textbooks, it is common to be taught a disease deductively so that symptoms and signs can be inferred from underlying pathophysiology. For example, in the text, pneumonia begins by describing various possible etiologies; viral, bacterial, fungal, parasitic, chemical,

etcetera; we then go on to the chain of events that causally explain the clinical symptoms. The biomedical data help shape the empirical evidence confirming the deduction so that the student can feel able to explain precisely and safely what elements led the patient to suffer that disease step by step.

The evaluation methods of this type of classical teaching correspond to the former theoretical portion. In a classic anatomy exam, the student faces an anatomical slide and a question text of the style: "Mark and list in the anatomical slide the ligaments and structures that make up the knee."

The preparation is the paradigmatic example corresponding to the theoretical structure of any knee disease, but how is each malady recognized clinically? How is the sign-symptomatological example that is going to correspond to the real patient that the doctor is going to receive in the hospital or his office instilled in the mind of the novice doctor?

For some decades, and since the beginning of the career, it has been sought that the student is prepared to solve clinical situations that imply previous anatomical knowledge, presenting the case as a paradigmatic example of a specific disease. For example: "During a soccer game, a player receives a blow to the side of the leg that is supporting his weight. At that time, he experiences severe pain in his knee that prevents him from walking again. What are the structures most likely to have been injured?[3]"

An example from biochemistry points to something similar. Once the student learned the metabolism and the consequences of the nutritional deficit of the different types of vitamins, the following clinical case is presented:"A 40-year-old woman who had suffered from obesity went to the doctor, proud of having lost 35 kilograms in the last two years, but now she notices that her hair is falling out. On interrogation, she tells her doctor that she has followed a strict fat-free diet. Her alopecia is probably related to a deficiency of which of the following vitamins?[4]"

Classical teaching with examples, which correspond to the pathophysiological basis of the theoretical structure of the disease, is combined with examples of "real" patients that include the practical sign-symptoms of the event that triggers the causal chain that the student has learned during the basic cycle when studying biomedical sciences (anatomy, physics, chemistry, physiology, pathology, and etcetera).

This kind of teaching is not intended to relegate to a world other than the universe of science. What is sought is that the doctor is trained, in addition to theoretical elaborations, with clinical cases from the "real" world. He cognitively elaborates on different types of ailments with models that will help him relate the case with other "similar" ones that will appear in the future.

The novice doctor, due to lack of experience, tends to use the deductive model as he has learned it in books when beginning his task. However, it is recognized that this teaching model has been a source of error or delays in diagnosis [14]. With the addition of "real" paradigmatic specimens, it is sought that the doctor can automatically access practical information already stored in his memory so that he can quickly recognize the case as if he were an expert.

[3] USMLE Step 1. Qbook. Kapplan Medical. 2002

[4] Ibidem

We have all heard stories of using expert intuition, the chess master who passes in front of a line of players and announces without stopping: "White checkmates in three moves," or the doctor who makes a complex diagnosis after looking at a patient. Expert intuition seems magical, but it is not. The expert has stored in his memory information obtained thanks to previous interaction with many specimens, and in a familiar situation, that information is triggered, and what is called intuition is neither more nor less than the recognition of those observations.

Nobel laureate Daniel Kahneman [15] sets an example for someone who has just learned to play chess. In the beginning, each move is like a letter. The novice player learns simple plays, such as syllables, that he must join to form words. On the other hand, the expert immediately perceives entire saved sentences as paradigmatic exemplars of certain moves. He interprets the case and relates it familiarly with others already seen; in this way, he solves complex situations that he has never experienced more easily and quickly.

Mario Bunge [16] warns that at least two conditions must exist to justify expert intuition: a) a sufficiently stable environment that gives predictability to the problem, and b) having had the opportunity of a prolonged practice that allows recognizing that these regularities really exist. Furthermore, even if that prediction is correct, the derived conclusions are subject to errors that should not be minimized.

The most significant source of confusion comes from wanting to over-generalize these applications. Extensive practice is needed, and even then, the expert model is still subject to failure due to perceptual bias, often caused by incorrect expectations, lack of experience, or lack of cognitive skills of the user, also, for breach of trust that results in the abandonment of data, that should have been considered[17].

Without ceasing to repair what Bunge warns us, what teaching through practical examples seeks is that at the moment of diagnosing, the student perceives that what has been learned deductively and practical knowledge are used for different things. After acquiring the information corresponding to the biomedical sciences, that knowledge remains encapsulated, and the doctor unpacks it when he needs it. He uses the deduction for complex cases or when he needs to increase the explanatory component of the problem.The hypothetico-deductive model is "weak" in solving problems, but it is the one that manages to tie up loose ends necessary to put together a causal explanation.

Doctor learns each disease through an ideal model, a "perfect" prototype with complete sign symptoms and a coherent pathophysiological deduction. However, just as in mathematical formulas, that ideal model does not exist in the real world. The patient is a concrete clinical case presented to the consultation with a specific problem; the teachers' task is to "show" what these specimens appear. The combination of both educational procedures gives a more exact way of selecting and testing clinical hypotheses during diagnosis.

3. THE PROCESS OF DIAGNOSTIC REASONING

During the diagnostic stage, doctors must separate, from all the diseases they have learned, which may correspond to what happens in his patient. That action triggers interesting questions; How does the doctor select from all the diseases the one that best fits as a hypothesis for his patient? In other words, how does the doctor elaborate and epistemically justify his diagnosis?

At first, it was considered that diagnostic reasoning was similar to that used by a scientist to justify a discovery, a deductive succession of facts causally linked that explain the chosen disease. However, that is different from what usually happens.

Considering the patient as a possible exemplar, the doctor looks for facts that serve as evidence. When considered heuristically, evidence is a statement that expresses a fact that occurs in the world, which, when faced with a hypothesis, can confirm or refute it. The evidence gives the event a justification that allows us to believe something, either because it exists as positive evidence or because it does not appear, then will be as negative evidence. These pieces of evidence as a collection of facts must be considered pragmatically concerning a hypothesis and a temporal-spatial context. In the process, different possibilities are played. According to the context, the evidence can play against, in favor of the hypothesis, or be neutral.

What at first is evidence may not be evidence later, or others may appear to refute it. What is evident to us may not be to another. The term has no semantic content; its true value depends on the circumstances that surround each experience. The fall of a hammer is confirmatory evidence of the law of gravity; it will fall if we do the test in the garden of a house, but if we place it in a capsule revolving around the earth, it will not happen. The evidence can only be clear if we attend to the context.

Considering the signs and symptoms as evidence of a fact that appears surprisingly in a patient, the doctor begins to draw up hypotheses; it is here where *abductive reasoning* can help us understand the selection process.

Studied by Charles Sanders Peirce (1839-1914), the abduction starts from a surprising fact. It is a novelty or anomaly that is considered a "problem."
In what follows, we take Pierce's original syllogistic reasoning [18][19] and add a medical example. In brackets are our comments:

1-The surprising fact "C" is observed.
("C" here is evidence, it is a sign-symptoms taken as evidence that a disease could exist. The patient has a cough and may be sick with bronchitis)

2-But if "A" were true, "C" would be a regular thing.
("A" would be the hypothesis of a disease (bronchitis) that we have intuitively selected. It is a conditional hypothesis, a belief. We have doubts, and we want to approach it slowly. We temporarily accept that disease "A" could be the reason for which "C" has appeared).

3-Therefore, there is a reason to suspect that "A" is true.
(Considered "C" as clinical evidence of "A," its presence would validate the use of "A" as a hypothesis. Therefore, there is reason to suspect that the cough is caused by bronchitis).
Evidence C potentially makes our patient a possible exemplar and makes us suspect that hypothesis "A" might be the case. However, "suspect" is not "believe." This hypothesis can only be established as a suggestion and must be accepted interrogatively.

If fact "C" is tentatively taken as evidence of having been caused by hypothesis "A," it means that we have left aside other diseases that account for the same evidence.

There are several ways to deal with this problem to select a hypothesis in relation to evidence. It is trivial to assume that the choice will be based on the most straightforward, most plausible, most explanatory, and least ad-hoc hypothesis. However, the primary argument is that the evidence must not merely implicate the hypothesis but also explain the rest of the observed data. One of the various possible hypotheses or diseases is chosen because we assume it will provide a better explanation according to all the available evidence. The term "best," used in relation to one over any other, is problematic, and it can never be concluded that the chosen hypothesis will be correct.

Let us put a case. It begins with a fact taken as evidence for a tentative hypothesis. For example: a) that bird is white, b) all swans are white, c), it is possible that this bird is a swan.
The method is based on a fact that is converted into evidence and tries to get a hypothesis right. There is a fact -a white bird- and an inductively accepted rule or hypothesis -all swans are white-. Our task is to ask ourselves if the case belongs to said rule.

Abductive reasoning starts from a weak argument -the judgment is nothing more than a complex version of the fallacy of affirmation of the consequent- but it is strengthened as a heuristic tool from a cyclical selection and testing process. If it is a swan, it is white. If it also has the rest of the properties that can be deduced from being a swan, that is, beak, neck, weight, size, and shape; all these singulars reinforce that the hypothesis of being a swan is the most accurate. Our data becomes evidence. Being white is a sample, which, together with the rest of the data, reinforces the appropriateness of the hypothesis. If it fits, it is approved; if not, it is rejected, and a new start is made.

If the data is refuted, it will be based on our chosen hypothesis. However, the fact will still exist (we saw a white bird that is not a swan). That information should be reinterpreted and used for an alternative hypothesis. The examples that we have previously learned help us on the track to draw up new hypotheses. That bird is white and has a flattened beak; all ducks have flattened beaks, and this bird may be a duck.

Although abductive reasoning is a good process for selecting clinical hypotheses [16] [17], more is needed to explain complex reasoning during diagnosis. However, if we add the explanation that Cesar Lorenzano gives when he proposes the medical diagnosis using the tools of structuralist metatheory [18], the description becomes more exhaustive.

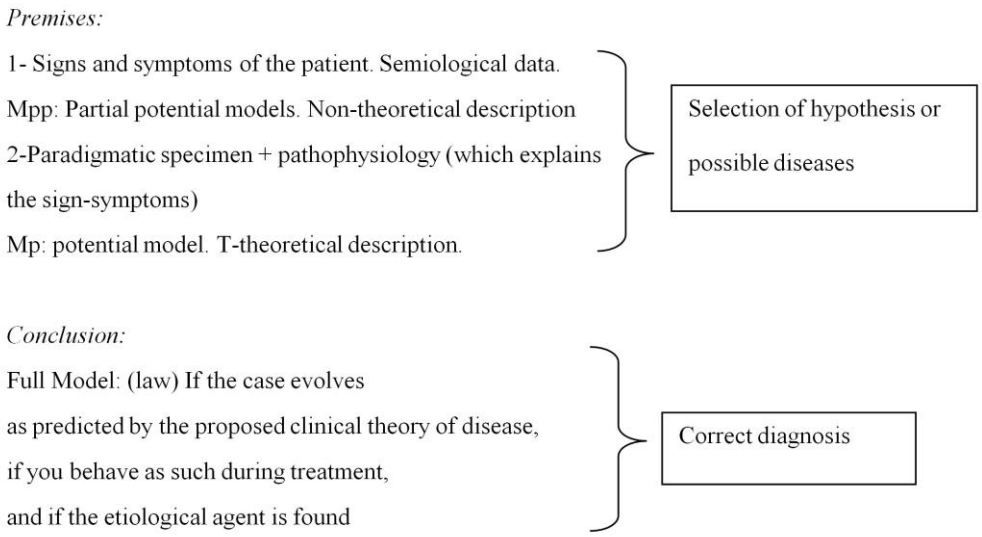
Through structuralist metatheory, medical epistemology seeks to understand the nature of medical knowledge with questions such as: What is medical knowledge, and how can it be justified? How does theoretical knowledge differ from the practice of medicine?

According to the structuralist conception, a theory is a conceptual structure used to produce knowledge. The theory claims to represent a "piece of reality," so its statements say that in this system happens "what the theory claims." It postulates that diseases are theoretical entities representing what happens to patients when they get sick.

To reconstruct a theory, doctors begin by considering the non-theoretical data (Mpp or Partial Potential Models), which means the signs and symptoms the patient brings that allow him to be framed in a "semiological disease." He takes these non-theoretical data, appeals to his previous experience of having made contact with other patients that he has seen and who have suffered from a similar condition, paradigmatic exemplars, that perceptual experience that he has developed under intersubjective control with other colleagues. Then the doctor adds his theoretical knowledge, that is, the pathophysiological interpretation of those symptoms (Mp or potential model). With this, he begins the process of selecting hypotheses, which are the different diseases or clinical theories that compete for a place in his mind, sensing that this patient could be an empirical application, an example of one of those possible hypotheses. He then issues a diagnosis, which will always be tentative, hypothetical, and subject to corroboration.

In this graph, we have analyzed the process of selection and testing of clinical hypotheses as part of an abductive process. We add the analysis made by the structuralist metatheory, and we add the use of exemplars, combining and completing both reasoning, which gives a more exact way of selecting and testing clinical hypotheses for medical diagnosis.

Table 1 Selection and testing of clinical hypotheses for medical diagnosis.



We start from the first premise, which contains the non-theoretical description, that is, the problem that the patient brings to the consultation, the semiological data, and the signs and symptoms that the patient refers to.The second premise contains the practical knowledge, the medical experience obtained with paradigmatic examples that the doctor has managed to obtain during his previous training, to which is added the theoretical interpretation, which explains the symptoms and signs that the patient brings to the consultation. With these two premises, a first clinical hypothesis is extracted. That is a disease in which these data, when used as evidence, could justify its selection before proceeding to the testing process.

If the data, according to their relevance, fit within the proposed disease, identifying the initial conditions continue, that is the rest of the elements that characterize it. The previous is the testing phase. If approved, it will be possible to trace a deductive retrograde flow of how the events occurred for the disease to develop.

The complete model, that is, the corroboration of the diagnosis, will be completed if the disease evolves as predicted by its evolutionary law or axiom if the patient responds to treatment; if the etiological agent that triggered the sequence is found, then the diagnosis will have been correct.
This scheme is apt to describe the structure of all medical diagnoses and, therefore, all exemplary medical clinic cases. According to Lorenzano [20], "In this conception, a theory consists only of structurally characterized exemplars, and the general word that encompasses them -disease- does not have more content than that of these exemplars, and refers exclusively to them, not to a supposed abstract entity called "disease."

4. REVIEW OF LITERATURE

In different articles about the philosophy of medicine, medical diagnosis has been considered in dissimilar ways. According to the metatheoretical studies reviewed in the field of general epistemology, especially in the domain of medical epistemology, we see that disease is considered as a conceptual structure [21]–[23], which combines a theory with an actual patient;

we added the idea of paradigmatic exemplars (as proposed by Cesar Lorenzano)[24], along with studies on abductive reasoning [14], in order to explain the clinical process of medical diagnosis.

5. METHODOLOGY

The clinical process of diagnosing is a complex reasoning procedure that includes not only the knowledge of the disease and its pathophysiological deduction, as has been learned in textbooks [25], but also metaphysical, epistemological issues, normative, and logical aspects that permeate this process. We can add the complexity of the "nature of disease" as a controversial issue. The question of whether it is a value-laden concept remains open. We wish to add the importance of ostensible demonstration of the patients, actual or fictitious, in-hospital medical education (medical epistemology). The objective is to show that although deduction is essential in the diagnostic process, abductive reasoning and the proper use of some scientific metatheories contribute to making this process more effective and better understood by the treating physician.

6. RESULTS AND DISCUSSION

The clinical process of diagnosing is highly influenced by how it is learned. Not just by reading medical textbooks but by how academic tests are presented to the medical student. Hospital clinical practice is equally important during the training period when the future doctor contacts his first patient next to the patient's bed. They will be empirical representations (paradigm exemplars) of the theory previously learned in medical textbooks.

7. CONCLUSION

Having described what we understand by paradigmatic examples, we made an analysis of the concept of disease, and we examined Wittgenstein's solution when defining the terms by their use, which, together with the need to show examples through experienced teachers, is how that the doctor manages to incorporate these specimens during his training, Finally we saw the importance of their use for medical diagnosis.

REFERENCES

[1] K. Sadegh-Zadeh, “Handbook of analytic philosophy of medicine,” 2012.

[2] L. Wittgenstein, “TRACTATUS LOGICO-PHILOSOPHICUS LUDWIG WITTGENSTEIN.,” *J. Hist. Ideas*, vol. 59, pp. 1–28, 1922.

[3] A. C. Campos, “El valor pragmático de los juegos de lenguaje y sus reglas en Ludwig Wittgenstein. Aportaciones teóricas para el estudio de la comunicación interpersonal,” *Disert. Anu. electrónico Estud. en Comun. Soc.*, vol. 7, no. 2, pp. 32–47, 2014.

[4] R. Bambrough, “Universals and family resemblances,” in *Proceedings of the Aristotelian Society*, 1960, vol. 61, pp. 207–222.

[5] C. Lorenzano, “WITTGENSTEIN YLOSPARADIGMASDEKUHN,” *EPISTEME*, no. 11, pp. 57–69, 2000.

[6] T. S. Kuhn, “La estructura de las revoluciones científicas (incluye la posdata de 1969),” *México Fondo Cult. Económica. Recuper. en Junio*, vol. 12, p. 2008, 1962.

[7] C. Lorenzano, *Filosofia de la Medicina. Epistemologia del Conocimiento Medico*, 1ra. Ciudad Autonoma de Buenos Aires: E-book, 2014.

[8] C. J. Lorenzano, “La Construccion de una Teoria y su Esquema Racional,” *Vol. Colect. del Inst. Investig. Filos. Mex.*, 2005.

[9] S. Janick, Allan; Toulmin, *LA VIENA DE WITTGENSTEIN*. Madrid: Taurus, 1974.

[10] R. Monk, *Ludwig Wittgenstein : el deber de un genio*, 2da. 1997. Barcelona: Anagrama, 1997.

[11] C. Lorenzano, “La estructura del conocimiento práctico,” *Rev. Filos.*, vol. 29, no. 2, pp. 21–41, 2005.

[12] LORENZANO C., CHULLMIR R., *ARTE CIENCIA Y EPISTEMOLOGIA*. BUENOS AIRES, 2020.

[13] C. J. Lorenzano, “Concepción estructural del conocimiento científico, metodología de los programas investigativos y criterios para formular políticas de investigación,” *Rev. Electroneurobiología*, vol. 18, no. 1, pp. 3–254, 2010.
[14] V. L. Patel, J. F. Arocha, and J. Zhang, “Thinking and reasoning in medicine,” *Cambridge Handb. Think. Reason.*, vol. 14, pp. 727–750, 2005.
[15] D. Kahneman, *Pensar rápido, pensar despacio*. Debate, 2012.
[16] M. Bunge, “Technology as applied science,” in *Contributions to a Philosophy of Technology*, Springer, 1966, pp. 19–39.
[17] R. Chullmir, “El Carácter Científico de la Cirugía,” Universidad de Tres de Febrero. UNTREF., 2017.
[18] A. Aliseda, *Abductive reasoning*, vol. 330. Springer, 2006.
[19] F. Soler Toscano, *Razonamiento abductivo en lógica clásica*, vol. 2. London: College Publications, 2012.
[20] C. Lorenzano, “El lenguaje de la ciencia,” *Arbor*, vol. 187, no. 747, pp. 15–24, 2011.
[21] C. U. Moulines, “Las ideas básicas del estructuralismo metacientífico,” 1996.
[22] J. A. Moulines, C. U., Diez Calzada, *Fundamentos de la Filosofia de la Ciencia*. Barcelona: Ariel, 2008.
[23] C. U. Moulines, “Cuatro tipos de desarrollo teórico en las ciencias empíricas,” *Metatheoria–Revista Filos. e Hist. la Cienc.*, vol. 1, no. 2, pp. 11–27, 2011.
[24] C. J. Lorenzano, “La Concepcion Estructural de las Teorias,” *Electroneurobiologia*, vol. 18, pp. 3–254, 2010.
[25] *Harrison's principles of internal medicine*. Fourteenth edition / [editors, Anthony S. Fauci ... [and others]. New York : McGraw-Hill, Health Professions Division, [1998] ©1998.

AUTHOR

Raul I Chullmir, Medical Doctor. University of Buenos Aires. ECFMG Certificate in United States. Accredited Surgeon. Argentine Association of Surgery. National Academy of Medicine. Medical specialist in Surgical Clinic. College of Physicians of the Province of Buenos Aires Thoracic surgeon. University of Buenos Aires Doctorate (PhD) in Epistemology and History of Science. National University of Tres de Febrero (UNTREF)

Awards: Benjamin Ceriani. Western Surgery Society.
Pedro Ovidio Bolo. Argentine Medical Association

Associate Professor of Surgery in University of Buenos Aires (UBA), Associate Professor of Histology, Cytology and Embryology. University of Buenos Aires (UBA), Associate Researcher at the Chair of Epistemology and History of Science National University of Tres de Febrero (UNTREF)