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"Cometomancy" and Francisco Sánchez: an additional reflection on to causality

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Abstract. The search for a causal mechanism begins with the observation of an association, but there is a long way until the fact that is observed as an association can be configured as a cause. The scientific community has historically demanded tools that facilitate the determination of causality. In 1965, Sir Austin Bradford Hill proposed nine postulates, which were adapted by modern epidemiologists as criteria. Later, Alfredo Morabia in 1991 showed that the concern to establish causality came from more than two hundred years ago, recognizing a great similarity between Hill's criteria and David Hume proposals for causality. However, the origin of these criteria could even come from four hundred years ago. In this reflection, we present the arguments taken from an ancient poem and contrast them with Hill's criteria, to propose Francisco Sánchez as one of the first authors and physician trying to give a logical and rational order from association to causation, probably introducing the philosophical origin of the current Hill´s criteria.

Key words: causality, Bradford Hill, causal criteria, Francisco Sánchez, philosophical origin

Introduction

The idea of causality has been controversial among philosophers and epidemiologists (1–5) and has given rise, among others, to theories of sufficient causes and multiple causes (2,6,7). Specifically in the health-disease process, the theory of multiple causes has been extended to the concept of a causal mechanism, a chain of events – some surely unknown – which finally leads to the manifest expression of the effect: the disease (6,7). The search for a causal mechanism begins with the observation of an association, but there is a long way to go to determine if what is observed as an association can be configured as a cause (6-9).

The scientific community has historically demanded tools that facilitate the determination or identification of causality. Around 1965, Sir Austin Bradford Hill (8 July 1897 – 18 April 1991) an English epidemiologist and statistician, who pioneered the randomized clinical trial and, together with Richard Doll, demonstrated the connection between cigarette smoking and lung cancer, published "The environment and disease: Association or causality?" (10). Hill proposed nine postulates that served as arguments to determine causality, in such a way that the causal relationship would become more likely the more criteria were met. These postulates were adapted by modern epidemiologists as criteria (6) and are, even today, the most cited in the medical literature of causality studies (11–13).

In 1991, Alfredo Morabia (9) recognized a great similarity between Hill's criteria and "the rules for judging causes and effects" (1) proposed by David Hume, an 18th-Century Scottish philosopher, who tried to explain causal relationships as starting from non-experimental observation, typical of the time. This kind of historical connection between Hume and Hill, Morabia proposed, seemed to be highlighted in the fact that Hume's thinking was shared by contemporary epidemiologists (9). Finally, Morabia showed

that the concern to establish causality came from more than two hundred years ago (9).

In this reflection, we present the arguments taken from an ancient poem and contrast them with Hill's criteria to trace an historical moment, almost four hundred years ago and long before David Hume; when Francisco Sánchez (14) define the aspects to consider in order to set up an association as a causation, introducing what could be the philosophical origin of the current criteria of causality. Therefore, the aim of our article is to establish an historical relationship between Hill´s causality criteria and Sanchez´s concerns regarding "cometomancy".

Materials and methods

Our article is a literature revision and argumentative reflection. We started the critical analysis of the ancient poem "The comet's song", written by Francisco Sánchez, then we identified arguments proposed by the author as criteria to establish a causal relation and finally, we did a correlation with the corresponding Hill's criteria.

The historical and philosophical context

Until the 18th Century, the appearance of comets was of paramount importance, as they were associated with terrible events (15). By that time, magical-religious thinking prevailed over reason, there was no formal probabilistic thinking and causal relationships raised few questions. A very popular belief, dominated and studied by astrologers, was "cometomancy" as a great predictor of events. Situations such as death, disease, and war were attributed to the passing of comets. One of the most renowned comets was that of 1577, known as "the Sebastic". While waiting for this comet, an astrologer of the French royalty, Francisco Iuntino, wrote a pamphlet in which he foreshadowed that the Sebastic would cause rebellions of countries and deaths of kings, arousing terror at its passage (15).

The aforementioned pamphlet came into the hands of Francisco Sánchez (1550–1623), known as "The Skeptic" ("*El Escéptico*"), a medical doctor trained in France, professor of medicine and philosophy at the University of Toulouse, fanatic in love with nature, an opponent of Aristotelianism and a devout Christian (15,16). In open opposition to Iuntino and his pamphlet, Sánchez elaborated his answer in the poem "The comet's song" (15), in which he presented twelve arguments to define causality and to establish the necessary aspects to probe it, and specifically to denied a causal relationship between celestial and terrestrial phenomena. Its purpose, in addition to demonstrating the absence of any foundation in astrological predictions, was to ensure that doctors did not look for the causes of diseases in celestial phenomena.

The philosophical substratum of the arguments developed by Sánchez was based on human weakness to achieve perfect knowledge of things (16). He assumed that knowing about a thing was knowing it by its causes; however, although it was not possible to be exact in knowledge, the judgment added to the sensible experience would allow a valid approach to turn a belief into science (16). These arguments by Sánchez could have some similarity with the postulates of Bradford Hill (10).

Results

The argumentative sequence

To note the proximity between both authors, Hill's postulates are contrasted with Sánchez's arguments, following the order of Hill's postulates (Table 1).

Hill defines the first postulate, specificity, by saying that there is a causal relationship if the association is limited to "specific workers and particular sites and types of disease, and there is no association between work and other ways of dying" (10). After discarding supernatural scenarios and affirming the need for an ontological continuity between cause and effect, Sánchez also resorts to specificity as a unidirectional relationship in his third argument: "even granting that the comet can predict how one wants it to, it cannot do things so disparate at the same time. Symptoms and properties always connote in a single direction, not in several opposites. That of such disparate things is a subterfuge to say later that something is right" (15, p. 162). Additionally, Sánchez shares with Hill the

Table 1. Hill´s criteria and corresponding Sánchez arguments

Hill's Criteria	Sánchez arguments
1. Strength	-
2. Consistency	-
3. Specificity	"Symptoms and properties always connote in a single direction, not in several opposites" "It is false that the hairy comet can predict two or more things indifferently. All sure signs usually portend only one thing"
4. Temporality	"The things that announce to me that something will assuredly happen are those that are concomitant on their cause: those that are or will soon be causes of the future or those that usually precede frequently"
5. Biological gradient	"The stars contained in the wide sky will not suffice for all of them[a], (because) mortal events exceed (in number) the stars"
6. Plausibility	"It does not follow logically that the hairy stars had predicted these things: nature wanted this to happen necessarily and for all of this to happen clearly without any comet."
7. Coherence	"All the causal relationships that they[b] want to establish between the appearance of comets and some events are inconsistent and absurd"
8. Experiment	"What we have experienced is solid proof for us"
9. Analogy	The events attributed to the passage of comets and even the passage of the comet itself, could also have been caused by Vulcan, "always present in heaven".

[a]The predicted things, [b]The astrologers.

one-to-one relationship between cause and effect of specificity, writing that a phenomenon must always be followed by the same effect to establish causality: "It is false that the hairy comet can predict two or more things indifferently. All sure signs usually portend only one thing. It would be impossible that smoke, which by nature is only an indication of the flames, was a true harbinger of the plague" (15, p. 166).

Cause and effect require a temporal relationship; that is, an order of events. This is Hill's fourth premise (10) and coincides with the fifth characteristic of causality offered by Sánchez, by establishing an immediate relationship between cause and effect, a proximity both in time and space (16), with the argument: "Although all these things are taken as true, they are not a consequence of the first (15, p. 182)"; and adds: "The things that announce to me that something will assuredly happen are those that are concomitant on their cause: those that are or will soon be causes of the future or those that usually precede frequently" (15, p. 190). While Hill is more focused on establishing which came first – did the diet lead to the illness or did the illness lead to the diet? (10), his starting point is the same argumentative basis as Sánchez's: an event must be preceded by a proximate cause, so that a probably causal succession between them is fulfilled (15,16).

The third similarity found between the authors deals with the biological gradient postulate, the proportionality between the intensity of the effect and the transmitted cause mediated by the causal link, in which Hill considered the dose-response curve among the highest number of cigarettes smoked a day and the highest occurrence of deaths from lung cancer (10). Sánchez seems to use this same argument, in a kind of logical opposition, to deny that a star can influence natural events, since the latter outnumber the stars: "*Nam si portendere quaeque, Privatimque velis cunctis asistere rebus, Motibus, inceptis, gestis, morientibus, ortis, Caetera queis passim et toto generantur in orb, Sufficiant vast contenta haud sydera coelo Omnibus, excedunt stellas mortalia gesta*." "If they intend that they predict each one of the things and that they singularly contribute to all of them: to the changes, to the initiatives, to the achievements, to the deaths, to the births and to all the other things that are continuously produced throughout the universe, the stars contained in the wide sky will not suffice for all of them, (because) mortal events exceed (in number) the stars" (15). A single comet cannot explain all the crops, all the deaths, earthquakes and plagues and, therefore, causality cannot be established (16). In the same rejection of astrological predictions, Sánchez highlights that the only link that exists between the comet and the earth, or at least the only one that can be observed, is the light rays and many other

stars that emit more rays would have a better link and a greater predictive ability for events:

If we exempt Father Phoebus and the lights of Phoebe, which by surpassing with their enormous body all (the stars) inferior to them, and by being closer to us and by standing out due to their superior strength, powerfully move things and they reach the bottom of the earth with their rays. What can your hairy star do instead? What could that minimal halo that has barely been endowed with a gloomy light transmit to us from the top of the sky (15, p. 194).

Hill's sixth postulate, biological plausibility, is similar to Sánchez's speech when he writes: "*Non tamen inde bene isthaec portendisse comata Sydera consequitur: Fieri Natura necesse Haec voluit, of course fierent sine cuncta Cometa*." "It does not follow logically that the hairy stars had predicted these things: nature wanted this to happen necessarily and for all of this to happen clearly without any comet." (15, p. 183). In other words, it is not natural – plausible – for example, for a king to be killed by a comet. Hill says that this criterion would depend on what is defined as plausible for the biological knowledge of the moment (10); but Sánchez, ahead of his time, already denied the possibility that comets were the cause of human events. In addition, within what is biologically plausible, Sánchez highlighted the freedom of human decisions and criticized the determinism that predictions of cometomancy presuppose (16). "*Missa sub arbitrio poterit portendere nullus.*" "No one can predict what is subject to free will" (15, p. 170) and if the natural cannot determine the human decision, neither does the inverse influence fit, discarding the causal link between the natural and the human in any direction: "*In mentem coelo concessa facultas Nulla est, nulla queant praedicere fata bonorum Sydera, non quidquam portendere libera possit Acta hominum: Queat ergo minus crinitus ocellus.*" "The heavenly bodies have not been given any power over the mind, none so that the stars can predict the future of the good ones, so that some can presage the free acts of men and less so that the shaggy eye can do it" (15, p. 171).

About the coherence, which states that the interpretation of cause and effect should not conflict with the facts known from natural history and biology (10); Sánchez uses it to deny that comets explain earthly events, because – for what was already known about comets and humanity – no relationship was possible. According to the interpretation of Joaquín Iriarte (15): "All the causal relationships that they want to establish between the appearance of comets and some events are inconsistent and 'absurd'".

Both authors also agree that experience or experimentation supports the cause-effect relationship. The astrologers of the time tried to give foundation to the cometomancy by appealing to the events that occurred after the passage of a comet, such as deaths or plagues, events that would be "explained" by the experience, since they were perceived with the senses. However, Sánchez, ahead for his time, says that although "*Sed dubii nodum non solvunt ista retortum*" "what we have experienced is solid proof for us" (15, p. 181), if an experiment was carried out on the comet, all predicted events would not follow, because although a comet was not seen in the sky, the deaths of kings, nor wars or plagues would not stop happening. The experiment, Hill's eighth criterion, was made up of the same support, saying that if by removing the cause the event is prevented or the frequency of events is affected, a stronger support for causality is achieved (10).

The last point of affinity between the authors seems to be the analogy, which can be useful to compare associations present from previous contexts, and, thus, orient the present observation towards causality (10). Sánchez, also in an apparently logical opposition, used it to explain how unbelievable cometomancy could be, raising an analogy between the reddish Vulcan planet and the "hairy stars" (15). His argument could be summarized in that if it were believed that comets could presage so much, the same could be said of the aforementioned planet, since the events attributed to the passage of comets and even the passage of the comet itself, could also have been caused by Vulcan, always present in heaven.

Discussion

It has been presented the similarities that we found in the discourse of causality between Francisco Sánchez and Sir Bradford Hill. Apparently, Sánchez agreed with 7 of the Hill's postulates. This coincidence was not perfect, given the significant differences in

literary styles, chronology and primarily in the topics that gave rise to their discourses. However, despite being found in such distant times, the similarity in the theoretical support is evident when presenting the characteristics that could be considered as requirements to establish a causal relationship. No elements were found in Sánchez's poem that would allow us to make similarities with the two remaining criteria: strength and consistency. The reason probably lies in the fact that these two postulates are defined based on principles established later, from the development of the scientific method and the statistical formalization of the measures of association. Sánchez was in a time of full upswing in the fight between reason and magical thought, so his poem had to bring the arguments within the reach of those who could be considered his opponents and the recipients of the message.

Everything here presented marks an historical precedent, almost four hundred years before Sir Austin Bradford Hill's epidemiological proposal, with a demarcation from philosophy and epistemology towards the traditional criteria of the theory of causality in medicine. This suggests *Francisco The Skeptic*, already considered a precursor of modern thought (16), as the first author and physician to attempt to give a rational order to the relationship between association and causality.

Conclusion

In this reflection, we presented the arguments used by Francisco Sánchez as a manner of postulates to establish causation and contrasted them with Hill's criteria, finding that both proposals agree on many fundamental aspects, and that Sánchez work could be considered as a philosophical antecedent of contemporary criteria of causation, being one of the first authors and physician trying to give a logical and rational order from association to causation.

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