Early Modern "Citation Index"? Medical Authorities in Academic Treatises on Plague (1480–1725)

Černý K.
Institute for History of Medicine and Foreign Languages, First Faculty of Medicine, Charles University in Prague, Prague, Czech Republic

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Abstract: The paper deals with the problem of early modern scientific citations. It attempts to establish a measure of scientific popularity in a specific area of the academic medicine in a way which resembles a modern evaluation of scientific activity (citation index). For this purpose an analysis of a series of plague treatises written between 1480 and 1725 in Europe was conducted. Citations for various historical medical authorities (Hippocrates, Galen, etc.) are given in Tables which reflect a long time development of popularity. The authorities from various groups (Ancient, Medieval, Arabic, Early Modern) are linked together, and "generic authorities" are explained and discussed.

Mailing Address: Mgr. Karel Černý, PhD., Institute for History of Medicine and Foreign Languages, First Faculty of Medicine, Charles University in Prague, U Nemocnice 4, 121 08 Prague 2, Czech Republic; e-mail: karel.cerny@lf1.cuni.cz

Introduction

The paper deals with a historical analysis of citation practice among the early modern medical authors. Specifically with those who wrote treatises on plague between 1480 and 1725. The goal is to illustrate changes in citation practice from a long established methodological point of view called in historiography by the French term *longue durée*.

An ordinary plague tract of this period has more or less predictable structure with theoretical chapters describing epidemics in the beginning, followed by an exposition on plague in general, and a practical advice on prevention and cure in the end. The content is often similarly unauthentic, although there are exceptions (Fracastoro, van Helmont, to some extent Massaria or Mercuriale). Due to the intimate link of early modern science with the past, often described as *philosophia prisca*, citations were an integral part of scientific text. I have found that even authors from the very beginning of the early modern era provide extensive references of sources and it was a common practice to use cited references as a strategy to strengthen one's position in theoretical discussion or to support the validity of a suggested cure.

To demonstrate the fact and general usability of citations in historical research I will show some characteristic features of this practice, namely who was cited, how the popularity of individual authorities changed during the time, and in discussion I will try to establish common trends which affected preferences of early modern medical writers.

The results should not be interpreted in a statistical sense for three reasons. First, it is impossible to create a randomly selected statistically relevant sample of anti-plague texts. No one knows how many books on plague have actually been written during the early modern era and any researcher is necessarily affected by a narrow selection of libraries he/she has an access to. In this study some texts were selected based on their presupposed role in the history of medicine and to make the results more relevant for a central European readership, I have also intentionally chosen several treaties related to the Czech kingdom.

Second, despite the presentation of results in Tables, there are no numerical values involved. As I will explain later, the difference between (a) the authority was cited, (b) the authority was cited only in the name of a remedy and (c) the authority was not cited can't be translated into truly statistical analysis. The difference between (a), (b), and (c) is not similar to, say, 1, 0.5, and 0.

Third, the study covers so called pre-statistical period. A use of mathematic analysis on such subject would violate basic principles of historical research as it is discussed in modern methodological manuals, see for example Iggers (2005), Eckart and Jütte (2007), Špelda (2009).

Typically, if we want to reconstruct an influence of a particular authority in a historical medical publication, we have two possibilities. Either we accept explanation given by the author of the publication, i.e. if the author claims to follow above all Galen, we accept, that his opinions are mainly Galenic. Or we attempt to evaluate

independently his scientific theories or methods and compare the results with possible sources which may have been followed by the author. Nevertheless, both approaches are far from perfect.

In the first case we have to rely on conscious self-definition which may or may not reflect the reality. We can expect an effort to suppress or underline certain resources based on the prevalent opinion of the contemporary medical establishment. The division may also partially follow a fissure between catholic and protestant part of scientific community, although there are numerous examples showing that so called "*res publica litteraria*" (contemporary term for scientific community) was probably more cohesive than we would expect based on savage disagreements of theologians or politicians.

The second approach is very difficult to utilize simply because of sheer amount of available medical literature during the early modern era. Brodman (1954) estimated that in the mid 17th century there were already tens of thousands of various medical titles, as the most extensive bibliography written in 1679 by Lippenius contains around 20,000 entries. Based on a rough estimation she claims that in the 2nd half of the 17th century there may have been up to 50,000 different medical books already in existence. Even if we reduce the perspective to the most prominent authors (books were not as readily available to anyone as they are today) we still get hundreds of volumes written in Latin sometimes with uncertain authorship and other difficulties. Therefore any search for a source of a particular idea is often only an educated guess.

Material and Methods

The research is based on citations found in series of medical treatises on plague written between 1480 and 1725. I have chosen plague tracts because the plague is one of the most prominent themes in the medical history. The pool of authors and works is mixed. Some authors are well known members of early modern medical community (Fracastoro, Mercuriale, van Helmont), but there are also virtually unknown personalities (Bonagentibus, Capellutius).

There is probably slight overrepresentation of Czech sources (Jessenius, Schamsky, Löw von Erlsfeld), but I don't think that it renders the selection unusable, because I do not believe, that a universally acceptable sample of historical works on plague can be established. A limited accessibility of old printed books through libraries, archives, museums, and recently also the Internet is probably the most important influence which prevent us from building a perfect sample. Therefore any set chosen for the purpose of this study will unavoidably suffer from some partiality.

The category of "citation" itself is a difficult subject, which stems from the ambiguous nature of quotation in the past. By "citation" I mean a reference to a historical author that may not necessarily contain also name of a particular title. Furthermore there are "mediated references", because some writings did not survive and are quoted through another source. For example a lot of pre-Galenic physicians

are known only via their quotations in Galen's books and some early writers (like Oribases) focused extensively on collecting ideas from various antecedent authors. It is impossible to tell whether the intermediary is correct or precise and therefore in such case both the intermediary and supposed original author are included.

Majority of citations are positive, which means that given authority is accepted and his opinion approved of. (Note that pronoun "her" really does not have a place here, as medieval and early modern academic writing is nearly exclusively male endeavour.) However, sometimes the reception is more mixed. When writing about particular disputes authors used to present both sides of the controversy (for example Mercurialis on venesection) and every now and then an authority is mentioned only to be condemned, this is for example the case of Andreas Libavius condemning Paracelsus.

Even if such strong negative opinion is expressed I include the authority into my consideration, because there was obviously a reason why Libavius felt compelled to comment on his German compatriot Paracelsus. If he weren't important he would not have been mentioned at all.

There are also citations pointing to names or works which for various reasons I wasn't able to identify. Fortunately, among more than 250 different authorities this happened in 30 cases. Some are probably misspellings, sometimes the name is abbreviated in a way that does not allow reconstruction, and there are also authorities cited only using their first names, which makes them virtually untraceable.

The last group of citations which stands out as something deserving our attention are names of remedies which contain name of supposed inventor (i.e. pills of Rufus of Ephesus, mythridatum – a remedy of king Mithridates, etc.). Those are difficult to evaluate, because on one hand invention of particular concoction in the ancient, medieval, or early modern medicine is always quite spurious, there is no doubt that lot of medications were ascribed to particular medical authorities as a form of advertisement and they have nothing to do with the supposed "inventor" himself.

However I believe that such citation conveys important information – the "inventor" was either true author of the remedy or was considered to be sufficiently famous to ascertain that his name will promote the remedy falsely ascribed to him. Taking this in consideration, I decided to present these cases separately from other authorities. If an author is mentioned as a standard authority (i.e. his books or ideas are quoted) and simultaneously as inventor of a remedy, only the first role is used.

I have chosen various texts on plague from the 15th to 18th centuries as resources for this study. In this timespan *terminus post quem* is based on introduction of modern printing methods (between 1450–1460), which in my opinion constituted a substantial change in a way how medical information was obtained and shared. The latter limit (*terminus ante quem*) is based on presumption that around 1730 it is possible to trace first substantial changes which signify arrival of the Enlightenment period. Both boundaries are to certain extent arbitrary, as modern historical

methodology believes that so called "historical periods" reflect subjectivity of the historian as well as changes of the history itself.

The oldest group contains three treatises, which still bear some marks of medieval literary production (form of print, extensive use of abbreviations, cited authorities are mostly ancient and medieval). The first one was written by a physician from Italian city of Parma Rolandus Capellutius (written in 1480's), another by professor in Bologna, Parma, and Paris Filippo Beroaldo the Elder (d. 1505), and the third by Wenceslaus Payer (also spelled Bayer), a Czech who studied medicine in Leipzig and lived here as a physician. He also worked for family of counts of Šlik in Jáchymov (Joachymsthal). Payer's short tract is reaction to plague epidemic from the beginning of 1520s (Nejdl, 1956; Křížek and Sajner, 1984; Payer et al., 1984; Sajner and Křížek, 1984). For further information on Capellutius, Beroaldo, and other Italian authors mentioned later in this study see *Dizionario Biografico degli Italiani*, published by Istituto Giovanni Treccani, a scientific institute existing from 1925. Although there is a printed version of the Dizionario (more than 70 volumes so far), I suggest using the digital version on www.treccani.it, which is up to date and maintained by the institute itself.

Next group was written in the humanistic style. Famous *De contagione et contagiosis morbis curatione* by Girolamo Fracastoro (1478–1553), is followed by a short treatise by less known Victor de Bonagentibus (Nutton, 1990). Tracts by Alessandro Massaria (d. 1598) and Girolamo Mercuriale (1530–1606) were both written in the aftermath of the great Italian plague of 1570's, which is also called "plague of St. Carlo Borromeo". Massaria, who was a city physician from Vicenza and later professor in Padova, wrote his book partially as a response to Mercuriale who published his own treatise a year earlier.

Andreas Libavius (1555–1616) was included because of his role in the history of early modern chemistry, a short chapter on the relevance of Galenic medicine can be found in his Schedismata from 1596. Later in two other books Syntagmatis and Appendix, I trace an interesting disagreement he had with a physician Henning Scheunemann. Originally, Scheunemann published a book in German containing short Paracelsian description of an anti-plague remedy, which I wasn't able to locate. However, the book attracted Libavius' attention and he quoted the remedy (translated into Latin) in his Syntagmatis (1613) in a very disapproving way. This quotation provoked Scheunemann, who wrote a personal letter to Libavius, and Libavius in turn gladly reprinted both the letter and his own vitriolic response in his Appendix two years later.

Emmanuelus Gommesus (also Manuel Gomez, born 1580) came from Portuguese Jewish background. He studied in Spain and lived in Spanish Netherlands. Joannes Jessenius a Magna Jessen (1566–1521) was born in Wroclaw, taught at the University of Wittenberg, and was executed in Prague during the aftermath of Czech Estates Rebellion. For the most recent and modern evaluation of Jessenius life and work see Nejeschleba (2008).

Political and religious antithesis to Jessenius is represented by Jesuit Athanasius Kircher (1601/1602–1680) who was an intellectual celebrity of the mid 17th century. Being a prolific author with an immensely wide scope of interest including sinology, music, geology, cryptography, egyptology, physics, religion etc., his only medical text *Scrutinium physico-medicum* was written shortly after the last great plague of Rome (1656) which Kircher personally witnessed as a curator of museum of curiosities in Collegium Romanum Societatis Jesu (Reilly, 1974; Findlen, 2004). Balthasar Timaeus von Güldenklee (1600–1667) graduated from the University of Wittenberg where he belonged among the pupils of famous Daniel Sennert. He was physician at the court of Prince-elector of Brandenburg, and personal physician to Queen Marie Eleonora, widow of Swedish king Gustav Adolph.

Three physicians from the latest period are associated with the Charles University. Tudecius de Monte Galea (1633?–1700) belonged to the generation of Prague's professors from the second half of the 17th century. His scientific legacy is rather modest, but he produced very systematically written text on plague. Johannes Franciscus Löw of Erlsfeld (1648–1725) was repeatedly dean of the Faculty of Medicine and rector of the university; he was probably the most famous representative of the Czech medicine in the beginning of the 18th century. Alexander A. I. Schamsky (1687–1714) was his pupil, author of two treatises on plague (one in German), and member of the oldest still existing scientific society in Europe (Academia Caesareo-Leopoldina medicinae curiosorum). Schamsky's promising career was interrupted by his premature death during a plague epidemic in Louny, Bohemia (Hlaváčková and Svobodný, 1988–1993).

And finally Christian von Helwich (1666–1750) was a physician from Wroclaw who produced the only scientific "paper" in a modern sense in my list. It was published in proceedings of the Academia Caesareo-Leopoldina called Ephemerides as reaction to the last wave of plague epidemics in the Central Europe (1710–1717).

For full list of resources from which the citations were extracted see the references.

Results

The results can be best seen in Tables. In Table 1, I present the most prominent medical authorities of the pre-modern medicine: Hippocrates of Cós (app. 460–370 BC), Galen of Pergamon (127–199/217 CE), Avicenna (app. 980–1037 CE), and Pedanios Dioscorides (app. 40–90 CE). I believe that they do not need further clarification perhaps with exception of Pedanios Dioscorides, who was a fundamental source of medieval and early modern pharmacopoea.

Table 2 offers some more frequent ancient authors: physician Aetius of Amida (5th–6th century CE), Andromachos the Elder (personal dates unknown, he was physician to the emperor Nero 54–68 CE), Aristotle (384–322 BC), A. Cornelius Celsus (25 BC–50 CE), natural philosopher Pliny the Elder (23–79 CE), orator and politician Marcus Tullius Cicero (106–44 BC), author of Illias and Odyssea Homer, king Mithridates VI of Pontus – supposed author of remedy called mithridatum,

Rufus of Ephesus (1st century CE), Thucydides (app. 460–395 BC) – author of the oldest historical description of a plague epidemic in Europe, which was part of his History of the Peloponnesian War.

The selection is based on frequency, there are several other ancient authors both physicians and non-physicians who are cited in plague treatises, but they are mentioned sparsely usually only once or twice.

Table 3 contains Arabic scholars, in this case the list is complete, the references to Arabic medicine (with exception of Avicenna) are indeed very rare. Following Table 4 contains set of the most quoted medieval authorities. As with Arabic writers, they are few and far between. St. Albertus Magnus (d. 1280) was respected for his natural works and Giovanni Boccaccio (1313–1375) is the author of an influential literary description of the Black Death epidemic in the beginning of Decameron. Both aren't physicians, that leaves only Ugo Benzi da Siena (1376–1439) and Gentile da Foligno (died from plague 1348) representing medieval physicians. Ugo and Gentile were professors of medicine at various Italian universities.

Girolamo Cardano's (1501–1576) appearance among early modern authors (Table 5) is rather surprising; he was famous 16th century mathematician, addicted to hazard games, and prolific author in natural sciences. His contribution to medicine of plague is – as far as I know – limited to few pages at the treatise *Contradicentium medicorum libri duo* from 1565. Jean Fernel (1497–1558) on the other hand represents a particular medical tradition, which focuses on "*proprietas occulta*". Those who mention Fernel either agree with this theory of "hidden qualities" or feel compelled to refute it.

Peter van Foreest (also Petrus Forestus, 1521–1597) was a prominent Dutch physician, who gained his fame as author of hundreds of medical observations later published in single gigantic volume of his *Opera omnia* (1609).

Apart from Fernel two other persons represent original contribution to 16th century medical thinking. The first one is Girolamo Fracastoro (1478–1553) who gave name to "French disease" by publishing his influential poem *Syphilis, sive de morbo Gallico*. His opinions on plague were made available through another important book *De contagione et contagiosis morbis curatione* from 1546. The originality and spread of his ideas were discussed above all by Vivian Nutton (1990, 1983). Another original thinker is Paracelsus (or Philippus Aureolus Theophrastus Bombastus von Hohenheim, 1493–1541), who assumed the role of *enfant terrible* of modern medicine. All citations of Paracelsus in my set of plague treaties are ambivalent (those made by Kircher and van Helmont) or strongly negative (Libavius). Paracelsus was credited with "invention" of anti-plague amulet called Zenexton made mostly from desiccated toads. A 16th century amulet did not necessarily mean something arcane and magical, quite contrary the idea of medical amulet was based on perfectly rational (but objectively wrong) presumptions about workings of nature. It was not perceived as a "spiritual" or "magical" remedy. Nicolao Leoniceno (also Niccolò L., 1428–1524) was influential above all as author of *De Plinii et aliorum*

in medicina erroribus, which heralds early modern critical attitude toward so far undisputed classical authorities.

Angelus Sala (1576–1637) was mentioned nearly exclusively for his authorship of remedy called "antidotum Angeli Salae". He wrote one tract on plague, and at least two others on anti-dotes. Andreas Vesalius (1514–1564) was included to this survey only to demonstrate the fact that despite his presupposed influence on early modern medicine, he is mentioned only once. This suggests that Vesalius' role is limited to anatomy and allied areas of medicine.

Among authors from the 17th century (Table 6) Thomas Sydenham (1624–1689) dedicated more than one work to fevers or plague. Isbrandius Diemerbroek (1609–1674) was author of a lengthy book about plague and was a strong supporter of smoking tobacco pipes as an antidote against plague. Czech (or Moravian) physician Schamsky in his dissertation thesis from 1710 claims, that his tutor professor Löw of Erlsfeld adopted the habit of smoking pipe before the great plague in Prague (1680) under the influence of Diemerbroek.

Jean-Baptiste van Helmont (1579–1644) was a Flemish chemist, physiologist, and physician. He introduced several new terms into the general medical theory, namely "*gas*" and "*archaeus*". Archaeus plays an important role in forming of new ideas about the inner workings of organism toward the end of century. Helmont is supposed to be a follower of paracelsian teachings, but in his treatise on plague (*Tumultus pestis*) Paracelsus is both prized for certain ideas and harshly condemned for others. Despite the strong critique of practically all the previous medical tradition (physicians are portrayed as bats dwelling in obscure underground caves, fleeing "light" of truth) his own contribution to the cure of plague is disappointingly unoriginal (he suggests faith, confidence, and amulets).

Next scholar on my list is a Jesuit priest and natural researcher Athanasius Kircher. He has already been mentioned as author of *Scrutinium* from 1658. Although it is disputed by medical historians, Czech authors (Schamsky and Löw) quoted Kircher as inventor of theory that the cardinal cause of plague – putrefaction – is caused by small worms that breed in human blood if one is infected by a plague contagion. According to Kircher, worms are observable by "igenious recent discovery arcanum smicroscopi" (i.e. microscope). And so ironically the most visionary approach toward the investigation of plague is attributed to non-physician and member of a Catholic Jesuit order. It is important to note that Kircher's theory was seen only as not very creditable option in a whole pool of various opinions. The idea of "small worms" in blood as cause of sickness had to wait another two centuries for its resurrection.

Very little is known about Raymud Minderer (d. 1621; Hirsch, 1884–1888), who wrote a book about plague but the citations suggest, that his influence stemmed more from another treatise written around 1621 on a military medicine (*De medicina militari*).

The last area analyzed in the research concerns "generic authorities". By this term I mean social or socio-professional groups which become a source of information

or are considered to be somehow relevant for treatment and/or theory concerning the plague. The generic authorities are not presented in form of Table, because the definition is often blurry and it may be difficult to assess the exact relation between certain subset of individual authorities (i.e. Avicenna) and corresponding generic authority (Arabic physicians).

Despite the uncertainties, I emphasize the search for generic authorities in early modern medical texts because they (a) cross boundaries of strictly academical writing of the time and (b) help us to identify a basic blue-print of socio-professional, geographical, or social landscape which was familiar to professionals writing about the plague.

They can be roughly divided into two subsets. The first one contains scholarly generic authorities: Greek physicians, Arabic physicians, Latin physicians (i.e. the physicians writing in Latin, not Latinos), aristotelics and peripatetics (both words mean scholars following teaching of Aristoteles), platonics (scholars following platonic philosophy), and mathematicians. These categories are used almost always in terms of general chronology, for example Girolamo Mercuriale notes in his discussion of contagion that, "… *neither Arabic, nor Greek physicians, who are followers of Galen and Avicenna, do not seem to mention contagion* …" (p. 4).

Some authorities are on the verge of the category: astronomers and astrologers (there is no discernible distinction between usages of those two terms), chemists, empiricists. These groups are more controversial, terms astronomers and astrologers were often invoked in discussion about relevance of heavenly influence on human body. The attitude toward astrology in plague treatises is mixed. The simplistic idea of an arcane influence of zodiac was probably refused by majority of physicians in the early modern era. On the other hand many believed that there is physical connection between heavenly bodies and human health mediated through influx of noxious particles emitted by the sun and planets. This more rational idea was often commented on in positive terms. Chemists and empiricists were general terms for either non-educated "specialists" who competed with contemporary physicians (and often won the interest and purse of patients) or for physicians who favoured teachings of Paracelsus. Both groups were perceived generally negatively by the mainstream medical establishment.

The second subset involves non-academic "authorities": maids (or female house servants, the Latin term used is *muliercula* – deminutive form of *mulier* "woman"), poors, pedlars, and peasants. Those were universally denounced. The attitude of contemporary medical writers can be summarized with a quotation from Alessandro Massaria, who wrote: "… *many regard themselves as experts, and those are very often insane maids* (*insanae mulierculae*)*, pedlars, and common beggars*" (p. 36). This list shows who was seen as anathema to medical profession.

Tables

Legend: "-" means that the authority is not cited; "+" means that the authority is mentioned at least once; "r" the authority is mentioned only in name of a remedy. Also note that for practical reasons only Table 1 is provided with heading which would be similar in all the remaining Tables.

Table 1 – The most prominent medical authorities of pre-modern era

Source	Capellutius (1480–1487)	Beroaldo (1505)	Payer (1522)	Fracastoro (1546)	Bonagentibus (1556)	Mercuriale (1577)	Massaria (1578)	Libavius, Schedismata (1596)	Gomez (1603)	Libavius, Appendix (1613)	Libavius, Syntagmatis (1613)	Jessenius (1614)	Kircher (1658)	Timaeus (1663)	Tudecius (1679)	Helwich (1712)	Schamsky (1714)	Löw, Universa med. (1723)	Löw, Theatrum (1725)
Hippocrates of Cós	+	+	+	+	+	+	+	-	+	+	-	+	+	+	+	-	-	+	-
Galen	-	+	+	+	+	+	+	+	+	+	-	+	+	+	+	-	-	+	-
Avicenna	-	+	+	+	+	+	+	-	-	+	-	r	-	+	-	-	-	-	-
Dioscorides	-	-	-	+	+	+	+	-	-	+	-	+	-	-	-	-	-	-	-

Table 2 – Selected ancient authors

Aetius of Amida	-	-	-	+	+	+	+	-	-	-	-	-	-	-	-	-	r	-	-
Andromachos	-	-	-	-	-	-	r	-	-	-	-	r	-	+	-	-	-	r	-
Aristoteles	-	+	+	+	-	+	+	-	-	-	-	+	+	-	-	-	-	-	-
Celsus	-	+	-	+	-	+	+	-	-	-	-	+	-	-	-	-	-	-	-
Pliny the Elder	-	+	-	+	-	+	-	-	-	+	+	+	+	-	-	-	-	-	-
Cicero	-	+	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Homer	-	+	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Mithridates	-	-	-	-	-	-	r	-	+	-	-	+	+	+	r	-	-	r	-
Rufus of Ephesus	-	-	-	r	-	-	+	-	-	-	-	-	r	r	r	-	r	-	r
Thucydides	-	+	-	+	+	+	+	-	-	-	-	-	+	-	-	-	-	-	-

Table 3 – Arabic authors

Averroes	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Mesue	-	-	+	-	-	+	+	-	r	-	-	+	-	-	-	-	-	-	-
Rhazes	-	-	r	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-

Table 4 – Medieval authors

Albertus Magnus	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Ugo Benzi da Siena	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boccaccio	-	-	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Gentile da Foligno	-	-	+	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-

Table 5 – Selected 15th and 16th century authors

Girolamo Cardano	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-
Jean Fernel	-	-	-	-	-	+	+	-	-	-	-	-	+	-	r	-	-	-	+
Peter van Foreest	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	+	+	-
Girolamo Fracastoro	-	-	-	-	+	+	+	-	-	-	-	r	+	r	-	r	r	+	-
Nicolao Leoniceno	-	-	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Paracelsus	-	-	-	-	-	-	-	+	-	+	-	-	+	+	-	-	-	-	-
Angelus Salus	-	-	-	-	-	-	-	-	-	-	-	-	+	r	-	r	r	r	-
Andreas Vesalius	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	

Table 6 – Selected 17th century authors

I. Diemerbroek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	-
Thomas Sydenham	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-
J. B. van Helmont	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	+	+	-
Athanasius Kircher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	-
Raymund Minderer	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	r	-

Discussion

The results concerning Galen and Hippocrates as seen in Table 1 can be explained more clearly if we take in consideration their traditional place in the history of medicine. It is generally accepted that during the transition from medieval to humanistic/renaissance medicine a complex change in evaluating of sources of medical knowledge took place. First, new manuscripts brought from Byzantium with the aid of newly invented print helped to generate a surge of interest in classical medical authorities. Inaccurate medieval translations often burdened with a strong Arabic influence were discarded and original *Corpus Hippocraticum* (which was believed to be written exclusively by Hippocrates of Cós) as well as Galen's voluminous publications were heralded as a definitive source of true medical knowledge, a mediator of the original (perhaps even God's) wisdom.

Later during the 16th century the authority of Galen and Hippocrates come under increased pressure above all from the anatomists like Andreas Vesalius, Bartolomeo Eustachio, or Girolamo Fabrizio d'Aquapendente, who realized and were able to empirically prove that the ancient anatomy was often flawed. Similar thing supposedly happened in other areas of medicine – physiology and pathology, with birth of alternatives to traditional medieval "theory of four humours" which was also based on Galen and Hippocrates ideas. The competition was based on a theory of occult qualities (Fernel, Ficino, della Mirandola), legacy of Paracelsus with his (al)chemical "tria prima", and even later in the 17th century new schools focusing on mechanistic approach or early forms of irritability/sensibility. This all is thought to lead to a gradual decline of Galen's and Hippocrates' influence on early modern medicine.

However the results presented in Table 1 suggest, that we should adopt more cautious approach toward supposed demise of both "Princes of medicine". Although the nature of their influence probably changed and there are differences in various branches in medicine the results show continuous undiminished authority of Hippocrates and Galen up to the beginning of the 18th century.

Another ancient authority – Dioscorides – in contrast became a victim of a formidable 16th century research in the area of botanics. After all, his "complete" list of all plants, animals, and minerals, which was still the best pharmacological handbook available at the beginning of the 16th century, contains only around 250 items. A hundred years later Caspar Bauhin's *Pinax theatri botanici* lists approximately 6,000 different species (Ogilvie, 2003). Nevertheless presence of Dioscorides is relatively strong at least throughout the 16th century and it dissipates slowly.

The last primary authority, Arabic physician Avicenna, offers a similar profile – he is quoted regularly in the 16th century and his influence shows signs of decline only during the following period. Avicenna however should be seen in context of other Arabic authors, who represent a completely different picture. The influence of oriental medicine as well as philosophy is scarce even during the first half of the early modern era. After 1600 it vanishes completely.

As seen in Table 2, it is obvious that some authors follow the pattern of Avicenna – stable presence during the 16th century and decline or disappearance between 1600 and 1650. This applies to Aristotle, Celsus, and Pliny the Elder. Aristotle was important for early modern physicians because his philosophy represented an influential explanation of movement, source of action, heavenly influence as well as other topics between medicine and physics. Pliny obviously remained the primary authority regarding natural phenomena. He was only slowly replaced with modern descriptions. Celsus was probably seen as a weaker companion to the Hippocrates and Galen.

Rufus of Ephesus and Mithridates were nearly exclusively mentioned in relation to remedies ascribed to them (*pilulae Rufii*, *mithridatum*), their repeated appearance documents therapeutic hopelessness or traditionalism of the time.

Table 4 (medieval authors) offers the most conclusive result. It shows that medieval medicine ceased to be relevant as authority at latest around the 1600. The influence of Arabic and medieval medicine should be probably seen as mutually connected. After all, the Arabic authors were also strictly speaking medieval.

The following Table 5 (15th and 16th century) contains much murkier findings. Apparently famous Andreas Vesalius was not very relevant for authors of plague treatises. Angelus Salus shares the fate of Mithridates and Rufus of Ephesus. On the other hand there seems to be a steady presence of Girolamo Fracastoro, albeit partially only in form of names of medical prescriptions. I would theorize that his position was later partially assumed at least in the Central Europe by Athanasius Kircher, who revised and amended his corpuscular theory.

It is worth to note that Paracelsus is mentioned only four times. It is possible that the result is affected by his opposition to medical establishment, in other words he may have been read but not quoted. Occasional resurgence of Jean Fernel is related to his theory of occult proprieties, but I'm not sure that the result in his case justifies a generalized conclusion. I have no explanation for relative popularity of Peter van Foreest.

Among the 17th century authors (Table 6) Jean-Baptiste van Helmont is the least surprising presence. His *Tumultus pestis* doesn't bring a substantially new point of view, however the way he dismisses basically all of his predecessors as unsatisfactory guarantees attention of contemporary commentators. Novelty of Helmont's approach lies in theory rather than therapy and even here the concept of *archeus* (a spiritual force animating human body) is only expansion/redefinition of older idea about *spiritus*. *Spiritus* can already be found throughout the first half of the early modern era and it constitutes (together with *archaeus*) the predecessor for irritability/sensibility theories of the 18th century.

Thomas Sydenham is mentioned by Helwich and Löw probably because of *Tractatus de febribus* which was repeatedly published as a part of his influential *Opera medica*. Apart from him I was able to identify only few British authors who all appear only once: Roger Bacon (1214–1294), Thomas Burnet (1635–1715), Nathaniel Hodges (1638–1684), Thomas Morus (1478–1535), George Thomson (1619–1676), Thomas Willis (1621–1675). It seems that the influence of insular medicine was still rather modest despite the existence of the Royal Society and its Philosophical Transactions. This however may also result from the fact that after mid 17th century the selection of plague texts in this paper becomes distinctly Central European.

To get a broader perspective let's compare the British presence with that of authors related to the Czech kingdom (no Table provided due to scarcity of results). I was able to identify only seven individuals associated with Bohemia and from those only three were mentioned more than once: Johann Crato of Krafftheim (1519–1585), Oswald Croll (1580–1609), and Pier Andrea Mathioli (1501–1577). Johann Crato of Krafftheim was a personal physician to the emperors Ferdinand I, Maxmilian II, and Rudolf II (VI). Apart from that he served twice as a city physician in Wrocław where he witnessed a plague epidemic of 1583. He was famous for his *Consiliorum et epistolarum libri VII,* a voluminous collection of correspondence with other physicians and patients. Oswald Croll (1580–1609) achieved during his short life position of personal physician to the Prince Christian von Anhalt-Bernburg. His *Basilica chymica* published in Prague (1608) and written in paracelsian style was very popular (with at least 18 editions). Pietro Andrea Matthioli (1501–1577), spent some time in Prague as a personal physician of Ferdinand II, Archiduke of Austria. Czech and German versions of his most influential botanical work *Commentarii in libros sex Pedacii Dioscoridis* were published in Prague in 1562 and 1563. Strictly speaking none of those three was Czech, their association with Bohemia is above all result of Prague being seat of Roman emperor Rudolf II (VI), who surrounded himself toward

the end of the 16th century with physicians, artists, natural philosophers and turned the Czech capital temporarily into a place appealing to various intellectuals (and quacks, of course).

Remaining Czech/Moravian authors are mentioned only once. Tomáš Jordán z Klausenburku (1539–1585) city physician in Brno studied in Paris and Italy, where he was a pupil of Girolamo Cardano. I find it surprising that Jordán's very well written *Phaenomena pestis* (1576) are not cited more frequently. Another three were in some stage of their life professors at the Charles University. Nicolaus (Mikuláš) Franchimont of Franckenfeld begun the career as a military physician of duke of Amalfi and later was professor of medical praxis, dean of the medical faculty, and rector of the Charles University (Hlaváčková and Svobodný, 1988–1993). Marek Marci of Kronland (1595–1667) was probably the most prominent professor of the medical faculty in Prague in the 17th century. He wrote several books on medicine, physics, and natural philosophy. Marek Marci acquired a wide collection of scientific contacts throughout the Europe (among others with Athanasius Kircher). For further information see Vinař (1934), Chládek (1977), Hlaváčková and Svobodný (1988–1993), Servít (1988), Čornejová (1995). Johannes Franciscus Löw of Erlsfeld (1648–1725) was another prominent representative of the Charles University, professor, dean, rector, and prolific author (Hlaváčková and Svobodný, 1988–1993).

There are very few 17th century authors with a steady appearance, among them is Isbrandius Diemerbroek whose three hundred pages long book on plague based on his own experience from the plague epidemics in Nijmegen obviously attracted attention. Raymud Minderer stands actually somewhere between the 16th and 17th century medicine. He died in 1621 and according the Hirsch (1885) he represented "spagiric" or paracelsian medicine.

Contrariwise Athanasius Kircher is very much 17th century writer, who belonged among the intellectual cream of the crop. He introduced some novel strategies into the scientific publication as for example lists of forthcoming works which allowed him to capitalize on extensive scope of his scientific interests. On one hand this very approach helped to spread knowledge about one of very few books on medicine written by a member of the Jesuit order and particularly Kircher's idea of worms forming in the putrescent blood. On the other hand Kircher's posthumous 18th century demise as a scientific authority (Reilly, 1974; Findlen, 2004) may have affected the later acceptance of the same theory. He was not an empirical scientist in a modern sense of the word and he surely could not observe *Yersinia pestis* with the microscope (Torrey, 1938; Baldwin, 1995). However no other 17th century author from my list of plague treatises mentions "arcanum smicroscopi" as a way to investigate the cause of plague.

Conclusion

Based on the results there are several points which can be made. First, the citations are an integral part of early modern medicine and as such they can be used for

further analysis, historical authors often quoted from a rich selection of various authorities. The citations were part of scholarly self-definition and a regular strategy for supporting validity of one's scientific claims. Furthermore the citation itself presents an interestingly diverse picture. There are citations with both positive and negative meaning (not to mention those situated in between). Negative meaning can be focused on individuals or as in case of some "generic" citations on a whole socio-professional group.

Second, it seems obvious to me, that Arabic and medieval authorities became obsolete toward the end of the 16th century, with exception of Avicenna, whose decline followed during the next century. This conclusion corresponds with generally accepted view of the history of medicine. In contrast the constant presence of Hippocrates and Galen throughout the whole period up to the 1725 is striking. It is however likely that the situation differs in other areas of medicine (for example anatomy).

Third, some names are rather conspicuously missing. I would expect for example René Descartes, because of cartesian dichotomy leading to understanding human body as a machine, or Isaac Newton, as changing landscape of early modern physics influenced concept of "contagion", or perhaps William Harvey, for his discovery of blood circulation (blood or heart were traditionally seen as the cardinal organs affected by the plague). Czech A. Schamsky speaks unambiguously about "circulation of blood", but he does not quote Harvey. This may mean that the Central European intellectual ambient was more conservative, but we need further analysis to confirm of reject such claim.

Finally, the clear temporary threshold of medieval and Arabic medicine doesn't seem to replicate in case of early modern authors who represent different theories. That suggests a diverse nature of 16th and 17th century medical thinking. In other words, while the demise of medieval and Arabic medicine happened in a "linear" way, the more modern ideas or theories (Fracastoro, Fernel, van Helmont) existed in a diverse space partially competing and partially being eclectically merged together.

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15th century

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16th century

Filippo Beroaldo, *Opusculum Philippi Beroaldi de terraemotu et pestilentia*, Bononia 1505.

Wenceslaus Payer, *Tractatus de Thermis Caroli IV. Imperatoris*, Lipsiae 1522. (This text contains three parts, the first deals with balneology in Karlovy Vary – Carlsbad, the second is named *Consilium de peste*, and the third contains text on balneology in German. Only the second part is used in this study.)

Girolamo Fracastoro, *De contagione et contagiosis morbis curatione*, in: Girolamo Fracastoro, Opera omnia, Venetiis 1574, fol. 77–110. The original treatise was published in 1546.

Victor de Bonagentibus, *Decem problemata de peste*, Venetiis 1556.

Alessandro Massaria, *De peste libri duo*, in: Alessandre Massaria, Opera omnia, Venetiis 1613. The original treatise *De peste libri duo* was published in 1577.

Andreas Libavius, *Schedismata medica et philosophica* …, Francofurti, 1596, pp. 20–36.

17th century

Emmanuelus Gommesus, *De pestilentiae curatione methodica tractatio*, Antverpiae 1603.

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