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Venesection conducted by physicians, barber-surgeons, bell-ringers and indigenous healers in Finland over 500 years. A narrative literature review with a limited genealogical search

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Contributions: JK has planned the study conception and design, analysed the results and prepared the manuscript, JK has read and approved the final version of the manuscript to be published and participated in the agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of interest: the author declares no competing interests and confirm accuracy.

Data sharing plans (for all data, documentation, and code used in analysis): the data extraction has been produced from the public genealogical database www.genealogia.fi by using "Hiski" genealogical search machine. The search words were limited to church bell-ringers and the language to Finnish and Swedish. The search covered the baptisms (father's occupation), marriages and burials. This study produced anonymous statistical data of bell-ringers in Finland in Excel format.

Ethics approval: all methods were carried out in accordance with relevant guidelines and regulations. An ethical review statement from a Human Sciences Ethical Committee is not required in this historical review, which is based solely on public information, registry, and documentary data (https://www.tenk.fi/sites/tenk.fi/files/Ihmistieteiden_eettisen_ennakkoarvioinnin_ohje_2019.pdf).

Availability of data and materials: data are available upon reasonable request. Requests to access data should be addressed to the corresponding author. Anonymised data will be available on request, from July 2024 to June 2030, to researchers who provide a methodologically sound scientific proposal that has been approved by an ethics committee and the scientific board.

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ABSTRACT

Venesection was was a common medical procedure from ancient times to the 19th century, frequently performed by physicians and barber-surgeons. In Finland, priests, church bell-ringers, and indigenous healers also performed venesection for a variety of diseases, although without a medical basis. Venesection and its complications may have caused a number of deaths. The treatment was discredited due to increased criticism, which was substantiated by statistical evidence. Today, medical venesection performed by physicians is only an exceptional treatment for a few number of disorders. The purpose of this article is to is to shed light on the long and fascinating history of venesection in Finland from 1488 to 1976, as well as its role in the evolution of medical procedures. This will be achieved through a review of the literature, the introduction of some neglected sources, a register-based search, and an investigation into who conducted the surgery and why venesection persisted for so long in Finland. The sources consist of church records and scholarly literature. The novel and main finding of this study was that there were a large number of professionals doing venesection when there were few physicians. This study discovered 2,341 bell-ringer-phlebotomists in Finland between 1755 and 1877 who constituted the bulk of people conducting venesection as compared to barber-surgeons and physicians. This former group was made up of predominantly Swedish-named guys who lived in western Finland. Another novel finding was that patient safety legislation effectively reduced the indigenous practice of venesection by quacks.

Introduction

Venesection, also known as bloodletting or phlebotomy, was a significant part of medical practice from ancient times up until the 19th century. It was based on the humoral theory and frequently performed by physicians and barber-surgeons. In Finland, priests, church bell-ringers, and indigenous healers performed venesection without a medical indication in a multitude of diseases as well. Venesection and its complications may have caused a number of deaths until increasing criticism of the treatment, supported by statistical evidence, led to its discrediting, thereby also reducing

the attendant harm in Finland. However, medical venesection as an evidence-based treatment has remained a part of care in an extremely limited group of medical conditions.

This article traces the long and intriguing history of venesection in Finland from 1488 up until 1976 through a review of the literature, introducing some forgotten sources, employing a register-based search, and answering the questions of who the phlebotomists were and why venesection survived so long in Finland. The sources consist of church records and scholarly literature. The aim is to describe some socio-demographic features of the phlebotomists in Finland and to appraise the complications and adverse effects of venesection as performed by both medical professionals and indigenous non-professionals. Also, the objective is to illuminate its significance in the evolution of medical practice and the factors contributing to its decline, which may be applied to other processes. The novel finding of this study was the discovery of 2,341 bell-ringer-phlebotomists in Finland between the years 1755 and 1877.

Aims of the study

The object of this article is to illuminate the history of venesection, performed by both professional and informal healthcare service providers in Finland. The focus of this review includes the history of medicine, biomedicine, and the study of folklore. The study uses a narrative literature survey and church records to answer the question of i) who the professional and indigenous phlebotomists in Finland were and ii) why venesection, as performed by both official and informal healthcare providers, was able to survive so long in Finland. These constitute the research questions of this review.

Methods

First, the narrative literature search concerning venesection in Finland was performed by using Medline, Google Scholar, Semantic Scholar, Primo and Finna as the search engines; digitalized Finnish newspapers; and the two bibliographies on folk medicine in Finland by Hindrik Strandberg [1]. The search was performed by using the following words in Finnish, English, Swedish and Latin: *'suonenisku,' 'suoneniskentä,' 'venesection,' 'phlebotomy,' 'venipuncture,' 'bloduttömning,' 'åderlåtning,' 'venesectio.'*

Second, source criticism was performed according to a checklist, discussing the reliability and validity of the sources [2]. The body of the source literature consists of historical literature, documentary literature, digitalized newspapers and journals, and the National Archives, but also of eyewitness findings from some private collections in addition to published interviews. The historical studies written by academic scholars are considered the most reliable of these sources, as well as the testimonies of eyewitnesses.

Third, the nationally digitalized church record archives at www.genealogia.fi, a rich resource for genealogical research [3], were searched systematically to find evidence of the professions in which venesection was performed in Finland between the years 1755 and 1877. This period was chosen based on the evidence that venesection that was not only performed by physicians and barber-surgeons but also by bell-ringers from at least 1755 until 1877 [4]. In the systematic genealogical search on www.genealogia.fi, we used the professional titles *'Lukkari'* or *'Klockare.'*

The literature review: the historiographical context of venesection in Finland

Geographically, Finland is situated in Fenno-Scandia, Northern Europe. The land area of Finland is currently 338,455 square kilometres but has varied throughout history. Finland's borders have changed over time, but its current neighbours are Sweden to the west and Russia to the east. Geopolitically, Finland is situated between the East and the West, straddling the Roman Catholic world and the Byzantine Orthodox world, and later positioned between the great powers of Sweden and Russia. Finland has been involved in some 20 wars between 1554 and 1945 (Table 1). Finland was ruled by Sweden from the 12th century until 1809 and by Russia from 1809 to 1917 [5].

Finland is mostly inhabited by ethnic Finns, Swedes, and Sámi people but is home to some minorities as well. Until its acceleration in the 19th century, population growth was slow: the great famines of 1698 and 1868, the influenza pandemic of 1918-1920, and several wars caused significant mortality [6]. The battles of Karelia, a region inhabited by Fenno-Ugrian folk groups, were a hallmark of Finnish war history and occurred intermittently from 1278 onward [7]. The last episodes of these armed conflicts were experienced in the Winter War of 1939-1940 and the Continuation War of 1941-1944 [6]. Finland has not been at war since 1945.

Healthcare in Finland: the historical context in brief

Finland's earliest reliable historical document is from the year 1171 or 1172 [6]. The development of healthcare in Finland has undergone many stages, with a documented history beginning in the year 1321 or 1324 [8-10]. There were seven medieval stone castles in Finland: Turku, Vyborg, Hämeenlinna from the 13th century, Kastelholma, Raseborg, and Korsholma from the 14th century, and Olavinlinna from the 15th century [6]. The Karelian castle of Käkisalmi (Kexholm) is from the 13th century and is in present-day Russia. Many castles, such as Turku, Vyborg, and Käkisalmi, had recruited pharmacists [11]. During the Middle Ages, monks and nuns in Finland's six monasteries treated patients [11]. To organize social welfare and healthcare, these orders decided to establish "*houses for the disabled and poor*" [12] near the churches beginning in 1548 [13]. The first field physician, German Johan Copp von Raumenthal (1487-1559), was mentioned in 1554 [14,15].

During Swedish rule, the first attempt by the state to develop healthcare was the establishment of the district physician system in the middle of the 18th century [16]. During Russian rule after 1810, the administration had to be re-established in Finland. Collegium Medicum administered the hospitals, while the state was now responsible for healthcare [17]. Municipal autonomy in healthcare since 1869 was based on the Emperor Act and consisted of the responsibility of organizing healthcare and managing the costs, control of outbreaks and zoonoses, and medication [17]. The development of healthcare also included pension and insurance systems for employees beginning in 1897 [17].

Finland gained independence in 1917. The Civil War in 1918 divided Finland in two: the conservative White "winners" and the revolutionary Red "losers" [17]. Social security in Finland was weak until 1937, when the social democratic and center coalition government started to put efforts into healthcare development [17]. Development towards a modern system occurred when the multi-channel social security and healthcare system, including community health, specialty healthcare, and occupational healthcare, was established during the years 1960-1990 [17].

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Table 1. The development and transition of the role of professions performing venesection through the centuries.

Century	Geopolitical status of Finland	Key events and trends in professions performing venesection	Landmarks in the history and development of medicine
14th century	Finland/Österlandia of Sweden 1323-1518	The first named barber, Hinzikinus, in Turku in 1321 or 1324.	The Third Crusade to Karelia 1270-1323
15th century		Venesection was performed by priests and barbers. The Missale book in 1488 included instructions for performing phlebotomy.	The Battle of Vyborg 1495
16th century	Finland, part of Sweden 1518-1809	Instructions for suitable days for venesection and cupping by Mikael Agricola in 1544. Venesection was preferred to cupping by Olaus Magnus Gothus in 1555. Physician Johan Copp ordered venesection for remedy in 1555. The Barbers' Guild was established in 1571.	The Russian War of Gustavus Vasa 1554-1557 The Cudgel War 1596-1597
17th century		Venesection was performed by barber-surgeons, priests and physicians. Other healthcare providers of the time, such as bath attendants and masseurs, were also permitted to perform venesection in 1657 and 1663. The Society of the Surgeons (Societas Chirurgica) was established in 1681	The War of Kalmar 1611-1613. The Thirty Years' War 1618-1648. Human blood circulation was discovered by Sir William Harvey in 1628. The Academy of Turku founded in 1640. Hypodermic hollow needle was used in an intravenous injection by Sir Christopher Wren in 1656. The Russo-Swedish War 1656-1658 Red blood cells were discovered by Jan Swammerdam in 1658. The earliest blood transfusion was reported by Richard Lower in 1666. The Battle of Brandenburg 1675
18th century		Priests continued performing venesection. Barber-surgeons used venesection until the 18th century. The Society of the Surgeons took control of the barber-surgeons' examination in 1755. King Adolf Fredrik of Sweden ordered in his Act in 1755 that every bell-ringer of the church should be educated in venesection. The Society of the Surgeons was abolished in 1798.	The Great Northern War 1700-1721 The Russo-Swedish War (The War of the Hats) 1741-1743The Russo-Swedish War (Gustavian War) 1788-1789
19th century	The Grand Duchy of Finland, Russia 1810-1917	Physicians, barber-surgeons, church bell-ringers, bath attendants and masseurs continued performing venesection. In the 1860s venesection was still very common in eastern Finland, but also in southwestern Finland. The regulation concerning the bell-ringers' duty to perform vaccinations and venesection was removed from the Church Act in 1869. The Swedish Medical Society in Finland s trongly reacted against venesection in 1877. The era of indigenous and non-official venesection had continued almost unchanged from medieval times until the end of the 19th century. Famous Finnish physician Erik Adolf von Willebrand (1870-1949) wrote his thesis on venesection in 1899.	The Finnish War 1808-1809 The University of Helsinki founded in 1828 The Crimean War 1853-1856 The Russo-Turkish War 1877-1878
20th century	Independence, The Republic of Finland 1917 Member of EU 1995	Venesection, cupping and leeches have all been used in Finland. Finnish authorities Max Oker-Blom and Arvo Ylppö in 1922 instructed that venesection should only be conducted by physicians in some conditions, for instance, in pneumonia, pulmonary edema, uremia, paralysis and carbon monoxide poisoning. The last reported indigenous phlebotomists performed venesection into the 1970s and 1980s. Phlebotomy is still performed in blood donations, diagnostic phlebotomy, and very occasionally as a therapeutic measure. The transition from indigenous phlebotomy to professional, biomedicine-based phlebotomy occurred during this century.	The Russo-Japanese War 1904-1905 World War I 1914-1918 The Finnish Civil War 1918. The Finnish Kinship Wars 1918-1922 The University of Tampere founded in 1925 The Winter War 1939-1940 The Continuation War 1941-1944 The University of Oulu founded in 1958 The University of Kuopio founded in 1966

To be continued on next page

Table 1. Continued from previous page.

Century	Geopolitical status of Finland	Key events and trends in professions performing venesection	Landmarks in the history and development of medicine
21th century	Independence, The Republic of Finland 1917- Member of NATO 2023-	Phlebotomy is still performed by laboratory nurses in blood donations and diagnostic phlebotomy, and very occasionally as a therapeutic treatment in some limited conditions such as haemochromatosis. Healthcare professionals do not perform treatment that is not based on evidence. Indigenous venesection by informal healthcare providers is no longer conducted.	Patient Insurance Act 2019

Venesection was brought to Finland in the Middle Ages

Historically, there is evidence that bloodletting was already known in ancient Mesopotamia and Egypt [18] and has been practiced in primitive cultures [19,20]. For centuries, it was understood to be based on the Greek and Roman humoral pathology theories [21,22] of Hippocrates of Kos (ca. 460-ca. 370 B.C.), Erasistratus (ca. 304-ca. 250 B.C.) [23], and Claudios Galen of Pergamon (129-ca. 201 A.D.) [24]. Venesection was also performed in many other cultures, such as in Islamic medicine, possibly having local origin [25], and in China [26]. In the humoral pathology theories, the excess of blood was thought to cause distension in the blood vessels and be the reason for diseases [22].

In Finland, venesection was performed as a significant part of healthcare from the Middle Ages until the mid-19th century [18]. Bloodletting, which can be divided into a generalized method performed by venesection or arteriotomy, and a localized method performed by scarification with cupping or by using leeches [27, 28], has been performed in Finland in all these forms [18,20,29,30].

From the 12th century on, barbers' practices included shaving and bloodletting [31]. The exact duration of bloodletting in Finland is unknown, but the first documented practitioner was barber Hinzikinus, who worked in Turku from 1321 to 1324 [8-10]. The first written documentation on venesection in Finland is found in a religious song collection in Latin called '*Missale Aboense*,' from Turku, dating to 1488. The short instructions, four sentences regarding venesection, can be found at the beginning of the collection: "*Avoid venesection before the fifth day of the month. Venesection in the spring and summer [should be done] from the right. In the autumn and winter, from the left. Do not perform venesection after the 25th day. Avoid such venesection as death*" (Figure 1) [32]. In 1491, reference was made to cupping, another form of bloodletting, in Ostrobothnia, Finland [20].

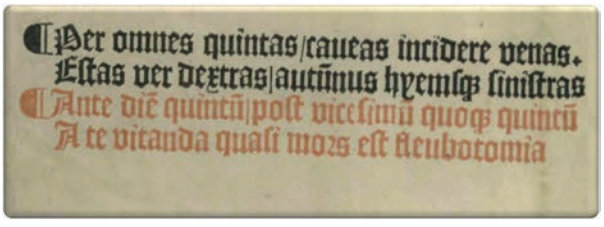
Per omnes quintas/cauteas incidere venas.
Estas ver dextras/autūnus hyemsq̄ sinistras
Ante diē quintū/post vicesimū quoq; quintū
A te vitanda quasi mors est flebotomia

Figure 1. Missale Aboense 1488. A brief instruction for venesection for the Finnish priests was written in the introduction to the Mass book. Source: http://www.doria.fi/handle/10024/67149

Calendars recommended suitable days: venesection from 16th to 18th century

The second historical reference to venesection in the Finnish literature is from the year 1544, when Finnish bishop Michael Agricola (c.1510-1557), regarded as the creator of the Finnish literary language, advised suitable days for bathing, cupping, and venesection by using celestial signs. Agricola wrote in his "calendar" in Finnish: "*My name is January: but do not perform bloodletting from the foot.*" "*February: perform bloodletting.*" "*March: do not let blood from your head.*" "*September: perform cupping and bloodletting.*" "*December: do not let blood from your knee*" [33]. Historiographer Olaus Magnus Gothus (1490-1557) wrote in his book '*Historia de gentibus septentrionalibus*' of the Finns in 1555, "*Both men and women use venesection against scabies rather than cupping because venesection can be performed better and more safely in barber-houses*"[34,35].

The first official calendar in Finland was released in Stockholm for the year 1608 by Finnish-born astronomer Sigfridus Aronus Forsius (ca. 1560-1624), who continued to publish calendars until 1623. His calendars also included the days suitable for bathing, taking medicine, purgation, venesection, cupping, and conception (Figure 2). Forsius marked the appropriate days for cupping and venesection with special red symbols [36,37]. He specified 82 suitable days per year for venesection and cupping, but the number of days could vary from 70 to 82 per year.

In historical context, it is interesting that English physician and scientist Sir William Harvey (1578-1657) discovered human blood circulation only a few years after Forsius's death in 1628 [20]. Furthermore, red blood cells were discovered by Dutchman Jan Swammerdam (1637-1680) in 1658 [38], and the earliest attempt to make a blood transfusion was reported by English physician Richard Lower in 1666 [39].

After Forsius, there were several publishers for the calendars. From the year 1700 up until 1725, professor of mathematics Laurentius Tammelin the Younger (1669-1733) was responsible for the publishing of the calendars. During this period, the number of suitable days for venesection and cupping decreased from 55 to 28 days. The most appropriate month for bloodletting in the 54 known calendars from the 17th and 18th centuries was December, and the least suitable was October [40]. It is worth noting that the days suitable for cupping, venesection, and bathing were very firmly connected to each other [36]. According to all these documents, venesection and cupping were first mentioned in the 15th century, suggesting a long history of venesection as a treatment in Finland [20 32].

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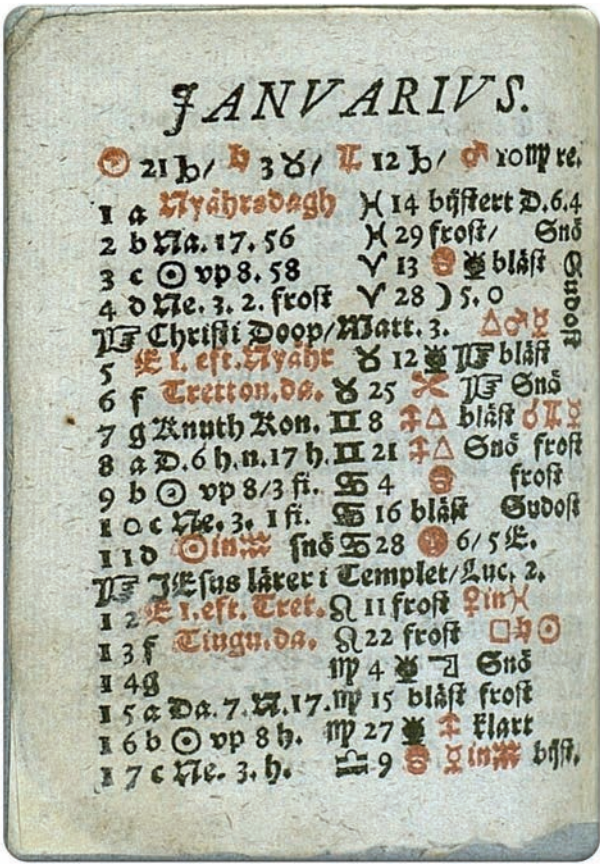

Figure 2. The calendar of Sigfridus Aronius Forsius included the suitable days for bathing, cupping and venesection. Source: Sigfridus Aron Forsius. Almanach Til thet Åår Christi M DC XVII. Som är / Ifrå Werldennes begynnelse 5579. Effter thet Ryska åhrtalet 7125. Ifrå första Påska och Pingesd. 3126. Medh flijt vthräknat af Sigfrido Arono Forsio Reg. Astr. [med] Prognostica Til thet åår Christi M DC XVII. Af naturlige orsakers grund stält och judiceret Af Sigfrido Arono Forsio Reg. Astr. Accessed Feb 21, 2020, from: https://litteraturbanken.se/forfattare/ForsiusSA/titlar/Almanach/sida/IV/faksimil?om-boken

A variety of professionals and non-professionals performed venesection

Venesection may have arrived in Finland from Central Europe via barber-surgeons, who conducted military surgery, amputations, medicating, and bloodletting [10]. Moreover, priests like Agricola, who had studied in Germany, also knew the art of venesection [32]. Until the 16th century, cupping and venesection were performed often by indigenous healers. Subsequently, several barber-surgeons performed venesection in the major castle towns in Finland [41].

Venesection was also a common part of official medical practice. The first named academic medical doctor in Finland was a German physician, Johan Copp von Raumenthal (1487-1559) [14]. Copp was a Catholic monk and priest who had achieved his academic medical education at the universities of Freiburg, Vienna, and Erfurt and became the personal physician of both King Gustavus Vasa and Duke John of Finland [42], who later became King John III of Sweden. While the plague hammered Central Europe, Copp seems to have been openly critical of venesection [43], but during the major outbreak in Vyborg in 1555, Copp ordered venesection, herbs, and powders as remedies [41].

Venesection performed by a surgeon was an expensive procedure. At the end of the 18th century, the surgeon's tax for a venesection varied between 2 ¾ and 8 shillings [18]. The tax would have represented a major part of a soldier's monthly salary, which could range from 3 to 18 shillings [44,45]. However, the estimation of currency value during different periods can be challenging [46].

Other health 'professionals' of the time, such as bath attendants and masseurs, were permitted to perform venesection in 1657 and 1663 [41]. Priests also continued to perform venesection, at least for some conditions [47], and barber-surgeons used venesection up until the 18th century [10, 41].

While the number of physicians and barber-surgeons was low at the end of the 18th century, King Adolf Fredrik of Sweden (1710-1771) ordered in his Act in 1755 that every church bell-ringer should be educated in venesection [18]. The bell-ringers' ordinary duty was ringing the bells at exact times: they needed to be reliable and educated professionals, at least to some degree [48]. In addition to singing during the service, they also handled vaccinations and provided general healthcare [47]. The King's Act of 1808 encouraged the bell-ringers to conduct venesection and wound treatment [49]. The duty of bell-ringers to perform vaccinations and venesection was removed from the Church Act in 1869 [18]. However, church bell-ringers may still have been receiving instruction in venesection; the second edition of Rinmann and Rothman's venesection and vaccination guide was published only four years later, in 1873 [29]. The publication of the guide was significant: it was particularly used in rural areas, where there were no doctors [50]. In the 1860s, venesection was still very common in Eastern Finland and Karelia (the latter now partly a region Russia), and in southwestern Finland, such as in Turku [4,51]. Up until the 18th century, physicians commonly favored venesection as a remedy for many diseases [51,52].

Indigenous healers in Finland also practiced venesection. To an extent, the various methods of venesection they practiced may have been derived from therapeutic techniques, and the implementation of the art of venesection seems to have happened rather quickly [53].

Non-official venesection survived for centuries in Finland

In many countries, criticism of venesection was on the rise in the 19th century. Scientific evidence for the possible complications of venesection had been published by Pierre Charles Alexander Louis as early as 1834 [21], and was further established in the controlled study by Joseph Dietl in 1849 [54]. In Finland, several decades passed before the Swedish Medical Society in Finland strongly reacted against venesection in 1877 [4]. This was nearly the end of the practice in official medicine. According to Strandberg, indigenous and unofficial venesection in Finland remained virtually unchanged from medieval times up until the late 19th century [53]. However, based on Vaskilampi's study, the indigenous practice of venesection persisted for nearly a hundred years after ceasing as a routine practice among the medical establishment [55].

The medical authorities continued their criticisms. In '*Family Medical Guide*' from 1922, a medical manual for homes written by Finnish authorities, respected professors and archiaters Max Oker-Blom and Arvo Ylppö referred to venesection as an ancient

healing method used by physicians for only five conditions: pneumonia, pulmonary edema, uremia, paralysis, and carbon monoxide poisoning. The authors highlighted the importance of good hygiene and the physician's responsibility in the operation [56].

There are also some case reports showing that indigenous or unofficial bloodletting practices survived in Finland during the 20th century. One case report [57] and two case interviews of bloodletters have been published. One informal healthcare provider interviewed had performed bloodletting up until the year 1976 [55]. An interview with a single eyewitness of indigenous bloodletting in the 1930s has also survived among the sources [58]. Generally, the indigenous healers who performed venesection have been described as skilled individuals technically capable of performing the procedure. Barber-surgeons [10], blacksmiths, and church bell-ringers [59] were the ones usually performing venesection [18]. Phlebotomists who performed the procedure were, according to the two documented cases from modern times, old men over 70 years of age who had learned their skills from their relatives. They were both from Eastern Finland, one from North Karelia and the other from Mikkeli [55]. A nurse was documented as performing unofficial venesection in 1985 and had learned the basics of the practice through his formal education [60]. Because of his healthcare education, he cannot be called an indigenous phlebotomist. Venesection was in many cases a side occupation [55]. The indigenous phlebotomists who were still practicing were no longer mentioned in sociocultural studies in 1985 [55].

The indigenous venesection charts in Finland

Within indigenous healing, the popularity of venesection during its peak is evident from the surviving instruments and charts. As early as 1608, the calendar of Sigfridus Aronus Forsius (1560-1625) already included instructions for venesection. In Forsius's recommendations, the astronomical position of the moon was given importance. The 'anatomical man' with suitable sites for venesection was introduced in the calendar for the year 1676, published by Nicolaus Olai Ringius (1611-1680). The calendar included both an illustration and explanations [40]. A medical '*Manual*' written by Dean Johan Wegelius (1693-1764) from Oulu in the year 1760 consists of written instructions for venesection without illustrations. Additionally, the indications for performing a venesection were limited to only fever and delayed childbirth [61]. This brief booklet is one of the few extant guides.

Another venesection chart, albeit a very small one, written by Matts Wiik from Laihia, is dated June 30, 1831 [58,62,63]. This illustrated chart is a simplified, hand-drawn diagram of the human body, detailing the proper locations for venesection and providing explanations for the indications. The chart was probably appreciated by other practitioners, because Johan F.H. signed the same original version in Ilmajoki in March 1840. Additionally, phlebotomist Johan Sten signed it in Laihia in 1860. Finally, the chart became the possession of 'house doctor' Jaakko Nyysti, who passed away in June 1907 ('house doctor' having been a common professional title for self-made indigenous healers). The venesection chart of Matts Wiik was written by hand in a Finnish dialect [63,58], and its interpretation can be challenging [64]. The most common indication for venesection according to this guide is pain: headache, tooth pain, ocular pain, throat pain, tongue pain, chest pain, heart pain, back pain, lower extremity pain, abdominal pain, and genital pain. Other reasons given are infections: malaria, erysipelas, tuberculosis, the plague, and lung disease. Severe disabilities such as blindness, rheumatism, and ureterolithiasis are mentioned, too [58]. Symptoms such as coughing, fever, dizziness, tinnitus, leaking eyes, and muscular spasms are represented in the indications, as well as infertility.

The 'diagnostic' features of the drained blood are also described in Matts Wiik's guide: '*foamy blood may indicate tuberculosis, blue blood could signal spleen disease, green blood may suggest cardiac failure, yellow blood could be a sign of hepatic disease, black blood may indicate joint swelling, red blood may indicate good health and red blood with black stripes may be a sign of pregnancy'* [58,63]. *'If the blood is light and milky, the venesection has to be discontinued. If the blood is dark, you may continue the venesection'* [65]. The exact sites for venesection in the guide are '*the vortex, under the eyes, the cheeks, under the earlobe, the nose, under the tongue, the chin, the median vein, the forearm, between the thumb and the forefinger, the small finger, the umbilicus, the thigh, behind the knee, the big toe, between the toes, the small toe*' [63]. According to Matts Wiik's guide, the preferred time for venesection to cure malaria is in April, and for tuberculosis or eye diseases, in September (Figure 3) [63].

One of the most interesting, preserved documents, '*Bloodletting Man*' - a handwritten guide of 18 pages with instructions for venesection - is from the year 1876 [66]. The booklet indicates suitable locations for venesection. The guide itself is a handwritten copy of the book by Professor von Hoorn from Piteå, Sweden, but it derives from Taivassalo Parish, Southern

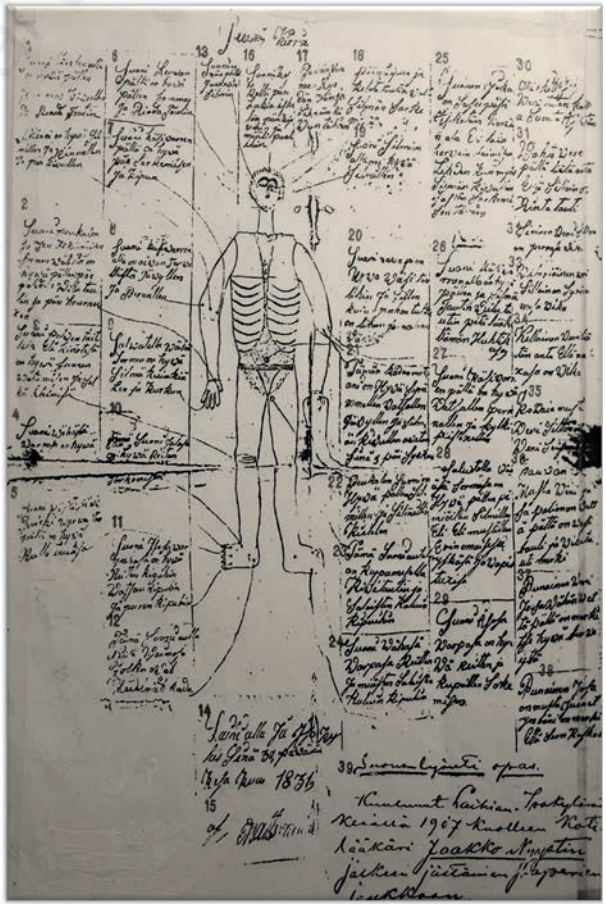

Figure 3. Bloodletting instructions by Matts Wiik, 1831. Numbering by the author. Author's collection. Source: Professor emeritus Osmo Hänninen, University of Eastern Finland.

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Finland. The guide consists of 42 specific instructions on veins that should be opened under various conditions, an instruction on the visual 'analysis' of the blood in order to make different diagnoses, and an alphabetical index of the diseases for which venesection can be performed. According to this booklet, the vein in the big toe can be opened for every kind of headache. The vein between the thumb and the forefinger can be opened for the treatment of headaches and the common cold. The instructions also advise on the 'diagnostics': "*Blue blood from the toe is a sign of a severe cardiac failure. Red blood with a bit of water is a sign of good health*." There are instructions for the treatment of a toothache by bloodletting in four locations, two near the teeth and two in the feet as well [66].

The art of venesection and the different techniques used in Finland

The basic instrument used for venesection, as mentioned before, is called the fleam, in Finnish *'suonirauta'* or *'näppäri.* (Figure 4). The construction of the fleam varied widely. Fleams may be made of iron [57] or of brass, but fleams made of pike jawbone have also been discovered. Some fleams have a handle, and the head can be attached with a hinge. Simple models consist of only a hammer-like iron ax [29,63]. The simple fleam could be easily manufactured from iron by any blacksmith [67]. The cutting edge can be either chisel-shaped or a spike; when the latter is used, the wound is smaller. Some models have an automatic spring-operated spike mechanism, which can be launched by a trigger to ensure the standard quality of the wound [29,55]. The fleam was sharpened using a file [29,57].

Using a simple manual fleam or a lancet may have required more experience [29,58]. Learning how to use the fleam may have been easily self-taught as well [55]. Venesection may have been an alternative to cupping and leech treatments, which were all performed in Sweden-Finland [18,20,29,30].

The superficial veins seem to have been the usual sites for bloodletting [57,65,68], while the median cubital veins may have been the most common of the veins for the procedure (Figure 5) [29,55,69]. Strandberg describes 42 different sites for venipuncture [66]. There were guidelines for proper hygiene: the dirty skin was washed with water and soap [57]. Controversially, some questionable hygiene methods have also been suggested. For instance, one of healers used only his saliva in the "cleaning" [57]. As the procedure continued, the arm was elevated with the support of a walking stick. A tourniquet was applied in order to dilate the veins [29]. The venesection was then performed. The amount of drained blood ranged from 2 to 5 deciliters, although sometimes it was challenging to estimate the exact amount [29,55,69]. Only one phlebotomist reported this experience that he had drawn 800 ml [60]. Finally, at least one phlebotomist applied tar and a linen bandage to cover the wound [55]. Indigenous phlebotomist Matti Matilainen [67] (1853-1934) had used a special ointment for the treatment of the wound [57]. In one case, a piece of ordinary paper had been applied to the wound in order to stop the bleeding [65].

The "indications" for indigenous venesection were mostly pain or illnesses. The most common site of venesection in the case of a headache was behind the ears, and in mental disorders, in the middle of the vortex [63]. In delirium and blindness, venesection was performed in the small fingers [53]. There is a report from 1980-1981 of an indigenous phlebotomist who seems to have operated without any diagnosis whatsoever, simply to fulfill the wishes of the patient [55]. He had continued performing venesec-

Figure 4. The fleam was used to perform a standardized venipuncture (18th century). Source: Turku Museum Centre.

Figure 5. Venesection in Maaninka, 1923. The patient is Professor Ahti Rytkönen (1899-1989). The indigenous phlebotomist in the photograph is Pekka Rissanen. The median cubital vein was the most common site for venesection. The amount of blood drained was some 2 dl. Source: Museum of Kuopio. With the permission of Ahti Rytkönen 1985.

tion until 1976. Bloodletting from the arteries was strictly avoided because of the great risks and threat of harm [29,65]. The strong blood spray from the wound was considered a dangerous complication [29, 70], and the phlebotomists seem to have been warned of possible severe infections [70]. The concept of hygiene in Rinmann and Rothman's guide did not include any principles on asepticism; the only instruction was to clean the blood off the lancet to prevent rusting [29]. The adverse consequences and side-effects of venesection seem to have been common, and the results of the procedure were not encouraging [58,69]. Cases of syphilis were reported after cupping [35,71], but not after venesection. One of the indigenous healers was reported to have performed venesection on horses, cows, and humans [57].

One example of a practitioner was farmer August "Aaku" Räsänen (1886-1943) in Kuopio, Eastern Finland. He performed venesection from the beginning of the 20th century onwards until the Second World War. He had learned his skills from his mother, who also used herbal remedies. One documented case of venesection performed by Räsänen occurred in the 1930s. The indication for bloodletting in this particular case was a toothache. The venesection was performed from the vein between the left thumb and forefinger. The patient reported that he gained relief from the pain after the procedure. This history was narrated in 1985 by farmer Kalle Viik (1910-1990), who was a young man at the time he heard the account [58,69].

Recent history: phlebotomy and hypovolemic hemodilution in evidence-based medicine

In current, modern biomedicine-based healthcare, phlebotomy is mainly used in three forms. These three forms are also widely accepted globally.

First, diagnostic phlebotomies for laboratory testing are performed frequently. The history of blood tests in the diagnostics of diseases is shorter than that of testing urine [72]. The earliest confirmed experimental use of the hypodermic hollow needle, which is used for intravenous injection, was reported by Sir Christopher Wren (1632-1723) in 1656 [73]. This innovation, and especially the successful production of hypodermic needles, made the blood samples for testing possible.

In terms of frequency, diagnostic phlebotomy conducted to analyse the patient's blood is one of the most common processes in healthcare. For example, in 2022, some 5.6 million laboratory examinations of blood were performed in the occupational health services in Finland alone [74]. The volume of the blood samples needed for diagnostic testing is usually insignificant.

The second major form of phlebotomy is venesection performed in blood donations. In Finland, very few blood donations were performed in hospitals before the Second World War. The need for and importance of blood donations was recognized, and systematic voluntary blood donation service was organized by the Blood League in 1935. During the Continuation War, almost 200,000 bottles of blood were stored and 45,000 bottles of plasma were prepared as well. Also, a direct method of transfusions from the donor to the patient still existed during the Second World War [75].

Nowadays, some 180,000 blood donations are performed annually in Finland [76]. In donations, the volume of donated blood is typically about 500 ml. Usually harmless for the donor, donations can be life-saving for the receiver – for example, in emergency medicine and military medicine.

Third, phlebotomy in the form of modern venesection is still a safe, effective, and evidence-based treatment in the conditions mentioned above [77-79], such as in *polycytaemia vera* [78,79] and *porphyria cutanea tarda* [80]. Scientifically-based therapeutic venesections are generally called hypovolemic hemodilution. However, venesection due to an illness is not common in Finland. For example, some 50-60 patients suffer from *polycythemia vera* annually [81], and some 22,000 have the genetic risk of getting *haemochromatosis*, but not all of them are diagnosed or in need of a venesection [82, 83]. Phlebotomy remains the treatment of choice in people with hereditary *haemochromatosis* who require bloodletting [83], but there is no evidence from randomised clinical trials [84], although phlebotomy in haemochromatosis decreases triglyceridaemia [85]. Overall, studies of hypovolemic hemodilution by venesection have been analysed, but its efficacy has been questioned [86]. Generally, hypovolemic hemodilution through blood donations may reduce the levels of oxidants such as pentraxin-3 and high-sensitive C-reactive protein in donors [87].

Results of the register search: bell-ringers in the church records

As mentioned previously, the King's Act of 1808 encouraged bell-ringers to conduct venesection and wound treatment [49]. One aim of the present study was to find valid information on the number of bell-ringers, which had not been studied before.

The number of church bell-ringers ('*Lukkari' or 'Klockare'*) between the years 1755 and 1877 who were mentioned in marriage records was 696; the number mentioned as fathers of the baptized was 1,110; the number of godfathers of the baptized was 54; and an additional 481 church bell-ringers were found in death and burial records. Altogether 2,341 individuals were identified in this group. The names were double-checked to prevent duplicates. Only about 2.5% of bell-ringers' names between 1755 and 1877 were of Finnish origin; the majority, 97%, were Swedish by name. Only 11 Russian names and 2 German names - Grüner and von Cräutlein - were present in the data. All the church bell-ringers were men. The number of children in their families varied from 0 to 16.

Church priests performed venesection to some extent from the 15th century (Missale Aboense 1488) up until the 18th century [47,81], but the exact extent of their activity is unknown.

Barber-surgeons were likely the oldest profession among those performing venesection, and in church records, the authors had previously found 279 barber-surgeons between the years 1700 and 1900 [10]. It was mainly the barber-surgeons, as well as physicians, who performed venesection from the Middle Ages - counting from the year 1555 - until the 18th century. The church records do not seem to accurately indicate the number of physicians, and therefore the official records of the physicians had to be taken from the literature. The number of physicians in Finland in the year 1800 was 33 individuals [88], and by 1880 it had increased to 155 (Figure 6) [68].

Discussion

Who were the phlebotomists?

The first research question is, "Who were the professional and indigenous phlebotomists in Finland?" The answer is, of course, multi-faceted and is based both on the literature search and the genealogical research. Many professions have conducted vene-

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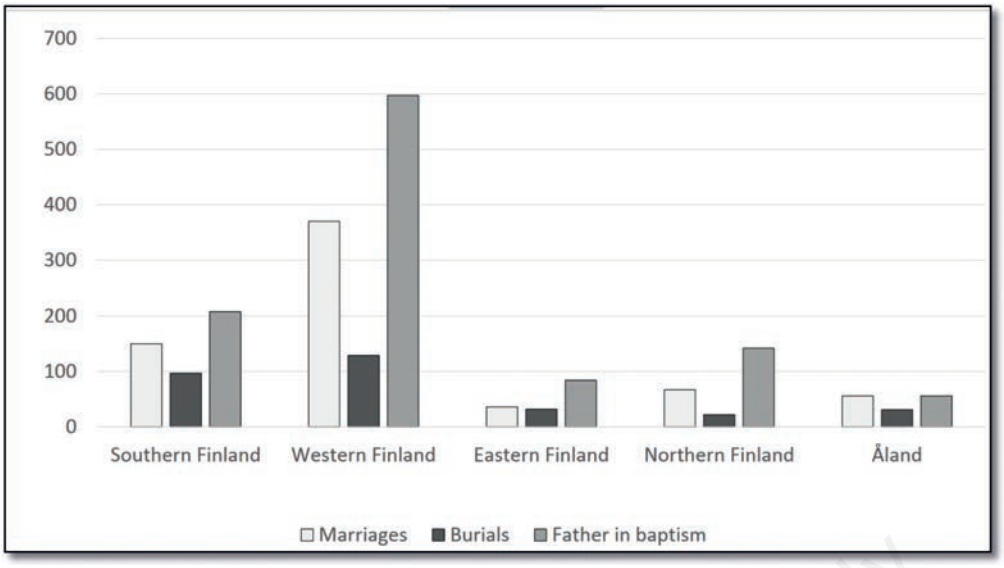

Figure 6. Distribution of bell-ringers in Finland according to church records between the years 1755 and 1877 in marriages, burials and baptisms.

section as a treatment: physicians, veterinary doctors, barber-surgeons, priests, bell-ringers, and quacks. The novel and main finding of this study was that the number of professionals performing venesection was high during times when there were very few physicians. From the genealogical database, we found that the number of professionals who may have performed venesection in Finland included 33-155 physicians, almost 300 barber-surgeons, and over 2,300 church bell-ringers, during a time when public healthcare in the country was not systematically organized. These numbers show that church bell-ringers formed a majority of those who performed venesection in Finland. The number of indigenous healers and quacks during this period is unknown, but they may have been a sizeable group [4].

The connection between the bell-ringers' profession and venesection has been verified through the literature review. The commonly available genealogical sources are introduced to show the possibility for use in the history of medicine. The findings and multiple aspects of this study may help to illuminate, for instance, some socioeconomic and health-related aspects of venesection. Although the context of this review is Finland, it takes a wider perspective to highlight the global similarities in the practice of venesection in different contexts. The finding of a professional group of over 2,300 bell-ringers performing official venesections in Finland was a novel discovery in itself.

The barber-surgeons in Finland were multinational and were all men [10]. What we know of the socio-economic features through the genealogical research of this paper is that the bell-ringer-phlebotomists in the Finnish context were mostly Swedish by name and married men, but some were Finnish, Russian, or German by name. According to this survey, most of the bell-ringers came from the western part of Finland (Figure 6). In the genealogical records, their families were often large: in one family the number of children was 16. It is remarkable that during the same period, the healers who performed indigenous cupping in Finland were women [20]. Strandberg (2012) illuminates the finding with a Finnish proverb: "*no male cupper, no female phlebotomist*" [20]. However, there may have been exceptions: at least one photograph of a female phlebotomist has remained [68]. One strength of this study is that the records concerning baptisms, marriages, and deaths have been digitalized well until 1850, aiding the search process. The limitation of this study is that the database is incomplete between 1850 and 1877. The digitalization process of records after 1850 has not been completed yet. The genealogical search inevitably entails the significant risk of a selection bias that cannot be avoided by any means. On the other hand, this kind of search cannot be performed by any other method, since the registered material has been produced over centuries.

Why did indigenous venesection persist so long?

The second research question is, "Why did indigenous venesection survive so long in Finland?" To be clear, it is difficult to identify any single variable that wholly explains this phenomenon. The fact that venesection remained almost unchanged from medieval times until the 19th century is remarkable [53].

The written history of venesection in Finland is long, covering a timeframe of almost 500 years: the first known report of venesection in Finland is from the year 1488, and the last documented case of indigenous venesection in this review is from the year 1985 [60]. The history is much longer than that of many other operations or methods of healing. There is also indirect evidence that the history may be even longer than what is documented, since the first barber-surgeon was already working in Turku at the beginning of the 14th century.

By the end of the 19th century, the first steps had been taken towards *evidence-based medicine* and statistics-based decision-making in the discrediting of unnecessary, ineffective, harmful, or even fatal routine venesection as a practice in official medical care. In Finland, the first strict statement against venesection by physicians was published in 1877 [4]. However, it is fascinating that one of the most famous Finnish physicians and medical scientists, Erik Adolf von Willebrand (1870-1949), wrote his thesis on venesection, "*Zur Kentniss der Blutverändrungen nach Aderlässen*" ("*The changes of blood after a venesection*"), in 1899 [89]

despite the growing criticism of the procedure. Moreover, venesection was still included as a treatment for pneumonia in the famous '*The Principles and Practice of Medicine*' until the year 1935 [22]. The indigenous quacks in Finland continued using venesection for some 100 years after the statement in 1877 [55]. Although the tradition of venesection had disappeared from Western Finland by the beginning of the 20th century [90], in Eastern Finland it was performed by physicians up until the 1920s [91], and amongst non-professional indigenous phlebotomists as late as the year 1976 [55]. In Northern Finland, the humoral pathology theory of excess blood has been documented as still in use within the last century among indigenous healers [65].

One type of indigenous bloodletting, called "traditional cupping," has been performed in Finland even in modern times, still common up until the 1990s [92]. By contrast, according to Sexton and Stabbursvik, cupping is in use far less or not at all today in Finnmark, Norway [93]. Interestingly, this kind of healing has remained an indigenous cultural relic in modern Finnish society. One possible explanation for this phenomenon may be that the use of indigenous healing methods has overall been significant [92], and may have been economically or socially beneficial for informal healthcare providers. Generally, the use of indigenous healers is lower in the Western countries compared to settings such as East Africa [94]. For comparison, some 10% of the adult population used indigenous healing methods in Finland in the 1980s [92], while in Great Britain, the Netherlands, and Norway, 19–30% had tried indigenous healing methods [95]. In East Africa, the use of indigenous healers may still be as high as 44%, or in some patient groups, 80% [96]. In this context, it is interesting to compare indigenous bloodletting with acupuncture, an ancient Chinese form of therapy. Acupuncture may have some similarities with indigenous venesection; for example, the acupuncture meridians and venesection charts may bear resemblances to each other. Acupuncture is still widely used around the world for many conditions, despite the lack of evidence supporting its effectiveness [97,98].

Venesection as a part of official medical care was believed to be an effective treatment in most conditions [99] until medical authorities limited its use [99]. The basis of this misconception was probably caused by the naïve *belief* in ancient authorities, such as Hippocrates and Erasistratus, whose theories of humoral pathology still existed and were not scientifically critiqued [52]. Moreover, some empirical - but unfortunately misleading - evidence from animal trials had been published by physician Benjamin Rush (1745-1813) to prove the effectiveness of massive venesection [21]. Complications in venesection were common, according to the literature, caused mostly by poor hygiene which led to infections. An arterial perforation could also be a severe complication of venesection. Furthermore, excess bleeding during venesection could be harmful and dangerous, but there is no evidence in the Finnish literature of these kinds of complications. The reason for this finding may be that in Finland, the usual amount of blood drained was only some 200-500 ml [91].

This is equal to a standard blood donation and makes sense of the low reported number of complications. However, the amount of blood drained was only very uncommonly as much as 800 ml [60].

Although there are no historical reports of diseases such as syphilis transmitted after venesection, it is possible that they have occurred. Also, no cases of hepatitis B have been reported in Finland. However, a recent report from Sudan indicates that the risk of hepatitis B connected to bloodletting is real [100]. Considering that one of the Finnish indigenous healers performed venesection on horses, cows, and humans [57], it is plausible that in such cases, transmission of zoonoses (such as rabies and BSE) through the fleam could occur.

Indigenous bloodletting by informal healthcare providers in the modern era could be characterized with the expression '*medical pluralism,'* which refers to the multiple choices of treatment people use to cure their illnesses and includes all the pluralistic aspects of healthcare [101]. Contextualizing indigenous phlebotomy in light of modern biomedicine is necessary, along with addressing patient safety and insurance issues. Indigenous phlebotomy does not have any *evidence-based* background, and especially when used without any indication, is more likely to cause harm than benefits. The discussion of poor hygiene in an indigenous context is essential. Although the authorities highlighted aseptics [56], Pänkäläinen, for instance, reported inappropriate hygiene before venesection [57]. It is possible that even serious side effects such as infections may not have been reported. In the modern practice, phlebotomy for laboratory testing used in clinical support and helping decision-making is decreasing the risk of harm and helping in the treatment of medical illnesses. It is also necessary to note that not all medical treatments can be based on evidence from controlled studies, and many treatments are based on rational biological decision-making [102,103]. The Act of Patient Safety in Finland 948/2019 does not cover alternative forms of treatment. This means healthcare professionals do not give those treatments [104]. Those performing indigenous phlebotomy cannot guarantee their own skills, the patient diagnostics, or the procedure's safety. This means that advertising and performing indigenous phlebotomy is not ethically correct. Consequently, the practice of informal healthcare providers conducting indigenous phlebotomy has been significantly eradicated through these mechanisms.

The disappearance of indigenous phlebotomy can also be understood as a replacement by modern biomedicine, which (only in a very limited group of medical conditions) adopted phlebotomy as a part of evidence-based medicine. This may be understood as an indirect transition from informal medicine to modern biomedicine. Phlebotomy by medical professionals and by medical indications may still be performed in hospitals, laboratories, and during blood donations.

Thus, it is impossible to given an unambiguous answer to the research question. The stages and *transitions* of the relationship between venesection and modern biomedicine in Finland can be illustrated by the following: adoption – acceptance – critique – rejection – denial – limited reacceptance. The "diagnostic" use of indigenous bloodletting, as reported by Strandberg (1982), may indicate an early stage of laboratory "testing". It also may indicate a transition from indigenous phlebotomy to official laboratory medicine.

Strengths and limitations

This study has some strengths. The topic of the study is stimulating. It takes a multidisciplinary approach to cover the long history of both medical and indigenous venesection in Finland from historical and medical perspectives. Another strength is that the literature review includes some forgotten and little-known historical sources.

The study also has some weaknesses and limitations. The long timeframe presents a challenge in the historiographical analysis. This issue could have been avoided by dividing the study into shorter periods or limiting the perspective to cover only indigenous or medical venesection, but this would have led

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to the perspective being fragmented. Also, including both aspects in the same review in order to analyze their connection to health aspects poses difficulties and can be understood as either a weakness or a strength.

The danger of inadvertently glamourizing an obsolete, outdated, debatable and mostly non-evidence-based treatment may always be present in history writing – and reading. The danger especially increases if there is any possibility of misunderstanding.

Significance and possible practical implications

It is crucial to discuss the practical significance of this study. This study revealed a preponderance of bell-ringers in Finland compared to physicians and barber-surgeons. In fact, the King's Act significantly increased the number of people performing phlebotomy. This information was a novel finding.

On the other hand, greater quantity did not ensure an increase of quality. The education of the bell-ringers was not as thorough as that of the barber-surgeons and physicians, and the bell-ringers could not perform procedures other than vaccinations and phlebotomy. However, this historical trend could yield applications for modern healthcare, for instance, by suggesting the training of other healthcare professionals to carry out certain limited tasks typically performed by physicians. Definitely, the King's Act was a *political* decision. This kind of political solutions have been made later as well: as an example, through the declaration of Alma-Ata in 1978, the World Health Organization (WHO) accepted traditional healers as a part of the official health services in order to provide healthcare for all [105,106].

Overall, the findings may be utilized to make a practical recommendation as to how the prolonged use of an unnecessary treatment or informal healthcare services can be ended. However, it is crucial to understand that there may be several possible mechanisms behind the finding. First, the overall development of society is important. The improvement of public healthcare enables the expanded provision of health services to citizens [17]. Therefore, the demand for informal healthcare providers, which heavily relies on the limited availability of public health services, diminishes [92]. Secondly, it is essential to provide citizens with basic health education at schools and through the media in order to increase fundamental health knowledge. In Finland, many health organizations or medical associations, such as the Scientific Society Duodecim along with the Finnish and Swedish Medical Associations, play an essential role in education through various channels, including books, general lectures, magazines, radio, and TV. Third, the Patient Safety Act plays an important role. Indigenous bloodletting by quacks is forbidden. Fourth, in official medical care, treatment is based on scientific evidence. Phlebotomy may still be utilized, but only by physicians for a very restricted group of illnesses, for laboratory testing, and in blood donations. In the book "*The Mayo Clinic Internal Medicine Concise Textbook*", phlebotomy is recommended for treating four specific illnesses: *porphyria cutanea tarda*, *polycythaemia rubra*, *polycythaemia vera*, and *haemochromatosis* [107].

Conclusions

The art of performing venesection in Finland has undergone a complete *transition* and change through the centuries. Similarly, the roles of both unqualified informal healthcare providers and qualified medical professionals have gone through several transitional stages (Table 1). First of all, the role of performing venesection started with barber-surgeons, was continued by both barber-surgeons and priests in addition to physicians, was expanded to bath attendants, masseurs, and bell-ringers, and then was limited to physicians and laboratory nurses. The fact is that self-taught indigenous healers were never given formal license to perform venesection, but their performance, similar to other informal healthcare providers, continued because of the lack of public health services. The history of indigenous phlebotomists in Finland has likely now concluded (Table 1).

Finally, during the long history of venesection in Finland, the role of the procedure changed from an unscientific, likely harmful, routine non-evidence-based method to a rare treatment in a minor group of conditions or for collecting blood for donations, or blood samples for testing. The improvement of the healthcare system, the health education of citizens, and the scientifically based criticism of routine venesection by medical authorities, as well as legal interventions such as the Patient Safety Act, appear to have been effective in discrediting the practice, especially indigenous venesection performed by informal healthcare providers. This principle can also be utilized to eliminate other unnecessary treatments or informal healthcare services.

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