

Ignaz Semmelweis: Hand Washing in the Times of Puerperal Fever and in those of COVID19 or how to Delay Progress Without Even Knowing it

Sola Augusto^{1*}, Sola Augusto Javier² and Rodríguez Susana³

¹Medical Director, Ibero American Society of Neonatology (SIBEN), Wellington, Florida, USA

²Creative Copywriter, New York, USA

³Education and Research Department, Garrahan Hospital and Ibero American Society of Neonatology (SIBEN), Argentina

***Corresponding Author:** Sola Augusto, Medical Director, Ibero American Society of Neonatology (SIBEN), Wellington, Florida, USA.

Received: July 19, 2020; **Published:** July 31, 2020

Abstract

This manuscript covers history, social aspects and ethics in the practice of medicine and the impact of delaying advances in health care and it could be an important contribution to the medical literature and clinical practice.

We utilize the history and life of Dr. Ignaz Semmelweis as examples of innovation and the rejection of new ideas despite adequate proof and of the social and health care consequences of delaying implementation of simple measures for quality of care improvement, making a parallelism with the COVID-19 pandemia.

In 1843, Dr. Oliver Wendell Holmes in Boston, advanced the controversial idea that doctors were capable of carrying puerperal fever from patient to patient. A few years later, Semmelweis described handwashing as a simple lifesaving tool in Vienna. He found that handwashing with a calcium hypochlorite solution before assisting a delivery was associated with a significant decreased in puerperal mortality from 12 - 20% in previous years to 1.3%. The push back to his findings by the professorial establishment of the time were weighty. Factual knowledge was systematically dismissed because the evidence ran contrary to existing paradigms. The history of medical science is replete with examples of pioneering ideas that endured decades of rejection (a few of them will be mentioned). Effective hand hygiene is a simple tool available to prevent the spread of the untreatable Coronavirus. All people should be redoubling handwashing efforts to prevent COVID-19 disease. Sadly, the enduring culture remains a barrier to patient safety.

Keywords: *Semmelweis Reflex; Belief Perseverance; Handwashing; Idea Rejection*

Introduction

Healthcare workers' hands are the most common vector in the transmission of microorganisms causing healthcare-associated infections [1]. In 1843, Dr. Oliver Wendell Holmes in Boston, advanced the controversial idea that doctors were capable of carrying puerperal fever from patient to patient: "The Contagiousness of Puerperal Fever" [2]. A few years later, Ignaz Semmelweis described handwashing as a simple lifesaving tool in Vienna General Hospital in Austria. He established the connection between maternal mortality and contaminated hands more than 150 years ago. Semmelweis found that handwashing with a calcium hypochlorite solution before assisting

a delivery was associated with a significant decreased in puerperal mortality from 12 - 20% in previous years to 1.3% [3-9]. Like other similar histories in medicine, Semmelweis findings was a path-breaking idea that endured years of rejection simply because they were ahead of their time. Since then, hundreds of reports and research articles have identified the imperative actions for proper hand hygiene among those caring for in-hospital patients. Modern medicine still has to contend with the major problem of infections resulting from patient care. Despite considerable evidence that appropriate hand hygiene is the leading measure to reduce cross infection, compliance with recommendations remains notoriously low among healthcare workers and compliance rates in most reports remain less than 50% [8]. Clearly, lack of hand hygiene by healthcare workers continues to be a very real problem.

During the COVID-19 pandemic, everyone should also clean their hands thoroughly. Diligent hand washing hands is one of the most effective ways to prevent the spread of germs from one person to another and throughout an entire community, from home and workplace to childcare facilities and hospitals [10]. All people should be redoubling handwashing efforts to prevent COVID-19 disease [11]. Sadly, the enduring culture remains a barrier to patient safety.

Objective of the Study

We review the fascinating history of Dr. Ignaz Semmelweis and the discovery of handwashing together with how factual knowledge was systematically dismissed because such emerging evidence ran contrary to existing paradigms.

Methods

A keyword search for “Semmelweis reflex,” “Belief perseverance,” “handwashing,” and “Idea rejection” was conducted using PubMed Central, MEDLINE and Google SCHOLAR. Literature published in paper-based journals and books was also searched. All manuscripts pertaining to these keywords were thoroughly analyzed for this review. We divide the manuscript in different sections as follows: Summary of historical landmarks; Puerperium and puerperal fever; Dr. Ignaz Semmelweis, a true pioneer yet not fully recognized for his significant contribution; Dr. Semmelweis’ history and parallels with current medicine; What transpired? Germs, healthcare-associated infections and a viral pandemic; Opposition to Semmelweis and the Semmelweis Reflex; His tragic death; How is progress delayed without even realizing and Epilogue.

Summary of historical landmarks

Ignaz Philipp Semmelweis (1818 - 1865), a native of Hungary, is well-known for his discovery of the etiology and prevention of puerperal fever, a vital advance in saving the lives of women during childbirth. During his work at Vienna General Hospital, there were two different areas in which babies were delivered. He noticed that one of the two areas had a maternal mortality rate of 15.8%, whereas the mortality rate in the other area was a mere 7.6% in the year 1842. This higher mortality was attributed to a disease called puerperal sepsis or child-bed fever, the understanding of which was poor at that time.

Semmelweis observed contrasts between the first and second clinics’ procedures. A discernible distinction was that the first area was controlled by medical students and doctors who performed autopsies, whereas the second one was run by midwives who did not do that.

One day, one of his physician colleagues acquired a similar illness to puerperal sepsis after an accidental stab with an autopsy knife. This serendipitous observation led Semmelweis to postulate that the transfer of “cadaveric particles” from the autopsy room to pregnant women in the labor room caused contamination that prompted puerperal fever and subsequently, a higher death rate. Based on his observations, Semmelweis instituted a handwashing protocol which required all medical personnel to wash their hands with chlorinated lime before conducting any obstetric examinations or deliveries. The mortality rate dropped dramatically from 12.2% in May 1847 to 2.2% in June, 1.2% in July and 1.9% in August.

However, the push back to his findings by the professorial establishment of the time were weighty. Factual knowledge was systematically dismissed because the evidence ran contrary to existing paradigms.

The history of medical science is replete with examples of pioneering ideas that endured decades of rejection; a few of them will be mentioned later.

Puerperium and puerperal fever

Puerperium is a concept that has its etymological origin in puerperium, a Latin word. It is the stage that a woman goes through after giving birth and before recovering the same state she had before becoming pregnant. It is defined as the time from the delivery of the placenta through the first few weeks or months after the delivery. The postpartum period or puerperium can be divided into three distinct stages: the initial or acute phase, 6 - 12 hours after childbirth; subacute postpartum period, which lasts 2 - 6 weeks, and the delayed postpartum period, which can last up to six months.

Puerperal fever, also called childbed fever, postpartum fever or "labor fever" is the infection of some part of the female reproductive organs. It is the most common infection that occurs during the first 15 days after delivery. It occurs in up to 12% of women who have given birth and is caused by bacteria such as streptococci and staphylococci, fungi or viruses, which infect the uterus, vagina and kidneys and can be fatal [12,13]. Obviously, this was not known in 1847.

The discovery and implementation of hand washing by Dr. Ignaz Semmelweis in Vienna in 1847 was the basis for the prevention of mortality associated with puerperal fever. This, associated with the later discovery of streptococcus and the advent of antibiotics, has caused that puerperal fever almost does not exist and that there is practically no mortality associated with it.

Dr. Ignaz Semmelweis, a true pioneer yet not fully recognized for his significant contribution

Dr. Semmelweis's life was that of a man who fought steadily and without hesitation for his ideals and convictions for the benefit of others and has improved lives of infinite human beings. We will initially describe the pioneering characteristics of Dr. Ignaz Semmelweis, and then we will narrate the significance of his contributions to obstetrics and medicine in general, which we believe has not yet been surpassed even by the advances of new genetic technologies in recent years.

The history of medicine has been recognizing this Hungarian doctor little by little, but his name is not even familiar or known by most obstetricians and pediatricians in the world. For example, a neonatologist with a long professional career, who has been professor of pediatrics and director of neonatal departments in renowned universities, has never heard nor taught about his marvelous contribution to the world. In fact, it was only three months ago, many years after Dr. Semmelweis's death, that he heard of him from his son, a non-medical individual with very different interests other than medical care. He could not believe that such a history of contribution to human health was not being taught in medical schools or post graduate education. Since then, both of them carefully and intensely searched the literature as described in methods and are co-authors of this manuscript.

Why was Semmelweis a true pioneer? Studying his life story, we find many characteristics of his personality that clearly show this:

- He did something that had never been done before, marked a before and after and helped save countless human lives, not only for women with childbed fever.
- What he did, with work and study, was unprecedented, and without external outside resources.
- He had a new dream and carried it out. His dream gave him strength, and that inner strength led him to be creative and persistent, no matter what. Nothing stopped him: neither lack of resources, nor obstacles, nor criticism.
- He was resisted, isolated, misunderstood, questioned, criticized and slandered by many, especially by the medical eminences of the moment, not only in Vienna, but throughout Europe and other regions of the world.

- He was resilient not to abandon his path.
- His idealism, hard work, dedication and methodology was not in vain, but it was not gratuitous either.
- He fought eminence-based medicine with evidence-based medicine, which was perceived as insulting by many.
- He was an innovator who was willing to try new things based on careful observation, data, statistics and also on heart.
- He did not seek his own benefit, but a greater good. So, he didn't mind paying the price.
- His effort and sacrifice transformed the lives of others and resulted in benefits for others.
- He raised a flag alone, against many adversities, but then that flag multiplied and over the years it was adopted and held by all.
- He left a mark so strong, so clear and so intense that the consequence of his legacy was that many others then followed his path.

In summary, his history shows that he was (and still is) an extraordinary example of methodical observation, reasoning and reflection, an authentic case of personal commitment to the vocation in medicine. Washing our hands as health care providers seems evident or obvious to all of us today, but at the time it represented a change of vision that was accepted and assimilated only by a few. He had to advance amid misunderstandings and difficulties and his only work summarizing his experience was published in 1861: "The cause, concept and prophylaxis of childbed fever".

Dr. Semmelweis' history and parallels with current medicine

He was born in Hungary in 1818, only 200 years ago. As we write about what happened then, the world is being plagued by a horrific viral pandemic. The overwhelming need and benefit of handwashing in this pandemic did not need to be proven by anyone. We owe it to Semmelweis.

In the early 1840s Semmelweis set out to study medicine in Vienna, one of the world's intellectual centers at the time, with many revered and admired professors at the university's medical school [14]. There he graduated as a doctor in 1844 [15]. He then worked at the Allgemeine Krankenhaus Teaching Hospital in Vienna [7] as an assistant in obstetrics. He was assigned to perform autopsies and dissection of corpses every morning and carry out deliveries in the afternoon. As this is a teaching hospital, with responsibility in education and in advancing the medical sciences, there was an obstetrics area for deliveries to be performed by teachers, doctors in training and medical students. This sector, which we will call sector 1, was for clinical care but also for teaching and instructing on techniques of childbirth. In the other sector (which we will call sector or area) 2, deliveries were performed by midwives only. Each sector had more than 3,000 deliveries per year. At that time, women from well-educated and wealthy families had deliveries at home rather than in the hospital, and postpartum or puerperal fever was hardly reported in these women.

Dr. Semmelweis using, perhaps for the first time, a methodological approach that incorporated detailed observation, data and statistics, contributed to improving maternal health as few have done so far. At the same time, he had to try to break with traditional and conventional truths and dogmas supported by medical elitism. That was not easy in its day, nor is it now.

What transpired?

Dr. Semmelweis observed that it seemed that the mortality of women after childbirth was high and he began to study. He learns that these deaths had been described by Hippocrates (before Christ) as women who, soon after delivery, were putrid by "an unknown power" and died. That is the condition called postpartum or puerperal fever, an obstetric plague that had been persistent for centuries.

Many causes had been attributed to this serious illness. Among them, air quality, climate, seasonal variation and even immorality of affected pregnant women. This is framed within what in medicine could be called overflowing imagination, without any verification. Many times, such unproven factors are repeated and repeated as absolute truths. Another theory for potential causation was that it could be due

to a reflux of breast milk into the woman's body. This theory was based on the fact that the doctors observed an enormous quantity of a pale whitish liquid in the peritoneal cavity and in other organs. Obviously, it was pus, but they did not know it.

Tormented by the deaths of so many young women after the birth of their baby, Semmelweis dedicated his efforts to investigating. His methodological steps began with observation and from there with the formulation of a question. His doubts and dedication were an integral part of the process he carried out. In short, he begins to use the scientific method in search of the truth. He did not have a hypothesis, but at that time nothing close to what we now call the scientific method had been described. However, the rules and principles of the scientific method, now well described, seek to minimize the influence of the subjectivity of the scientist in his work, thus reinforcing the validity of the results, and therefore, of the knowledge obtained. Dr. Semmelweis followed in the footsteps of what we now call an observational and descriptive study, many of which have made great strides in medicine and/or led to the formulation of one or more hypotheses.

Once he obtained data, he started analyzing it with simple statistics. He found that climate, seasonal variability and prostitution were not associated with puerperal fever. But he also found that, in obstetrics' sector 1, there were far more deaths than in women who gave birth in sector 2. In this last sector, around 60 women per year (about 2%) died and in sector 1 there were about 10 times more annual deaths (15 - 20%). Overwhelmed and distraught, he continued to search for the cause of the tremendous difference, and in data analysis finds that, when a certain teacher was the one giving birth, there was practically no puerperal fever. However, the uncertainty continues to despair him.

As in other stories of important discoveries in medicine, chance or serendipity helped him find the truth of what caused so many deaths in one sector and not in the other one. One day, one of his teachers, who had been a dedicated mentor to Semmelweis, passed away with a clinical condition that seemed to him like postpartum fever. His autopsy findings described multiple renal, bones and pulmonary septic foci derived from a gangrenous injury to the right middle finger. A few mornings before, while the teacher was teaching a student about autopsy and dissection of a corpse, the student unintentionally produced a small cut with the blade of the scalpel on the teacher's finger. Semmelweis associated this with the fact that they perform autopsies in the mornings and deliveries in the afternoons and builds the theory (hypothesis) that the "corpse particles" are lethal. Despite his grief and depression for feeling that he was guilty of sending many young women to their grave, he struggles to develop a way to get those "corpse particles" out of his hands and the hands of others. He makes a lime chloride solution and, knowing very well the smell of corpse on his hands, he washes his hands until the smell disappears. Convinced of his initial observations, he established a clinical intervention that all students and doctors had to adopt in a compulsory way: before examining the women giving birth, everyone had to wash their hands according to his method. Puerperal mortality began to decrease in 1847 as mentioned before, and in the year 1848 it decreased further to 1.27% in sector 1, compared to 1.33% in the second area [16]. His study today would be called a case-control study or one of quality care improvement, pre and post intervention, thorough hand washing [17]. The findings were received very positively by the young doctors, but not by the revered and renowned professors. A separate and sad consequence of his findings also occurred. A younger colleague of Semmelweis had delivered a baby from his niece and she died with puerperal fever a few days later. Tragically, he could not stand learning that he was responsible for her death and committed suicide.

Semmelweis, amidst sadness, violent opposition (see later) and anger, continues to support his hypothesis. In a similar way that maternal mortality in sector 2 was much lower because midwives were never involved in dissection of corpses, he attributes to the same factor the significantly lower maternal mortality rate occurring in home births. In addition, Semmelweis finds that 11 women who died of puerperal fever had been examined and cared for during delivery by doctors who first examined a woman in labor with ulcerated cervical cancer. He concluded then that puerperal fever could be produced not only by cadaveric matter but also by putrid matter from other humans [18]. At that time of course, there were no identified germs and the medical field did not know what an infection was.

He begins to argue, “through thick and thin,” that removing “corpse particles” from the hands is the key to preventing many unnecessary deaths. And he showed that in his hospital there was a very significant decrease in postpartum fever and postpartum deaths since 1847, with rates that became equal to or better than the existing data in sector 2 of the same hospital.

Germs, healthcare-associated infections and a viral pandemic

Louis Pasteur (1822 - 1895) and Robert Koch (1843 - 1910), clarified several years after 1847 the basic postulates of puerperal fever disease, as a product of bacterial infection. They demonstrated the existence of the “contagium animatum”, the microorganisms or germs.

At a meeting of the Paris Academy of Sciences in 1879, where puerperal fever was being discussed more than 30 years after Semmelweis’s revolutionary discovery, Pasteur recognized his accomplishment. While a speaker was lecturing about possible causes of the condition, without mentioning the hands at all, Pasteur interrupted him and said: “None of what you are saying explains postpartum fever: It is the nurse and the doctor who carry the microbes on their hands to a healthy person”. Pasteur has also been a pioneer and an example of the ethics of speaking up, just as Semmelweis was. In that same year, Pasteur identified the streptococcus as the causative agent of puerperal fever. However, it was not until 1928 that Alexander Fleming accidentally discovered penicillin when he found that the mold *Penicillium notatum* had contaminated Petri dishes in his lab and were killing some of the bacteria he had been growing. It took until 1942 for mass production of penicillin and this went on to change the way we treat illnesses and wounds. Nonetheless, Fleming, Pasteur, Koch and Semmelweis were also keen on finding a way to prevent infections from occurring. Semmelweis found a simple and inexpensive one in the mid 1840’s.

Sepsis is known to be a serious condition and has been associated with the death of approximately 1,400 persons per day [19]. Hospital acquired or nosocomial infections are truly healthcare-associated infections (HAI). HAI are the most common complications in hospitalized patients as 5 to 10% of them acquire at least one infection during their hospital stay. HAI occurs in 2 million patients per year in the United States, causing 90,000 deaths and resulting in \$ 4.5 - 5.7 billion in additional patient care costs [20,21]. Hand hygiene is the most important factor in controlling HAI. However, it is estimated that handwashing is done only one-third to one-half the times that it should [22]. So, even though today we know much more about germs and antibiotics, we are also learning about the serious damage produced by the unnecessary abuse of antimicrobials [21,23-26] and therefore of the significance of hand washing for prevention of HAI.

The current Covid-19 pandemic, has caused over 600,000 deaths worldwide in less than 6 months. The virus SARS-CoV2 should make us understand that we have a lot to learn, just like back then in the 1800’s, as it is well known that effective hand hygiene is a simple inexpensive tool available to prevent the spread of the untreatable Coronavirus [11]. Just like it happened in one center in Vienna more than 160 years ago thanks to Dr. Semmelweis, all people should be redoubling handwashing efforts to prevent COVID-19 disease. This decreases infection rates and saves lives. Sadly, the enduring culture remains a barrier to patient safety and still today hand hygiene is not practiced in institutions or in the community as it should.

Opposition to Semmelweis and the Semmelweis reflex

As we have seen, he raised the flag of hand washing. However, his breakthrough finding based on evidence, but not on “eminence”, was not implemented for many years beyond just one area of his own hospital. And the opposition was based on non-medical reasons.

Doubt and healthy skepticism are necessary in science and medicine to ask questions and to probe deeper. Some asked him how he knew there were no “corpse particles” in human hands and other relevant things, but he took most of them as insulting, since many colleagues had already evaded or even sabotaged his handwashing regimen [27].

The million-dollar question can be: Why such a refusal by health professionals to adopt a simple practice that proved to be effective and that, in this case, if it harmed someone, it was not the patient? So different to the abuse of antibiotics and other unnecessary treatments that in fact do harm patients [21,23-26].

In 1847, Semmelweis could not persuade many others to see his vision for improvement. His frustration, anger, and ego also became obstacles to implementing this change to improve the quality of medical care.

Conventional dogma and medicine based on “eminence” did not tolerate and rejected Semmelweis. The eminent doctors resisted the changes for various reasons, none of them medical. Washing hands before treating each patient would be too much work and it would require rebuilding hospitals so that sinks and running water became widely available throughout many areas. They somehow considered the profession of being a doctor to be divinely blessed, so it would be unreasonable to think that they themselves could cause disease. Egos were often inversely proportional to the evidence. The scientific evidence was very scarce at that time, but the power of the eminences was not.

From that time, we have rescued some comments that included: What does this young man think? He is not the head of a service or director of a hospital. Is he going to tell us that we were wrong? How does he dare? And many of the prominent doctors felt extremely offended.

Unfortunately, another difficulty for some to adopt the practice of hand hygiene is attributed to Semmelweis himself as he lacked the skills necessary to be an agent of change and did not publish the results until 14 years after he had shown the best medical advance for centuries to prevent puerperal fever and the death associated with. His book from 1861 mentioned previously, was poorly written and poorly received by the medical establishment [28].

On the other hand, it seems that he wrote letters to the eminences who opposed the change, directly criticizing them. At some point, having learned that they were saying if he believed that they were dirty, he wrote: “Dirty is not the problem. You are causing deaths and a plague caused by doctors”. It has been documented that in a letter to an obstetrician in Vienna he wrote: “You have been a partner in this massacre” and that to another one he wrote: “If you, without having been able to refute my doctrine, continue to train your students against it, I declare before God and the world that you are a murderer and that the history of childbed fever would not be unfair to you if it were to commemorate you as the Nero of medicine” [15].

Despite everything, or perhaps “because of everything,” the eminences and the faculty “establishment” prevailed: Semmelweis failed to renew his professorship as an assistant in 1849. He was offered a clinical faculty appointment without permission to teach. Feeling betrayed, he fled Vienna, abandoned his followers, and went home to Budapest where in 1851 he was appointed chief of obstetrics at St Rochus Hospital. There he publicly criticized doctors and nurses for not practicing handwashing and he achieved a significant reduction in maternal mortality also. In 1855 he resigned from this position to become a professor at Pest University.

It was not until approximately two decades after his death that his work was reviewed and credited; only after Pasteur, Koch, and others had produced more evidence of germ theory and antiseptic techniques, was the value of handwashing appreciated.

The Semmelweis Reflex [5] or Semmelweis effect, is a metaphor for the reflex-like tendency to reject new evidence or new knowledge because it contradicts established norms, beliefs, or paradigms.

His tragic death

The history mentions that at a young age of about 44 years he begins to show signs of aggressiveness and altered behavior. Sometime before, he had gone to live with a prostitute, leaving his wife and children. Then, due to uncontrolled attacks of violence, neuropsychiatric changes and early dementia, he was admitted to a public mental institution. The changes found in his central nervous system after his death are compatible with chronic meningitis including the spinal cord, that may have been due to neurosyphilis. Additionally, it is thought that the guards punished him harshly in each of his episodes of great violence and that he died at the age of 47, on August 13th, 1865, as a result of head injuries or perhaps due to systemic infection from the wounds produced by said blows.

Somehow Semmelweis was a martyr in his life and later a hero, the “savior of mothers”. On the centenary of his death, Austria issued a postage stamp in his honor and the Budapest medical school, where he taught, is now the Semmelweis University of Medicine.

How is progress delayed without even realizing

We will not discuss here the many different factors that lead to discoveries or inventions and scientific or medical progress that can improve quality of care.

However, there is long list of them that are due to chance or serendipity, like what happened in Semmelweis’s breakthrough. Pasteur pointed out that a discovery can only result from a casual observation if the person’s mind is prepared for that: “In the field of observation, chance only favors prepared minds”. Lynen, Nobel Prize for Medicine in 1964, argued that “chance often appears in the course of systematic research and points those who know how to value it in the right direction.” Semmelweis and Fleming are two good examples of this.

On the other hand, who are the ones that hold up progress in the medical field? We reviewed here the significant delay in the case of handwashing produced by non-medical reasons, but there are many others. According to Julius Comroe [29], clinicians or scientists who delay progress meet five criteria: 1) Highly respected “eminent authorities”; 2) Strong convictions; 3) No hesitation to utter these forcibly in writings, lectures or both; 4) Are wrong although surely not recognizing the error in this instance; and 5) No one dares to challenge this “eminent authority”.

We will briefly present a few of many examples of such circumstances that plague the history of medicine:

- Pulmonary surgery: It was held back for almost 90 years by the failure of surgeons and anesthetists to use simple effective ways of rhythmically ventilating lungs in an open thorax [30].
- Right heart catheterization in humans: The same influential authoritarian surgical “eminence” who was responsible for the delay above, Professor Sauerbruch, considered as heresy any divergent opinions. An intern young surgeon, Werner Forssmann, went to his department to expand his education. Previously, Dr. Werner had published the first original paper on heart catheterization in 1929, for which he received a Nobel Prize 27 years later. In relation to this, the Professor told Dr. Forssmann “You might lecture in a circus about your little tricks, but never in a respectable German University”. And then screamed: “Get out of my department immediately!”

More recent examples in our field of neonatal medicine are the following:

- Original description of the use of continuous positive airway pressure (CPAP) to improve neonatal survival for respiratory distress syndrome by Dr. George Gregory in 1971 [31]. His descriptive publication of lives saved received violent opposition by some, saying that nothing had been demonstrated since he had not studied the topic with a prospective, controlled, randomized and masked methodology. Fortunately, for many sick newborns, eminent authorities did not prevail for long and many newborns survive and are healthy thanks to this other pioneer in the history of perinatal medicine.
- More recently, the original description by us in 2003 [32] on the inappropriate and unnecessary use of oxygen in preterm babies was met by significant resistance in many places. Seventeen years later, many finally agree that unnecessary oxygen administration is a health hazard and that hyperoxemia is very risky to newborns, children and adults [33-36].

Several adages are pertinent to the issues described in Semmelweis’s paradigm, the cases briefly described above and many other similar situations in medicine. Albert Einstein’s (modified): “Great spirits have always encountered (violent) opposition from mediocre minds (some eminences). The mediocre mind is incapable of understanding the man who refuses to bow blindly to conventional prejudices and chooses instead to express his findings and opinions courageously and honestly”. Claude Bernard wrote: “It is the things we do know (or we believe we know) that are the great hindrance to our learning the things that we do not”. Maimonides in the 1100’s wrote:

“Teach thy tongue to say ‘I do not know’ and thou shalt progress”. Jorge Luis Borges, a literary writer from Argentina, has said that “doubt is the name of intelligence”.

All of the five components that we mentioned in the second paragraph of this section must be present to delay progress, or this will not work. It is very difficult to eliminate components 1 - 4. Therefore, component 5 has to be eradicated. The ethics of speaking up is essential, as it is not being indifferent when one is witness of the first four components. Innovative investigators must be supported to defend the truth, despite the fact that it implies a paradigm shift and/or injures or threatens personal or socially accepted interests. To support the truth is often associated with exercising self-criticism and accepting change. As Karl Popper sentenced: “It is only with respect of truth that we learn from our mistakes. It is only the idea of truth which allows us to speak sensibly of mistakes with rational criticism and self-criticism, with the serious purpose of eliminating as many of these mistakes as we can, in order to get nearer to the truth”.

Epilogue

It is not easy to improve quality of care and patient safety, but we can learn a lot from Semmelweis’s story and from what is currently known as Semmelweis Reflex, briefly mentioned before.

While there is uncertainty regarding the origin of the expression Semmelweis Reflex, it had been used by the author Robert Anton Wilson [37]. In Wilson’s book “The Game of Life”, Timothy Leary provided the following definition of the Semmelweis Reflex: “Mob behavior found among primates and larval hominids on undeveloped planets, in which a discovery of important scientific fact is punished” [37]. Thomas Szasz, in the preface to the fiftieth anniversary edition of his book “The Myth of Mental Illness”, says that Semmelweis’s biography impressed upon him a “deep sense of the invincible social power of false truths” at a young age [38]. More recently, the expression has been used by others [5,39].

There is no doubt that Semmelweis made outstanding observations and was a pioneer in identifying an urgent need to improve patients’ quality of care and safety. At the same time, he was not able to identify the prevailing challenges to discover opportunities and manage to implement necessary changes in the system in order to ensure that his very useful innovation reached a large number of human beings. He insulted his enemies and accused his superiors of causing the death of mothers. Additionally, he refused to publish, was arrogant, angry and suffered with himself. This did not, and will not, work well to achieve major positive changes rapidly.

Then again, it is obvious that “eminence-based” medicine rather than evidence-based, resistance to change, egos placed above the well-being of patients and jealousy and envy of professionals with mediocre minds delayed improvement of maternal care and survival for non-medical reasons in the late 1800’s and they will always interfere with significant advancements. The history of the current Covid-19 pandemic will likely show how these same personal characteristics, but of politicians and many others not in the medical field, delayed preventive measures to avoid losing so many human lives.

Semmelweis legacies include empathy and not to be indifferent to pain, suffering and deaths. Other legacies are the value of detailed observation and defense of the truth without making up answers. Search for data, analyze it carefully, and construct hypotheses before formulating assertions or, worse so, before establishing unsubstantiated speculations with imagination overflow that fills holes of ignorance.

Other key legacies of Semmelweis are not accepting conventional beliefs as unmodifiable fixed truths and to be curious and doubtful about prevailing reality. Not to feel guilty for changing it or for, at least, contributing to the solution.

Good, simple, focused questions in epidemiological research arising from clinical observation are and will continue to be, simple and effective ways to improve health care and survival. “We ourselves feel that what we are doing is just a drop in the ocean. But the ocean would be less because of that missing drop”, Mother Teresa from Calcutta.

Conclusion

Ignaz Semmelweis changed medicine and humanity for the better. In addition to the discovery of hand washing and its beneficial impact to save lives, he was a pioneer in fighting “eminence-based” medicine with evidence-based medicine. Unfortunately, he also attacked them in wrong ways and this did not accomplish anything of value, but caused the entrenched minds to become more entrenched. Progress was significantly delayed, but fortunately evidence prevailed for the good of humankind.

Conflict of Interest

No financial interest or any conflict of interest exists for any of the authors.

Bibliography

1. Pitter D., *et al.* “Hand Hygiene: A Handbook for Medical Professionals”. Wiley-Blackwell 1st Edition (2017).
2. Dunn PM. “Oliver Wendell Holmes (1809-1894) and his essay on puerperal fever”. *Archives of Disease in Childhood Fetal Neonatal Edition* 92.4 (2007): F325-F327.
3. Carter KC and Carter BR. “Childbed Fever: A Scientific Biography of Ignaz Semmelweis”. New York: Routledge Edition (2015).
4. Stewardson A., *et al.* “Back to the future: rising to the Semmelweis challenge in hand hygiene”. *Future Microbiology* 6.8 (2011): 855-876.
5. Gupta VK., *et al.* “Semmelweis Reflex: An Age-Old Prejudice”. *World Neurosurgery* 136 (2020): e119-e125.
6. La Rochelle P and Julien AS. “How dramatic were the effects of handwashing on maternal mortality observed by Ignaz Semmelweis?” *Journal of the Royal Society of Medicine* 106.11 (2013) 459-460.
7. Loudon I. “Ignaz Phillip Semmelweis’ studies of death in childbirth”. *Journal of the Royal Society of Medicine* 106.11 (2013) 461-463.
8. Pittet D and Boyce JM. “Hand hygiene and patient care: pursuing the Semmelweis legacy”. *The Lancet Infectious Diseases* 1 (2001): 9-20.
9. Gawande A. “Two Hundred Years of Surgery”. *The New England Journal of Medicine* 366 (2012): 1716-1723.
10. When and How to Wash Your Hands. Centers for Disease Control and Prevention (2020).
11. Alzyood M., *et al.* “COVID-19 reinforces the importance of handwashing”. *Journal of Clinical Nursing* 29.15-16 (2020): 2760-2761.
12. Adriaanse AH., *et al.* “Semmelweis: the combat against puerperal fever”. *European Journal of Obstetrics and Gynecology and Reproductive Biology* 90.2 (2000): 153-158.
13. AbouZahr C., *et al.* “Puerperal sepsis and other puerperal infections”. In: Murray CJL, Lopez AD, editions. Health dimensions of sex and reproduction: the global burden of sexually transmitted diseases, HIV, maternal conditions, perinatal disorders, and congenital anomalies. Cambridge, MA, Harvard School of Public Health [en nombre de la Organización Mundial de la Salud y el Banco Mundial], 1998 (Global Burden of Disease and Injury Series, No. III) (1998): 191-217.
14. Ataman AD., *et al.* “Medicine in stamps-Ignaz Semmelweis and Puerperal Fever”. *Journal Of The Turkish-German Gynecological Association* 14.1 (2013): 35-39.
15. Best M and Neuhauser D. “Ignaz Semmelweis and the birth of infection control”. *Quality and Safety in Health Care* 13.3 (2004): 233-234.

16. Ellis H. "Ignaz Semmelweis: tragic pioneer in the prevention of puerperal sepsis". *British Journal of Hospital Medicine* 69.6 (2008): 358.
17. Gould DJ, *et al.* "Interventions to improve hand hygiene compliance in patient care". *The Cochrane Database of Systematic Reviews* 9.9 (2017): CD005186.
18. Hempel CG. "Filosofía de la Ciencia Natural". Madrid: Alianza Universidad (1980).
19. Bone RC, *et al.* "Definitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. The ACCP/SCCM Consensus Conference Committee". *Chest* 101 (1992): 1644-1655.
20. Burke JP. "Infection control-a problem for patient safety". *The New England Journal of Medicine* 348 (2003): 651-656.
21. Cardetti M, *et al.* "Mismanagement of Antibiotics in Neonatal Medicine". *Global Journal of Pediatrics and Neonatal Care* 2.2 (2020).
22. Gawande A. "On washing hands". *The New England Journal of Medicine* 350 (2004): 1283-1286.
23. De Tejada B. "Antibiotic use and misuse during pregnancy and delivery: Benefits and Risks". *International Journal of Environmental Research and Public Health* 11 (2014): 7993-8009.
24. Davey P, *et al.* "Interventions to improve antibiotic prescribing practices for hospital inpatients". *The Cochrane Database of Systematic Reviews* (2017).
25. Sola A. "Abuse of antibiotics in perinatology: negative impact for health and the economy Neo Reviews (2020).
26. Cardetti M, *et al.* "Uso (y abuso) de antibióticos en la medicina perinatal". *Anales de Pediatría* (2020).
27. Nuland SB. "The doctors' plague: germs, childhood fever, and the strange story of Ignaz Semmelweis". New York: WW Norton (2003).
28. Kadar N. "Rediscovering Ignaz Philipp Semmelweis (1818-1865)". *American Journal of Obstetrics and Gynecology* 220.1 (2019): 26-39.
29. Comroe JH Jr. "Retrospectroscope. Insights into medical discovery". Von Gehr Press, Menlo Park, California: (How to Delay Progress Without Even Trying (1977): 114-119.
30. Comroe JH Jr. "Retrospectroscope. Insights into medical discovery". Von Gehr Press, Menlo Park, California (1977): 110-113.
31. Gregory G, *et al.* "Treatment of the Idiopathic Respiratory-Distress Syndrome with Continuous Positive Airway Pressure". *The New England Journal of Medicine* 284 (1971): 1333-1340.
32. Chow LC, *et al.* "CSMC Oxygen Administration Study Group. Can changes in clinical practice decrease the incidence of severe retinopathy of prematurity in very low birth weight infants?" *Pediatrics* 111.2 (2003): 339-345.
33. Sola A. "Oxygen in neonatal anesthesia: friend or foe?" *Current Opinion in Anesthesiology* 21.3 (2008): 332-339.
34. Sola A, *et al.* "Safe oxygen saturation targeting and monitoring in preterm infants: can we avoid hypoxia and hyperoxia?" *Acta Paediatrica* 103.10 (2014): 1009-1018.
35. Sola A. "Oxygen Saturation in the Newborn and the Importance of Avoiding Hyperoxia-Induced Damage". *Neo Reviews* 16.7 (2015): e399.
36. Damiani E, *et al.* "Oxygen in the critically ill: friend or foe?" *Current Opinion in Anesthesiology* 31.2 (2018): 129-135.

37. Wilson Robert Anton. "The Game of Life". New Falcon Publications (1991).
38. Szasz Thomas. "The Myth of Mental Illness (50th Anniv. Edition)". Harper Perennial (2010).
39. Mortell M., *et al.* "Physician 'defiance' towards hand hygiene compliance: Is there a theory-practice-ethics gap?" *Journal of the Saudi Heart Association* 25.3 (2013): 203-208.

Volume 9 Issue 8 August 2020

©All rights reserved by Sola Augusto., *et al.*