Side Effects of Mercury Based Clinical Thermometer and India’s Trade Performance to Select Countries – an Analysis

Dr. B. Kalpana Sai, Dr. S. Senith, Dr. S. Anthony Raj
Authors 1 & 3: Associate Professors, Department of Management Studies, Karunya Institute of Technology and Sciences, Coimbatore; Author 2: Assistant Professor, Department of Management Studies, Karunya Institute of Technology and Sciences, Coimbatore, India

Abstract
A clinical thermometer is a device that tests the temperature of a person's body. Thermometers are now commonplace not only in hospitals and clinics, but even in offices, institutes, and even several households. Though the invention of digital thermometer and other temperature measuring have been launched, sold in the market, and shrink the local and global demand, still Galileo’s Mercurian is wanted by a specific market. In this article, a detailed analysis is performed about India’s export and import of clinical thermometer for select countries.

Keywords: Clinical Thermometer, Mercury exposure, Clinic, Neurotoxic, Indian Trade Clarification-Harmonised System (ITC-HS)

1. Introduction

A clinical thermometer is one that is used to take the temperature of a person's body. Mercury-in-glass thermometers were the most common type in the twentieth century. They are precise and sensitive, with a small area where the mercury level rapidly increases. The mercury level is not falling on its own due to a kink in the tube. These thermometers are therapeutic thermometers that doctors use in hospitals. 35 degree Celsius to 42 degree Celsius. Medical thermometers are cleaned before and after each use, with alcohol. Medical thermometers used to be big and took a long time to record a temperature. Smaller, improved thermometers were made in the 1860s, and thermometers were used more often as a result. In the 1960s, an ear thermometer was developed that works quickly and easily. In the late twentieth century, automated thermometers were commonly used.

2. History of Clinical Thermometer:

The clinical thermometer is the most widely used of the many tools and instruments considered important to the clinical test. Only the hand was used to sense the heat or cold of the human body in Ancient times, despite the fact that fever and chills were thought to be symptoms of sinister processes. The pulse was used as a disease predictor in Alexandrine medicine, replacing the crude measurement of temperature. The four humours were given the attributes of hot, cold, dry, and moist in the Middle Ages, and fever regained prominence. Galileo devised a simple temperature measurement instrument in 1592, but it lacked a scale and therefore no numerical measurements, and it was also influenced by atmospheric pressure. Santorio (SanctorioSanctorius) took a major step forward when he invented a mouth
thermometer. Professor Santorio (1561–1636), a Paduan physiologist, performed quantitative experiments on temperature, respiration, and weight, as well as measuring "insensible perspiration," laying the groundwork for the study of metabolism. In 1625, he mentioned his inventions (Santorio S, 1625). Sanctorius produced many prototypes, but they were all inconvenient to use and took a long time to measure the oral cavity. It's still difficult to get a reliable, consistent reading right now. For 8 minutes, glass thermometers must be in contact with sublingual tissue. It takes 5 minutes to reach rectal temperature, and 11 minutes to reach axillary temperature.

However, it was not until Hermann Boerhaave (1668–1738) and his students Gerard L.B. Van den Bergh (1668–1738) that the thermometer became widely used. The thermometer was first used at the bedside by Swieten (1700–72), founder of the Viennese School of Medicine, Anton De Haen (1704–76), and separately George Martine (Martine G, 1740). Carl Wunderlich (Wunderlich, 1868) reported temperature readings from over 1 million patients taken with a footlong thermometer in the axilla in 1868. He developed a standard temperature range of 36.3 to 37.5 degrees Celsius. Temperatures outside of this range implied the presence of disease. The scale of thermometers was also a big drawback. In 1852, Aitkin created a mercury instrument with a narrower tube above a bulb reservoir, ensuring that the mercury did not fall back after the reading. In 1866, Thomas Clifford Allbutt (1836–1925) was tasked with designing a compact 6 inch clinical thermometer. Temperature readings were an unavoidable part of daily life. Digital, electronic direct and predictive thermometers, infrared ear thermometers, and dotmatrix or phase shift thermometers are among the most recent advancements in thermometer design. None, however, is without flaws.
3. Review of Literature:

Despite the many benefits and uses of thermometers, researchers and scientists continue to raise questions about the use of mercury and glass, both of which are harmful in nature. This portion of the article discusses the clinical thermometer literature. Tang and Li (2006) investigated worker exposure to mercury at work, which causes negative health effects and damage to the central nervous system. Their goal was to evaluate mercury concentrations in the workplace ambient air and assess the health effects of mercury, especially neurotoxic effects and oral disorders, in workers working in a clinical thermometer manufacturing plant. They discovered high levels of occupational mercury toxicity in the factory, as demonstrated by urinary Hg concentrations. Manometers, barometers, and thermometers are all examples of industrial and medical devices that use liquid mercury (Hg). Mercury is a poisonous metal that has been linked to a variety of health problems in humans (Rajagopal et. Al, 2006). In his paper, Dales LG (1972) concluded that prolonged exposure to mercury would result in chronic mercury poisoning and central nervous system disorders. Neurasthenia (insomnia, headaches, exhaustion, drowsiness, fatigue, muscle atrophy, twitching, intellect impairment, memory loss, altered nerve reactions, etc.), mental changes (mood swings, irritability, anxiety, nervousness, shyness, depression, impaired self-control, timidity, and loss of confidence), and tremors (which can lead to vision and hearing loss and haemorrhage) are the most common CNS disorders. Long-term and low-level mercury exposures are the most common causes of work-related mercury poisoning. High-level exposures can occur in manufacturing plants with unsafe working conditions and inadequate health security, causing severe health consequences for employees. Occupational exposure to mercury has been shown to cause neurasthenic symptoms, according to scientific evidence. The Community's laws would also have an effect on the mercury thermometer. There have been no reports of intact thermometers causing mercury poisoning, though broken thermometers may pose a risk. The most serious poisoning occurred when a neonate in an isolette (incubator) inhaled mercury vapour after a mercury-operated switch broke, pouring mercury into a confined room. Even so, the majority of cases involving mercury thermometers are caused by trauma, as the thermometer is broken. The mouth floor (Shimoyana et al, 1998), the rectal injury (Maurage C et al, 1989), the eye injury (Auer C et al, 1997), and injuries to the hands and fingers (Rachman R, 1974) and the lower limb are among the sites of injury (Theodorou SD, 1981). In nearly all of these cases, the severity of the injury is comparable. In their research paper, Langford and RE Ferner (1999) made a definitive statement regarding mercury toxicity. They are a group of individuals who Mercury poisoning is uncommon in today's world, despite its widespread presence in the atmosphere, both naturally and as a result of contamination. Its danger is well-known, but the way it manifests itself is highly dependent on the route of administration and the form it takes. Because of our limited exposure to mercury in our everyday lives, modern clinical use of mercury appears to be safe, but caution is advised when handling large quantities of mercury or fixing mercury-containing instruments. Continual use of glass mercury thermometers, according to Aprahamian et al. (2009), has resulted in paediatric injury, particularly in children under the age of four. According to Mukherjee et al. (2009), the overall atmospheric emission from industrial sources decreased from 321 Mg in 2000 to 253 Mg in 2004 due to a transition in the chloralkali industry to the membrane cell method. Coal combustion in thermal power plants accounted for the majority of Hg emissions.
in 2004. Since Hg-cell technology was previously used in chlorine and sodium hydroxide processing, Hg concentrations in terrestrial and aquatic organisms are now very high in coastal areas, leading to India's designation as a mercury "hot spot."

4. Research Methodology:

This article is a descriptive paper with secondary data obtained from Director General of Foreign Trade Data Bank. The secondary data were analysed using Tableau opensource for table formation and image creation. Simple Percentage and Ranking tools were used to analyse the data.

5. Analysis of India’s Export and Import of Clinical Thermometer:

Percentage of total export broken down by country vs vs year is shown in the table and figure. After analysing the last 5 year data India exported clinical thermometer is high in the year 2018-2019 to Tanzania is 100% and 2020-2021 to Singapore is 100.0%. Followed by in the year 2019-2020 to Singapore 99.8% and 2016-2017 year 90.7% to US. Next to Kenya in the year 2015-2016 is 54.4% and to US 2015 -2016 year is 43.1%.

| Year     | Canada | Italy | Kenya | Russia | Singapore | Tanzania | United Arab | US  |
|----------|--------|-------|-------|--------|-----------|----------|-------------|-----|
| 2015-2016| 0.0%   | 0.0%  | 54.4% | 1.6%   | 0.2%      | 0.0%     | 0.8%        | 43.1%|
| 2016-2017| 0.0%   | 0.0%  | 0.0%  | 0.0%   | 8.2%      | 0.0%     | 11.1%       | 90.7%|
| 2017-2018| 9.9%   | 0.0%  | 0.1%  | 0.0%   | 2.8%      | 18.5%    | 0.1%        | 68.6%|
| 2018-2019| 0.0%   | 0.0%  | 0.0%  | 0.0%   | 0.0%      | 100.0%   | 0.0%        | 0.0% |
| 2019-2020| 0.0%   | 0.0%  | 0.0%  | 0.0%   | 99.8%     | 0.2%     | 0.0%        | 0.0% |
| 2020-2021| 0.0%   | 0.0%  | 0.0%  | 0.0%   | 0.0%      | 100.0%   | 0.0%        | 0.0% |

% of Total Export broken down by Country vs. Year.

Table 1: Indian Export of Clinical Thermometer to select Countries from 2015 to 2021

Source: Computed from Secondary published in dgft.gov.in

Figure 2: India’s export of clinical thermometer to select countries from 2015 to 2021
Computed from Secondary data

Figure 3: India’s Total export of Clinical Thermometer

Table 2: Descriptive Statistics mean-value of India’s Export of Clinical Thermometer to select Countries from 2015 to 2021

Descriptive statistics mean-value is given in the above table for the export broken down by country and by year. The highest mean value is 106.1 for the year 2019-2020 which depicts that India exported high quantity of clinical thermometer to Singapore during 2019-20 also during 2020-2021 India witnessed more exports with 49.5 thousand of clinical thermometers to Singapore which recorded the second highest mean. India’s export of Clinical Thermometer to Tanzania recorded third with a Mean value of 24.2 thousand of quality
during 2018-2019, which is the third highest export made in last five years by India.

A ranking is a relationship between a group of items in which the first item is either "ranked higher than," "ranked lower than," or "ranked equal to" the second. The rankings are in no particular order. Rankings make it possible to evaluate complex knowledge according to certain criteria by reducing complicated steps to a series of ordinal numbers. In Table 3, it is found that countries like Singapore during 2019-2020 and 2020-2021 and Tanzania during 2018-2019 and United States during 2016-2017 and 2017-2018, Kenya in the year 2015-2016 stands first reported in chief buying nations in terms of clinical thermometer. It is followed by Canada during 2018-2019, Italy in the year 2018-2019, Kenya in the year 2018-2019, Russia in the year 2018-2019, Singapore in the year 2018-2019, Tanzania in the year 2017-2018 and 2019-2020, United Arabs in the year 2018-2019 and 2020-2021 finally US in the year 2015-2016 and 2018-2019 stands second in export.
Table 4: Percentage of total Indian import of Clinical Thermometer broken down by year and country.

% of Total Import broken down by Year vs. country.

Source: Computed from Secondary published in dgft.gov.in

Figure 5: Percentage of total import for each year
Percentage of Import broken down by Country and Year is presented. India’s Imported from Germany in the year 2016-2017 is 100 percent followed by 35.7 percent in the year 2017-2018 from USA and 38.0 percent in the year 2019-2020 from USA. In the year 2019-2020 is 22.9 percent of Import was made from china and 22.6 percent from USA during 2020-21. In the year 2016-2017 India’s import from China was recorded an 18.6 percent and 12.2 percent during 2017-2018.

Sheet 1

| country | 2015-2.. | 2016-2.. | 2017-2.. | 2018-2.. | 2019-2.. | 2020-2.. |
|---------|----------|----------|----------|----------|----------|----------|
| china   | 1,535    | 2,630    | 1,723    | 1,937    | 3,245    | 3,096    |
| Germany | 0        | 7        | 0        | 0        | 0        | 0        |
| USA     | 0        | 0        | 1        | 0        | 1        | 1        |

Average of Import broken down by Year vs. country.

Source: Computed from Secondary published in dgft.gov.in

Table 5

Figure 6: Descriptive Statistics mean-value of India’s Import of Clinical Thermometer to select Countries from 2015 to 2021
Descriptive statistics for import have been broken down by year wise and country wise and is presented here. China carries highest average score compared to all countries. The analysis shows that India has been importing a greater number of clinical thermometers from China for the last five years. Germany is also considered as good supplier or seller of Clinical Thermometer to India.

The below chart depicts the Clinical Thermometer imports made by India from the year 2015 to 2021. It is clearly evidenced from the below diagram that China tops as a major supplier or seller of Clinical Thermometer to India.

6. Findings and Conclusion:

Amidst many issues of using mercury as a raw material to manufacture Clinical Thermometer, Countries still require these medical devices to use from ordinary to specific usage in their labs, hospitals, Institutions etc. This article is prepared with a careful analysis of statistics obtained from government sources and it is evidenced that China plays a major role in India’s Import and Singapore has been a good country of buying Indian Clinical Thermometers. But over the years of study period, it is also found that the number of quantities dealt both in imports and exports are diminishing leaving a suspicion that digital thermometers might have started replacing this Galileo’s Mercurian.

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