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REVIEW ARTICLE

Quarantine: Concept, Origin and Impact on COVID-19 Pandemic

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ABSTRACT

Although, the story of the beginnings of quarantine is associated particularly with the epidemiology of pest (pestilence or plague), the concept is deeply rooted in religious scriptures. Whereas the Holy Bible commands the separation of people with leprosy from other people as early as 1513 BC, the Hadees (Reported Sayings of the Last Messenger Muhammad (AD 570-632) ordains "If you hear of an outbreak of plague in a land, do not enter it; but if the plague breaks out in a place while you are in it, do not leave that place." This dictate seems to have its influence to the main tenets of the Law of Ragusa dated July 27, 1377 which stipulate: -Visitors from areas where plague was endemic were not being admitted into Ragusa until they had remained in isolation for a month. No one from Ragusa was allowed to go to the isolation area. The quarantine is much modified in modern practice because of the better understanding of contagion and introduction of new terminology. Social distancing and self-isolation have proved their worth in the prevailing COVID-19 pandemic. Shielding of clinically extremely vulnerable individuals has been implicated with remarkable success in UK. However, public health practices including quarantine have always been much debated and economic, cultural, ethical and political issues have been raised. Today, many countries have the legal authority to impose quarantine. However, the WHO advises that it must be fully respectful of the dignity, human rights and fundamental freedoms of persons, in accordance with Article 3 of the International Health Regulations -2005.

INTRODUCTION

"The history of quarantine is closely interwoven with that of medicine in general and of shipping".

John Macauley Eager (1862-1916) - "The Early History of Quarantine" [1]. The term and concept of modern quarantine is deeply rooted in culture and the health practices related to the bubonic plague (Black Death). Adriatic port city of Ragusa (modern Dubrovnik-Croatia), being a hub for the international trade between Europe and the Ottoman Empire, suffered frequent outbreaks of plague. Aimed at halting the rapid acceleration of epidemic activity, it became the first to pass legislation requiring the ships coming from infected or suspected areas to stay at anchor for thirty days before docking. It was on July 27, 1377, when the Great Council of Ragusa officially issued the so-called 'trentina' (an Italian word derived from 'trenta', that is, the number 30) which stipulated that those who come from plague-infested areas shall not enter Ragusa or its district unless they spend a month on the islet of Mrkan (an uninhabited rocky island south of the city) or in the town of Cavtat (situated at the end of the caravan road used by overland traders en route to Ragusa), to screen for those infected with plague [2]. This duration, later on, was extended to 40 days. The term 'quarantine' comes from the Italian word 'quarantena', which means a period of 40 days (in Italian, 40 is 'quaranta'; the latter derives from the Latin word quadrāgintā) [3].

Origin of Quarantine

"Quarantine is one of the oldest and most effective health measures elaborated

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by mankind to control the transmission of communicable diseases” [4].

The term “Quarantine” is used to refer to compulsory physical separation (including restriction of free movements) of a healthy individual or such a group of individuals who have been potentially exposed to a contagious disease [5]. Contagious is an infectious disease (such as influenza, measles, or tuberculosis) that is transmitted by contact with an infected individual or infected bodily discharges or fluids (such as respiratory droplets) or by contact with a contaminated surface or object. The story of the beginnings of quarantine is associated particularly with the epidemiology of pest (pestilence or plague). Cladius Galen (129–216 AD), renowned Greek physician, in tune with the views of Hippocrates (460–370 BC), argued that any disease that caused the almost simultaneous death of a large number of people should be regarded as of the nature of pest (pestilence or plague). With the passage of time, it was restricted to the dreadful visitation (bubonic plague) occupying the human mind for centuries, the first available record of the occurrence of which is from Holy Bible, in 1,000 BC in the city of Ashdod (now in Israel) [6].

What is the significance of 40 days quarantine? This raises further questions. The first question is why the period of thirty days was fixed? Possibly it was felt that a calendar month was enough. Alternatively, it could have been determined by economic necessity, since there was dire need to safeguard the economy in the crisis of Black Death pandemic. The second question is why quarantine period was changed from 30 days to 40 days? In 1448, the Venetian Senate, the main deliberative and legislative body of the Republic of Venice, prolonged the waiting period to 40 days, thus giving birth to the term ‘quarantine’ [7]. The underlying rationale may be a mystery. However, there are some plausible theories. It may be that the thirty days was not found effective enough to check the spread of the disease or could have been derived from Hippocratic School of thoughts of “critical days,” which held that contagious disease will develop within 40 days after exposure. With the observation that “after forty days, people stricken with the plague either died or recovered without further spread to others”, this number, in ancient Greek medicine, became a medical turning point useful in differentiating different diseases, and later on, the established length of quarantine for transmissible diseases [5].

The “forty” is known to have a great symbolic and religious significance. The biblical significance of forty is actually a long one in so far as the Old Testament. After childbirth, a mother was advised to rest for 40 days, for “purification”. Thus forty days got firmly entrenched into the contagion strategy. It has been contended that the duration was changed due to Christian practices, such as the observation of Lent, the length of the great flood of Noah, or the length of Jesus’ stay in the wilderness.

Undoubtedly, the increased duration, irrespective of the background, resulted in improvement, halting the risk to the city. Whereas, the present concept of incubation period was unheard of to the then public health officials of Regusa, they showed remarkable understanding of its basis. Limiting restrictions to 30 days and then extending to 40 days could not be without logic. Although, no chemoprophylaxis or immnuoprophylaxis was known to them, they recognized the importance of lifestyle intervention in the form of:

- Avoiding contact with infected persons
- Avoiding contact with contaminated objects.

Interestingly, both these measures have been given fancy names in the present scenario — social distancing and disinfecting.

Quarantine in Religious Scriptures

“I will say of the Lord, “He is my refuge and my fortress, my God, in whom I trust. Surely he will save you from the fowler’s snare and from the deadly pestilence”.

Psalms 91:2–3 (NIV). The Holy Bible commands the separation of people with leprosy from other people as early as 1513 BC, as recorded in Leviticus chapter 13 of the Old Testament.

“The leprous person is unclean. He shall live alone. His dwelling shall be outside the camp. (Leviticus 13:46---EVS). Numbers, chapter 5, prescribes a duty: “Command the Israelites to send away from the camp anyone who has a defiling skin disease or a discharge of any kind, or who is ceremonially unclean because of a dead body” [1, Num. 5.2 NIV]. The Hebrew word for defiling skin disease, traditionally translated “leprosy,” was used for various diseases affecting the skin. These accounts fit isolation and confinement and not quarantine. Of note, early in the history of human civilization, isolation and confinement of ill persons were the predecessors of quarantine [8].

The statement exactly fitting the modern definition of quarantine is found in Hadees (Reported Sayings of the Last Messenger Muhammad (AD 570–632), recorded in Sahih al-Bukhari. 7.62):

“If you hear of an outbreak of plague in a land, do not enter it; but if the plague

breaks out in a place while you are in it, do not leave that place” [6]. This Hadees seems to have its influence on the main tenets of the 1377 Law of Ragusa which stipulate:

- 1- “Visitors from areas where plague was endemic were not being admitted into Ragusa until they had remained in isolation for a month.
- 2- No one from Ragusa was allowed to go to the isolation area “.

Quarantinable Diseases / Legal Authority

“Quarantine and other public health practices are effective and valuable ways to control communicable disease outbreaks and public anxiety” [9].

It is important to understand that each jurisdiction has the right to make their own laws. In United States, for example, Federal isolation and quarantine are authorized by Executive Order of the President of United States for the following communicable diseases [10]:

- Cholera
- Diphtheria
- Infectious tuberculosis
- Plague
- Smallpox
- Yellow fever
- Viral hemorrhagic fevers
- Severe acute respiratory syndromes
- Flu that can cause a pandemic
- Measles

Confusion often occurs between the terms “isolation” and “quarantine”; many people mistakenly, use the term quarantine to mean either isolation or quarantine. Although, both the terms are public health measures used to control the spread of contagious disease, they have their own entity.

Since concept of incubation was unheard of, in early epidemiological history, isolation, not quarantine, was the primary method of halting the spread of pandemics. With the passage of time both these terms have become meaningful. The term “isolation” must be considered distinct from the term “quarantine”, since the former denotes the separation and confinement of subjects already known to be infected with a contagious disease to prevent them from transmitting disease to other people; the latter, essentially the same procedure but with suspected (however, not yet confirmed; harboured and potential transmitter) of the disease. In simple words quarantine is required when one has been exposed to the pathogen (Contact) while isolation is needed when one has been infected with the pathogen (Case) [10]. What is the role of Centers for Disease Control and Prevention (CDC) in this scenario? Under 42 Code of Federal Regulations parts 70 and 71, CDC is authorized to detain, medically examine, and release persons arriving into the United States and traveling between states who are suspected of carrying these communicable diseases.

As part of its federal authority, CDC routinely monitors persons arriving at land border crossings and passengers

and crew arriving at U.S. ports of entry for signs or symptoms of communicable diseases. When alerted about an ill passenger or crew member by the pilot of a plane or captain of a ship, CDC may detain passengers and crew as necessary to investigate whether the cause of the illness on board is a communicable disease [11].

“A feeling normally as individual as the ache of separation from those one loves suddenly became a feeling in which all shared alike,” What We Can Learn (and Should Unlearn): From Albert Camus’s “The Plague”

The earliest recognition of communicability of diseases led to extreme measures which, later on, were known as isolation and quarantine. They were designed to separate infected persons or communities from healthy ones. Fear of leprosy, for example, resulted in wide adoption of the control measures set out in Leviticus 13—namely, “isolation of the infected and the cleansing or burning of his or her garments”.

A notable proclamation in 1374, was of Viscount Bernabo of Reggio, Italy, commanding the segregation of victims of pestilential maladies, outside the city, into the open country, a camp, or the woods, there to remain until dead or cured. The impetus for these recommendations was an early contagion theory, which promoted separation of healthy persons from those who were sick [12]. After the issuance of the official order of “trenta”, Jacob of Padua, the Chief Physician of Ragusa, advised establishing a place outside the city walls for the treatment of sick (or suspected to be infected) citizens [13]. To begin with aggressive separation between healthy and infected persons was initially accomplished through the introduction of makeshift camps (temporary settlement or shanty).

Ragusa was the first city to set up a temporary plague hospital on another island called Mljet. In 1423 that Venice set up permanent plague hospital known ‘lazaretto’ (quarantine station) on the island of Venetian Lagoon where the monastery of Santa Maria of Nazareth was. The health staffs were acquired from the Saint Lazzaro’s hospital [14]. Venice was dangerously exposed because of particular geographic configuration and its prominence as a commercial centre. It championed to perfect a system of maritime cordons [15]. The name “Lazaretto” derives from St. Lazarus, patron saint of lepers. A leper colony or leprosarium administered by a Christian religious order was often called a lazaret house, after the parable of Lazarus the Beggar. The totally state-funded Lazaretto was serving two purposes: a medical treatment centre and a quarantine facility to shield a population from infectious diseases spread by incoming ships. The selection of location of Lazarettos was of paramount importance: far enough away from centres of habitation to restrict the spread of disease but reasonably close to a natural barrier such as a river separating from the city [9].

With the passage of time, the Venetian model gained

popularity in other European countries and the 'lazaretto' became the standard term for all quarantine centres [4]. The first lazaretto, in United States, was built in 1742 on Fisher's Island in Philadelphia which became the point of entry for all ships and passengers arriving during the quarantine season of June through October. Later on, with the recognition that it was too close to the growing city, the new facility, with 500 bed hospital, was commissioned in 1799 and built at Tinicum, about 7 miles downriver from Philadelphia. It was closed in 1895, after the opening of a new quarantine station the further down the Delaware River at Marcus Hook. The Fisher's Island lazaretto is no longer in existence. However, as an acknowledgement of the last surviving example of its type in America, the U.S. Department of the Interior, in 1972, approved Lazaretto's nomination to the National Register of Historic Places.

At present, the US Quarantine Stations, staffed and managed by CDC's Division of Global Migration and Quarantine, are part of a comprehensive system that serves to limit the introduction and spread of contagious diseases in the United States. They are located at 20 ports of entry and land-border crossings where most international travellers arrive. The designated staffs decide whether ill persons can enter the United States and what measures should be taken to prevent the spread of contagious diseases [16].

"When written in Chinese, the word 'crisis' is composed of two characters - one represents danger, the other represents opportunity".

It has been shown, in the literature, that the epidemics - and measures taken to control them - may comprise psychologically stressful experiences. In a General Population Survey (GPS) conducted to cull lessons from Toronto's experiences with large-scale quarantine during the outbreak of SARS in early 2003, 37% respondents who had been quarantined reported psychological stress resulting in sub-optimal compliance to quarantine. The reported emotional reactions were fear, isolation, loneliness, depression, insomnia, and anxiety. The fear of loss of income, being of paramount importance, turned out to be a significant obstacle to compliance [17]

The quarantine measures to combat the Ebola outbreak in rural Sierra Leone, in 2014, were found to result in psychological problems for the community. To begin with they complained "It destroyed many things, especially farming, our crops were destroyed and there is no food available now". However, with improvement in food supply and comparison of affected versus un-affected, they understood the value of quarantine. "Because of quarantine, we couldn't spread Ebola to other households" [18].

The stress reaction among staff members, involved in SARS, in a hospital in East Taiwan that discontinued emergency and outpatient services to prevent possible nosocomial infection, were investigated. Whereas 5%

suffered from an acute stress disorder, 20% felt stigmatized and rejected in their neighbourhood because of their hospital work, 20 % reported reluctance to work and 9% had considered resignation [19]. In a Canadian Healthcare Workers Survey, 5% reported such high stress that they were tempted to break quarantine, 34% were "pretty stressed" but not tempted to break quarantine, 33% were "uncomfortable but not overly stressed", 16% were mildly un- comfortable, and in 11% stress was not a problem [17]. Being the target of stigma was reported by 39% quarantined individuals in a Canadian GPS, and 68% quarantined healthcare workers reported that stigma affected them or someone close to them [17].

"Life imposes things on you that you can't control, but you still have the choice of how you are going to live through this."

The use of quarantine to control infectious diseases has a long and venerable history that goes back centuries. Today, many countries have the legal authority to impose quarantine which, in accordance with Article 3 of the International Health Regulations-2005, must be fully respectful of the dignity, human rights and fundamental freedoms of persons [20].

In the context of prevailing COVID-19 global pandemic, caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), there are two scenarios in which quarantine may be implemented:

(1) The restriction of movement of travellers upon arrival from areas with community transmission. According to the WHO's Policy considerations for implementing a risk-based approach to international travel in the context of COVID-19 updated July 2, 2021, if quarantine of international travellers is implemented in the arrival country, ensure that a risk-based approach is used in decision-making, and that the dignity, human rights and fundamental freedoms of travelers are respected and any discomfort or distress minimized, as per the provisions of the International Health Regulations 2005 [21].

(2) Segregation of contacts of individuals with confirmed or probable SARS-CoV-2 infection. For them, WHO recommends quarantine in a designated facility or in a separate room in the household for duration of 14 days from the last contact with the confirmed case? It has been estimated that 95% of all people infected would develop symptoms a median of 11.6 days after exposure; however, this value varied considerably between studies - from 9.5 to 14.2 [22]. WHO advises that any adjustment in the quarantine period of contacts from 14 days balances the public health risks and benefits against its social and economic impact? The objective is to control onwards transmission of the virus and monitor contacts for the development of any symptoms to ensure the early detection, and appropriate management of potential cases [23]. The quarantine is much modified

in modern practice because of the better understanding of contagion and introduction of new terminology. Social distancing also called physical distancing is a set of non-pharmaceutical interventions or measures intended to prevent the spread of a contagious disease by maintaining a physical distance between people and reducing the number of times people come into close contact with each other [24]. This means staying at least 2 metres (6 feet) apart from other people. It also means avoiding face-to-face contact where possible, washing your hands regularly and for at least 20 seconds and following strict hygiene advice [25]. Self-isolation applies to those who have symptoms of COVID19 and those who live with them. Self-isolation measures also apply to people who are at an increased risk of COVID19, including those over the age of 70 and pregnant women [25]. In addition to social distancing steps, this involves staying at home and not having visitors [25]. Shielding is a way to protect people who are Clinically Extremely Vulnerable (CEV) from coming into contact with coronavirus by minimising all interaction between them and other people by staying at home at all times and avoiding all face to-face contact for at least twelve weeks, except from carers and healthcare workers [25]. Shielding, was introduced in England on March 21, 2020 and ended on September 15, 2021. Over time, shielding figures, as estimated by NHS, rose to 3.7 million people [26]. As of December 24, 2021, those enlisted as CEV are being labelled "Highest Risk Group" [27]. "Quarantine and other public health practices have always been much debated, perceived as intrusive, and accompanied in every age and under all political regimes by an undercurrent of suspicion, distrust, and riots" [9]. These strategic measures have raised (and continue to raise) a variety of political, economic, social, and ethical issues [28,29]. Dagnino have argued that the COVID-19 epidemic has caused a parallel epidemic of fear, anxiety, and depression worldwide, along with concerns about the future [30].

Besides economic pressure, the quarantine measures adopted to control the COVID-19 pandemic were found to have negative psychological and social effects. Umberson and Montez argue that the "Social isolation of otherwise healthy, well-functioning individuals eventually results in psychological and physical disintegration, and even death" [31]. As shown in an Italian study [32] and a Brazilian study [33], the quarantine disrupts people's lives, especially since there is no possibility of getting around or carrying out daily activities outside the home. In an Australian study, aimed at investigating "psychological consequences of social isolation and quarantine: Issues related to COVID-19 restrictions", Jurblum et al concluded that the quarantine has been associated with increased rates of suicide, anger, acute stress disorder, depression and post-traumatic stress disorder, with symptoms continuing even years after quarantine ends [34]. While discussing the "The Mental Health Consequences of COVID-19 and Physical Distancing", Sandro Galea et al argued that instituting the practice of social distancing may be critical to mitigate the spread of the

disease but it will undoubtedly have consequences for mental health and well-being in both the short and long term [35]. The results of the studies conducted on various spots of the globe are interesting and thought provoking. In a Chilean study, to explore the psychological effects of social isolation, the main perceived psychological impacts were concern (67%) and anxiety (60%). The future concerns were: general health (55.3%), employment (53.1%), and finances (49.8%). The vulnerable group included women, younger people, the self-employed, and people with psychological processes that were interrupted [30].

In a Jordanian study, conducted to estimate the prevalence of quarantine-related anxiety and its socio-economic correlates in COVID 19 patients, 40% experienced quarantine related anxiety. Younger age, female gender and poor social support were prone to anxiety [36]. In a recent review on the psychological impact of quarantine, Samantha Brooks et al pointed out that Post-Traumatic Stress Symptoms (PTSS) occur in 28 to 34% and fear in 20% of quarantined subjects. Additional quarantine-related mental health problems included depression, low mood, irritability, insomnia, anger and emotional exhaustion [37]. A cross-sectional retrospective study on Bahrainis aged >18 years who had undergone either isolation (cases) or quarantine (contacts), 40% of participants shows clinically significant depression, and 20% had indications of some post-traumatic distress, with greater depression and distress in those isolated than those quarantined. Perceived stigma was reported by 53.4% (268 of 502) of participants, more prominent among those quarantined [38]. Another cross-sectional nation-wide Chinese study, to ascertain the psychological impact of quarantine on general population, revealed that quarantine measures were associated with increased risk of experiencing psychological symptoms including anxiety, depression, insomnia, and acute stress. The vulnerable groups include those with pre-existing mental or physical illnesses and frontline workers [39]. COPD patients with comorbid anxiety and depression, in the prevailing COVID19 pandemic, are quite likely to present with worsening symptoms, because of home isolation and social distancing [40]. This is even more true in elderly patients who, often with pre-existing mobility limitations, now find themselves "trapped in their own homes", potentially triggering hopelessness and even suicidal ideation [41]. In the UK people with COPD (and other severe respiratory conditions) were among those defined as "extremely clinically vulnerable" and advised to "socially shield", avoiding all face-to-face contact for at least 12 weeks in the first instance [42]. What was the "after-effects?" The findings from the first wave of data collection from a community cohort study established in the UK to prospectively examine the mental health consequences of the COVID-19 pandemic revealed that 64% of participants reported symptoms moderate to severe depression [43]. Boiutou et al have concluded that "shielding" has further exacerbated physical activity decline, shown through a 39% reduction in daily steps from post-pulmonary rehabilitation

to shielding (3 months) [44]. It is known that physical inactivity and deconditioning can often lead to worsening of symptoms in COPD and subsequent deterioration of physical functioning and health –related quality of life (HRQoL) [45] along with an increased risk of hospitalizations and mortality [46], of depression, 31.6% were of moderate to severe depression [43]. “Buddha has often referred to medicine as the most suitable analogy for the Noble Truths: “Know the sickness, Abandon the cause of the sickness, Aspire the cure and Rely upon the medical treatment [47]. In-patients with COVID-19 suffer both the physical impact of their disease and the emotional impact of forced quarantine, which manifests as anxiety and mental distress [48]. Mader et al, while discussing the “Role of Religious and Spiritual Aid in Quarantine Hospitalization Due To SARS-CoV-2”, argued that many patients, with different religious beliefs, report that their religious and spiritual needs are overlooked in the hospital setting as they have difficulty in practicing their traditions and commandments in the COVID-19 Unit [49].

CONCLUSION

“I think it’s very healthy to spend time alone. You need to know how to be alone and not be defined by another person.”

Quarantine, a concept developed by society to protect against the crisis of epidemics of contagious diseases, has a long and venerable history. Although, it is not a panacea against the epidemics and pandemics, it has, undoubtedly, contributed significantly in halting the rapid acceleration of their activity. Whereas the basic concept of quarantine is still fully valid, it is much modified in modern practice because of the better understanding of contagion and introduction of new terminology. The public health practices, in the past, have always been much debated and economic, cultural, ethical and political issues have been raised. The quarantine, by no means, is an exception. Whereas many countries, at present, have the legal authority to impose quarantine, the WHO advises that it must be fully respectful of the dignity, human rights and fundamental freedoms of persons.

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