Undulant Fever: Colonialism, Culture, and Compliancy

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Introduction

Colonialism can be viewed as a distal social determinant of health where colonial relations of the indigenous population and colonizer are shaped by historical, political, social and economic exchanges.[1] The distal determinant acts on the health of the colonized through a complex pathway of the intermediate and proximal social determinants of health.[2] To date, much of the discourse on colonialism and health has focused on the negative consequences. For example, colonialism's hegemonic actions and imperialistic goals[3] have resulted in increased disease experience. Exposure to new pathogens arises from direct contact with infectious agents or their hosts by means of an efficient global transportation system. Indirect health inequalities proceed from colonial actions forcing the adoption of new economic strategies that disrupt the local ecology; from land and property dispossession; from the creation of overcrowded environments with poor sanitary conditions; from the construction of colonial mentalities and 'othering' through economic, educational and social marginalization; from the introduction of westernized foods that promote malnutrition and, in turn, result in poor physical and mental development as well as greater susceptibility to infectious diseases; and finally, from the ineffective quarantine measures that foster a downturn in the local economy, an increase in unemployment and a general state of helplessness, and heightened anxiety.

By contrast, comparatively few studies have shown how colonial authorities contributed positively to the wellbeing of the indigenous population through benevolence, or altruism or imperialistic motives.[4] Such actions have included: (1) the implementation of specialized commissions[5] to inquire into matters related to health and the sanitary infra-structure[6]; (2) the establishment of hospitals and other institutions for the care and cure of the sick; (3) the implementation of sanitary and scavenging services; (4) the production of annual health reports[7] that provide accurate counts of sickness and deaths as well as identifying health problems that warrant attention; (5) the regulation of vaccination procedures; (6) the

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[1] Karina Czyzweski, "Colonialism as a Broader Social Determinant of Health," *The International Indigenous Policy Journal,* vol. 2, no. 1, Spring 2011, 1-13.

[2] Proximate determinants are those controlled at the individual level and intermediate are those organized and maintained at the community level.

[3] The impact of colonialism should not be viewed as monotonic as they vary in accordance with changing actors and their policies.

[4] Muhammad Umair Mushtaq, "Public Health in British India: A Brief Account of the History of Medical Services and Disease Prevention in Colonial India," *Indian Journal of Community Medicine,* vol. 34, no. 1, Winter 2009, 6; It is also possible for colonial powers to have benevolent imperialistic agendas, see Simone Azopardi, *Imperial Policy in Malta, 1934-1939: Britain's Need for Benevolent Despotism (*Master of Studies in Global and Imperial History thesis), 2012, 1-80.

[5] These were commissioned by the colonial Home Office to safeguard their troops with the implicit recognition that health of the military was inseparable from that of the civilian community (e.g., John Sutherland, 1866, The Sanitary Commission). Here the focus could be on the disease etiology and transmission, the sanitary infrastructure and related matters.

[6] disease causation and control, the current state of sanitary conditions and issues of household security of food, housing and water

[7] Such as the Medical Officer's Annual Health Reports, Hospital Returns, and the Surgeon Reports

creation of legislation[8] to monitor, control and police a wide array of health related issues[9]; and last, (7) the broad-based educational reform partnered with selected propaganda that encourages people to adopt practices which support the wellbeing of the individual, the family and society.

The British authorities efforts to manage and control the spread of undulant fever in the British colonies, is one such example of colonial efforts to improve the health of the native population. This paper explores the question, why did the undulant fever experiences of Malta and Gibraltar differ drastically despite a known etiology? Through an exploration of how the disease was modified during a complex process that involved colonial action taken on cultural milk practices and the scale effect's impact on the creation, implementation, and enforcement of health policy, we argue that Gibraltar's experience with the disease was distinct from that of Malta. The difference is attributable to Gibraltar's having: (1) a culturally entrenched tradition of goat-herding, but not an exclusive tradition of consuming raw goats' milk; (2) effective health-directed policies regarding herding and milk consumption; and (3) greater enforcement of policies and higher levels of group compliancy.

Gibraltar: A small-scale society

Gibraltar is an unusually rich ground for studying the interrelationships of colonialism, scale and culture in the development of its medical and sanitary history. Located at the western end of the Mediterranean,[10] Gibraltar's physical setting and the periodic socio-political isolation from Spain have imposed constraints upon spatial and demographic development of its population. As a British colony,[11] Gibraltar has long been regarded by 'outsiders' as a British stronghold[12] governed by a purely military administration.[13] Politically, Gibraltar is also referred to as a continental enclave.[14] As a British colony situated within a fortified garrison post,[15] the civilian population can be regarded as a small-scale

[8] Through ordinances and byelaws

[9] Such as housing regulation, milk byelaws

[10] It is attached to the southern tip of Andalusian Spain by a flat sandy strip of land 10 feet above sea level. Running nearly due north and south, Gibraltar is 3.2 miles in length, its greatest breadth of 1 mile, and circumference about seven miles. The entire territory covers approximately 1,266 acres or about 3.6 square miles.

[11] While the term colony is used throughout this work, it is important to recognize that there is no unifying definition of what constitutes a colony nor can one make general statements about colonialism. For a recent and thorough discussion on this subject see Robert Aldrich and John Connell, *The Last Colonies* (Cambridge University Press, Cambridge), 1998. It is important to not oversimplify this relationship as the words 'colony' and 'colonized peoples' are often laden with 'specific and emotionally heated connotations.' The 'colony' is often described in the 'rather simplistic vernacular understanding of as distant outpost lorded over by white foreigners who deprive local inhabitants of self-government and extract immense riches for their own profit'(Aldrich and Connell, 3). While Gibraltar exhibits 'the indelible imprint of a colonial past' with the lack of political sovereignty, it does not display other traces of colonialism such as the economic fragility and social cleavages produced by disparities among resident ethnic groups.

[12] Unlike other British colonies in Africa, the Far East and the New World, Gibraltar was known primarily for its strategic location and a place for the seasoning of its troops.

[13] Of the more than two hundred pages devoted to a description of the various Colonies of Great Britain in 1887, Gibraltar received less one page of note; C. S. Salmon, *The Crown Colonies of Great Britain,* 1887.

[14] Aldrich and Connell, 1998.

[15] While much has been written of Gibraltar's military history, there is an unfortunate paucity of information on the history and development of the Rock's civilian inhabitants. Two factors contributing to this lack of interest are: Gibraltar's internal affairs were relatively unimportant compared with its external affairs and second, the colony was never larger than a small market town and its topography made a great increase in population size impossible. See Lawrence A. Sawchuk, *Deadly Visitations in a Dark Time: A Social History of Gibraltar*, 2001, 22-27, for more information on the history of the military in Gibraltar.

community where day-to-day, face to face contact is the norm.[16] We define the scale effect as a multifaceted construct that embodies the demographic properties of size, density and dispersion together with its impact on the social determinants of health. Gibraltar has an area of 6.5 square km and a fortress, whereas Malta has an area of 316 square km, several thousand people and numerous military bases located in various towns throughout the Maltese islands. Gibraltar's 'requirements are thus more easily dealt with than those of the larger colonies with scattered populations.'[17] For example, large-scale populations have inherent logistical problems in creating, delivering and maintaining primary health determinants such as the public sanitary system, the water supply, the scavenging system along with monitoring issues of housing, and overcrowding. Scale effects can also impinge on ease of communication among widely dispersed localities. For example, scaling up the system reduces day-to-day, face-to-face interactions. As such, it figures in 'the mental map' that community members construct for themselves and influences the degree of solidarity and the strength of the traditions they foster. The dissemination of information relevant to health is markedly more difficult in scaled-up populations, particularly in our study period.

Gibraltarians under Colonialism and Military Rule

Unlike other British possessions settled by colonists, the administration considered Gibraltarians:

> not colonists in the true sense of that word. They are substantially part of the garrison that is both British subjects permitted to reside for the purpose of supplying the rest of the Garrison with such necessary provisions and as such are imported from a distance and their employee's domestic servants, camp followers and civil officers.[18]

During the repopulation of Gibraltar after the yellow fever of 1804, colonial officials regarded the manageability or tractability of settlers as the primary factor of settlement in the garrison town. Any opposition to government policy by civilians was viewed strictly in negative terms as 'refractory,' 'insolent,' 'troublesome,' or 'demanding.' To control population growth, initiatives restricted where civilian housing could be located, set stringent limits on the height of buildings and featured direct competition for scarce resources such as housing and water supplies. Free movement of the civilians was simply not possible in a garrison town where every movement was carefully monitored by the police and district inspectors. Even the right to be outside at night was regulated by special passes. The subordinate position of the indigenous population and the preferential treatment of 'outsiders' from the British Empire in terms of position, housing, wages and mobility reinforced the process of marginalization among the

[16] Paternalism and patronage were essential tools for the colonial system and, no doubt, operated in Gibraltar. Gibraltar's vast defence works and admiralty dockyards required a large labour force which the colonial officials were able to exploit and control.

[17] Gibraltar Police Archives, *Governor Duddurk Letter to J. Chamberlain*, 1896; See chapter x "Deconstructing Colonial Health Differentials: Malta and Gibraltar prior to World War II," in this volume.

[18] Government of Gibraltar Archives, *CO 91/309, Solly Flood to R.S. Baynes, 25th June*, 1870; Henry William Howes, "The Gibraltarian," in *The origin and development of the population of Gibraltar from 1704*, 1950, 189.

civilian community. Improvements to local health and sanitary infrastructure typically became a priority only when it became apparent that there could be direct benefits for the garrisoned military forces.[19]

Early Sanitary Reform in Gibraltar and Malta

While the great epidemics[20] of the early 19th century had a profound impact on death rates, they did not produce substantial initiatives either in sanitary thinking or in understanding disease causation. The first step in sanitary reform came after the Barrack and Hospital Commission of 1862.[21] Led by Dr. John Sutherland and Captain Douglas Galton, an examination into the state of hospitals, the barracks, and the sanitary conditions of civilian dwellings in their immediate vicinity, resulted in an important finding: the principle of inseparability in which the welfare of troops and colonial administrators were linked to the health of the civilian population. On June 16th 1865, another cholera epidemic broke out bringing with it excessive illness and death.[22] Two months after the last case of cholera, a newly constituted body responsible for watching over local health matters came into office on 1st January 1866: Gibraltar's Sanitary Commission. The Commission consisted of five officials and twelve local members. While the governor played a role in selecting the laymen on the committee, this was the first time that members of the civilian population had a direct role or 'voice' in running affairs related to sanitation and health matters. In addition to a number of personnel designated as health inspectors, the local police force assisted the Commissioners in their various duties.

The newly formed administrative health body coincided with a shift in attitude towards sanitation and public health in England, and some medical men were pointing at the Army's neglect of the soldiers and civilians, a combination which precipitated an 'era of reform.'[23] The Home Office realized that the cost of caring for afflicted soldiers and training new recruits to replace the dead was far greater than the cost of sanitary and health-promoting measures.[24] Concerns held by the War and Colonial Office translated into the principle of inseparability where the welfare of its troops and colonial administrators were linked to the health of the civilian population.

Notwithstanding the change in attitude, colonial officials still had misgivings over the state of sanitation of the garrison near the end of the 19th century. In a confidential memorandum to Governor Harding, the Attorney General voiced concern for the 'garrison of 5000 in the midst of a densely crowded and naturally uncleanly civil population of over 18,000, liable at any moment to become, on the outbreak of an epidemic, a source of extreme danger to the Garrison, which cannot in any way be effectively segregated from the civil community.'[25] Fresh stimulus to amend Gibraltar's sanitary predicament arrived with the publication of the Tulloch report on the 15th of May 1890. While Tulloch remarked extensively

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[19] In the absence of an open and free press in Gibraltar, there was little opportunity to criticize colonial officials and their policies.

[20] Epidemics of yellow fever (Gibraltar 1804, 1813/14 and 1828), plague (Malta 1813) and cholera (Gibraltar, 1834; Malta,1837)

[21] No doubt stimulated by an outbreak of cholera in 1860

[22] There was also an outbreak in Malta in June of 1865, see John Sutherland, 1866 for more details.

[23] Sir Neil Cantlie, *A History of the Army Medical department, vol. 2,* (Churchill Livingstone, Edinburgh and London). 1974; For more information on the history of sanitary reform in Gibraltar see, Sawchuk, 165-173, 282-290.

[24] Sumit Guha, "Nutrition, Sanitation, Hygiene, and the Likelihood of Death: The British Army in India c. 1870-1920," *Population Studies*, vol. 47, no. 3, Fall 1993, 389.

[25] Gibraltar Government Archives, *Henry J. Burford Hancock to Sir. A. Harding, 24th November,* 1887.

on the 'existing evils' in Gibraltar, he was clearly dismayed because, '… it will scarcely be believed that, up to the present and during the long existence of the Commission, only one solitary bye-law has been passed, and that one has reference to cases of infectious diseases in common lodging houses…'[26]. Accordingly, he recommended the immediate introduction of legislation embodying a comprehensive code of bye-laws that recognized that both military and civilians alike would benefit. [27]

The Mediterranean Fever Commission

The health of the garrison forces in the Mediterranean improved once again when the Secretary of State for the Colonies proposed to the Admiralty and the War Department the appointment of a Joint Commission to investigate cases of Mediterranean Fever.[28] Created to represent the Navy, Army and the Malta Government, a sub-committee of the Tropical Diseases Committee of the Royal Society was formed in 1904. [29] Arguably, the stimulus for this inquiry was fueled by concern for the health of garrison forces and only indirectly for its civilian inhabitants. The foundation of this inquiry was grounded in economics rather than concern over human suffering and sickness. [30]

The primary objective of the Commission for the Investigation of Mediterranean Fever was to eradicate the disease from the garrison personnel: the military and the navy. The concern among the Military officials in Malta was a valid one, considering the incidence of the fever reached an alarming rate of 25.6 cases per 1000 per year among the garrison. The navy was as acutely interested as the military. Because of its prolonged course and high invaliding rate, undulant fever was undermining the strength of the 25,000 soldiers and sailors in Malta. In fact, in 1891, calculations showed that, on account of undulant fever alone, the Malta garrison was costing the state an expense equal to that of a whole regiment: one thousand strong in hospital for twenty five days.[31] While the Commission made numerous recommendations that were effective prophylactic measures against the disease, they were, simply put, recommendations. [32] There was no means by which these recommendations could assume legislative status that would result in the mandatory control of undulant fever.

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[26] Major Hector Tullock, *Report on the Water Supply and Sewage System of Gibraltar*, (Waterlow and Sons Limited, Printers, London Wall, London), 1890.

[27] Major Hector Tullock. *Correspondence respecting the Amendment of the Gibraltar Sanitary Order in Council to Crown Agents (*Presented to both Houses of Parliament by Command of Her Majesty in May1892), (Eyre & Spottiswoode, London) 1892, 2.

[28] The first part of the reports was published in March 1905, followed by the second part a few months later. This sophisticated set of recommendations, if followed and enforced, would have effectively rid the population in Malta of undulant fever.

[29] Under the chairman Colonel David Bruce, a number of members were appointed to the sub-committee: Major William Heaton Horrocks, Staff-Surgeon E.A. Shaw; and Dr. Themistocles Zammit, Government analyst Malta. Later Dr. Ralph W. Johnsone joined and acted as epidemiologist. Captain James Crawford Kennedy and Staff Surgeon Gilmour, joined towards the end of the year during their spare time; *Malta Colonial Report*, 1904, 47.

[30] As has been demonstrated in Gibraltar, the vector of colonial health-work was not always routed purely from what Anderson has termed a "centre" to a "periphery", but was rather strongly influenced by military concerns; Warwick Anderson, "Where is the Postcolonial History of Medicine?" *Bulletin History of Medicine*, vol.72, no. 3 1998, 524.

[31] Paul Cassar, The Pattern of disease in Malta, in *Medical History of Malta*, ed. F. N. L. Poynter (William Clowes and Sons Ltd., London and Beccles), 1964, 242.

[32] The report of the Commission in 1907 provided "Recommendations for the Prevention of Mediterranean Fever," which included an elaborate set of recommendations that detailed an economically viable system that would balance costs and profits associated with the process of managing the disease, especially in the goat. These steps included: mandatory disease notification; control of goat travel both within the colony and to and from other

Overview of Undulant fever experience in both Colonies

Undulant fever is a disease of some singularity, because the discovery of the goat as the vector of *B. melitensis* is considered one of the greatest advances in epidemiology.[33] Known primarily for its debilitating consequences rather than a high mortality rate, brucellosis[34] has the potential to create significant economic consequences for the individual, family and community. This fact was not lost on the Maltese health authorities who noted:

> The large yearly expenditure for the hospitalization and care of the sick, with which the Government is faced every year, and the financial loss in wages through the illness and the more or less protracted disablement and consequent distress, would be materially reduced if the Government were to undertake the pasteurization of milk and make pasteurized milk easily obtainable at a cost that would compete with raw milk.[35]

Today, it remains a disease of marked geographic diversity found predominantly in areas with similar agricultural environs along the coast of the Mediterranean where a 'poverty of the grazing land'[36] gives scant opportunity for cattle breeding, but favours the breeding of small ruminants such as goats.

To set out the conditions necessary for undulant fever to achieve epidemic or endemic status, we set forth three domains that represent the epidemiological triad: agent, environment, and host (Figure 1). Framed within the epidemiological triad, we will show how brucellosis was expressed differently in the two sister British colonies. Effective colonial actions in Gibraltar significantly altered the interaction of the conditions for the chain of infection and interrupted the process of transmission of undulant fever from the agent to the host through environmental conditions.

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locations; education on disinfection of goat sheds, infected human excrement, and on the practice of boiling milk; provision of condensed/tinned milk to the garrison, where consumption of raw milk was prohibited, and to the civil hospital; regular bi-weekly testing of goats at special laboratories; a system of segregation and slaughter of infected goats where goat meat was sold; and the selective breeding of valuable animals or good milkers so yearlings could be sold to defer costs and compensate goat herders for their lost revenue. It was also suggested that a new Ordinance, 'Infectious Diseases (Mediterranean Fever) Ordinance of 1907,' should be introduced for the purpose of stamping out Mediterranean Fever from the goats of the Maltese Islands.' There are no records, however, to indicate that such a law was ever created; Dr. Eyre, Major McNaught, Capt. James Crawford Kennedy and Dr. Zammit,"Bacteriological and Experimental Investigation, 1906", in *The Reports for the Investigation into Mediterranean Fever Commission Report*, 1907, part VI, 136-137; Major McCulloch, Major Weir and, Staff-surgeon Clayton, "Epidemiological work in 1906," in *The Reports for the Investigation into Mediterranean Fever Commission Report*, 1907, part VII, 260-261.

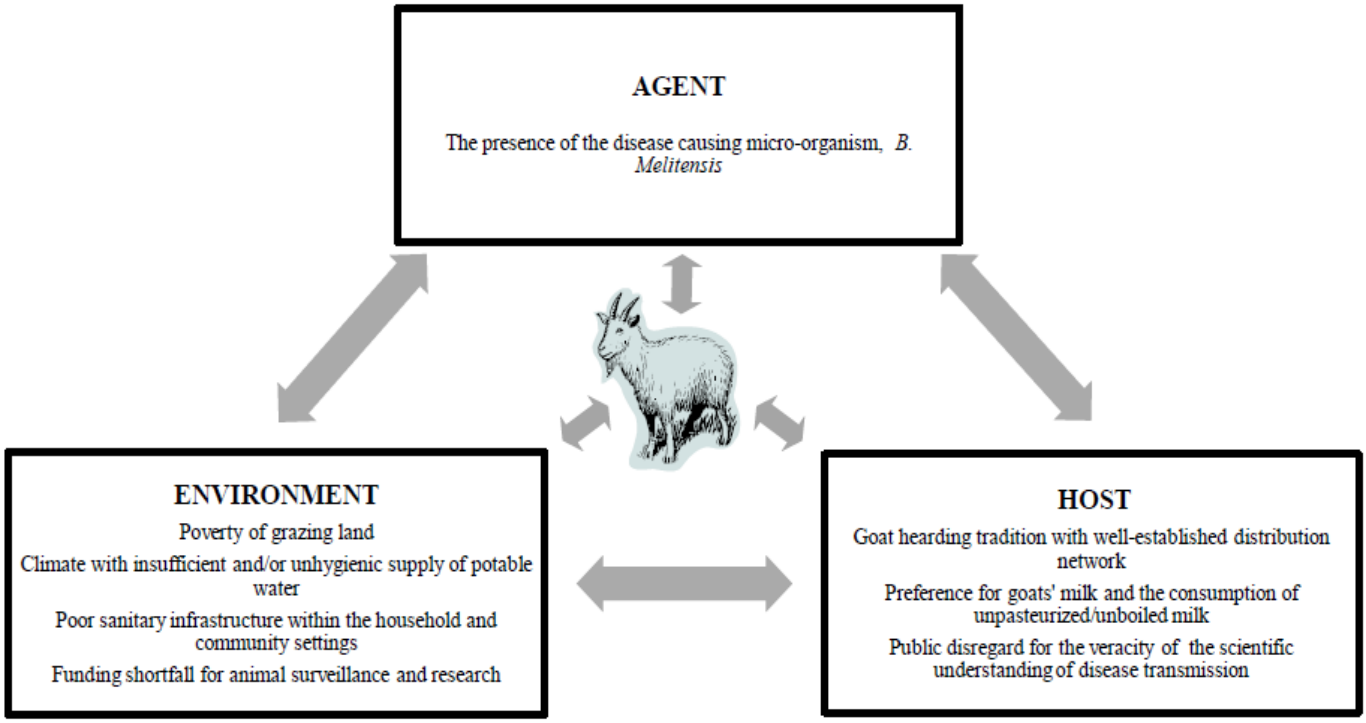
[33] H. Vivian Wyatt, "How Themistocles Zammit found Undulant fever (brucellosis) to be transmitted by the milk of goats*," Journal of the Royal Society of Medicine,* vol. 98, no. 10, Fall, 2005, 451; Brucellosis is both a disease of great antiquity as well as a newly emerging zoonotic disease. Here zoonotic disease is defined as an infectious disease that can be transmitted between humans and wild and domestic animals, J. Singenbergh, M. Gilbert, K. de Balogh, and W. Wint, "Ecological Sources of Zoonotic Disease," *Journal of Review of Scientific and Technical Off. International Epizoonotics*, vol. 23, no. 2, 2004, 467; With respect to undulant fever, the goat is typically the natural reservoir and the vector that passes the micrococcus to humans via its milk.

[34] Also colloquially referred to as Malta fever, Gibraltar fever, Rock fever, or Mediterranean Fever because of its associated presence or origins in these two locations and the Mediterranean in general

[35] National Archives Malta*, Annual Report on the Health of the Maltese Islands during 1931-32*, 1932, T6.

[36] M Monir Madkour, "Epidemiological Aspects," in *Madkour's Brucellosis 2nd Edition*, ed. M. M. Madkour (Springer, Berlin), 2001, 24.

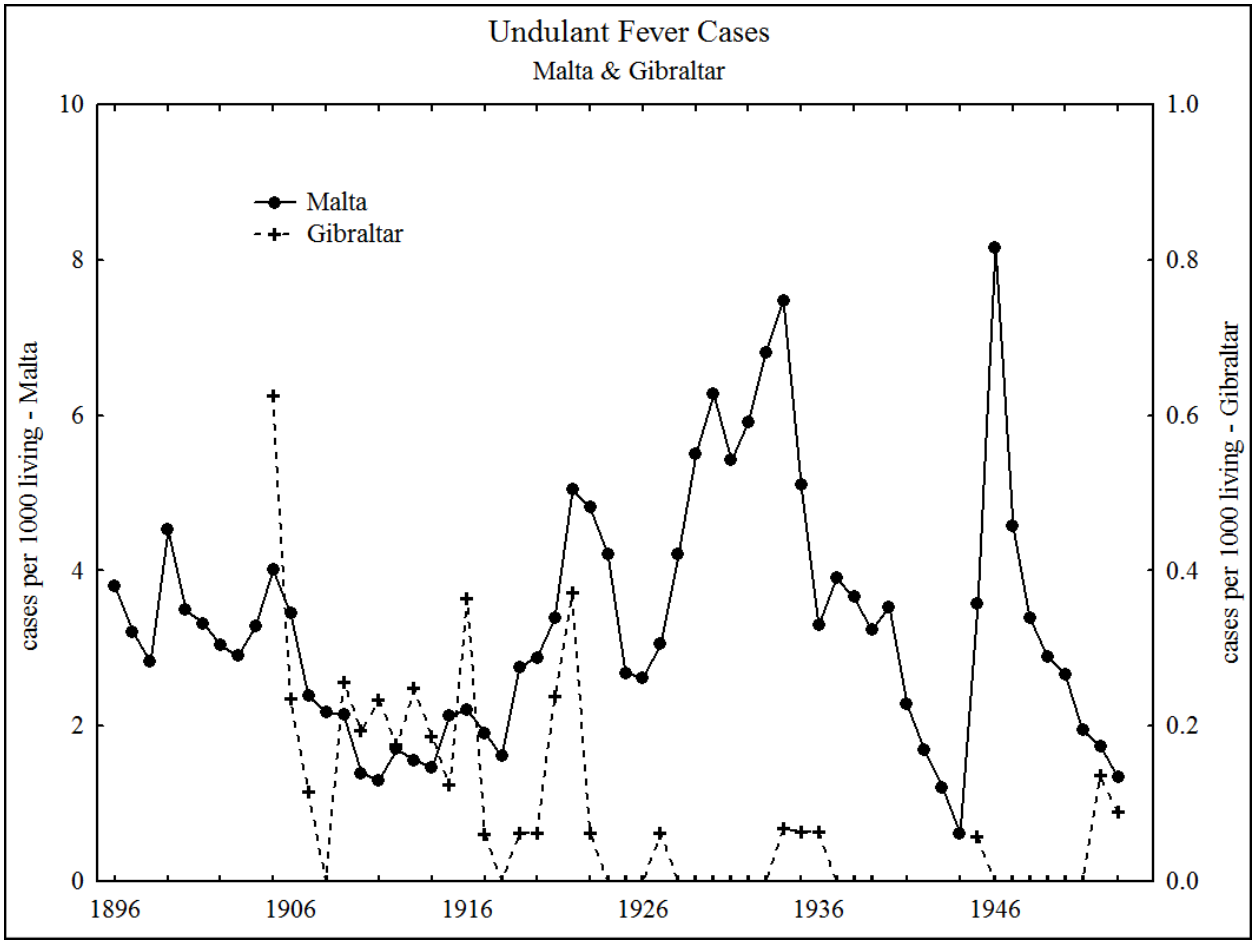
Figure 1. Epidemiological Triad for Undulant Fever



Before we consider any chronicles of the history of undulant fever at the population level, it is important to address complications that arise from misdiagnosis, classification issues and under-reporting. Throughout most of the 19th century, undulant fever remained poorly documented.[37] After the discovery of the micrococcus by Bruce in 1887, our understanding of the disease and its prevalence was much improved. The low prevalence of undulant fever in Gibraltar in the latter part of the 19th century stemmed, in all likelihood, from the diversity of terms used to name undulant fever. For example, Hughes identified 46 terms used to refer to what he aptly coined as 'undulant fever' in 1896.[38] Similarly, various synonyms were used in the Malta Health Reports: Remittent fever (1897 and 1902-1903), Continued Fever (1897, 1906-1908), Febricula (1898, 1906-1907) and Undulant fever (appearing for the first time in 1912-1913).[39] 'Remittent fever,' at one point was used in the Official Returns of the Royal Navy and Civil Government of Malta, but 'was not used much except in connection with cases of fever developing

[37] In Gibraltar the Medical Health Authorities used 'Mediterranean Fever' and by at least 1927, they had adopted the name undulant fever. It was later changed to Brucellosis in the late 1960s. The term Brucellosis was adopted beginning in the 1920s in Malta (Cassar, 247).
[38] Matthew Louis Hughes, "Undulant (Malta) Fever," *The Lancet*, Summer 1896, vol. No., 238-239.
[39] John William Watson Stephens, "Undulant Fever in the Naval, Military and Civilian Populations of Malta," *Annals of Tropical Medicine and Parasitology*, Winter 1922, vol. 16, 11-17.

Figure 2. Cases of Undulant Fever in Gibraltar and Malta from 1896-1952



*Note that the Y2 (Gibraltar) scale is 1/10 that of Y1 (Malta) scale

in regiments which had recently arrived from stations where malaria was prevalent.'[40] Some terms were used so loosely that they could refer to any one of many fevers. The most notable of these was 'Simple Continued fever,' an umbrella term that covered 'febrile attacks of short character as well as cases of prolonged fever attended by marked anemia and complicated by rheumatism. 'Malta Fever,' 'Rock Fever' and 'Gibraltar Fever' were the three most commonly used terms just before the turn of the century.[41]

Compounding the problem of prevalence estimation were the issues of misdiagnosis, confusion over the etiology, and intentional failure by civilian doctors to report cases. In 1909, Fowler noted that underreporting may have been an issue of confusion with other diseases such as influenza or even

[40] William Heaton Horrocks, "Mediterranean Fever in Gibraltar," Commission for the Investigation of Mediterranean Fever, part 5, Winter 1907, 54; Horrocks was the Medical Officer of Health in Gibraltar from 1904 until 1908.

[41] Sir Weldon Dalrymple-Champneys, Man. in *Brucella infection and undulant fever in man* (Oxford University Press, London), 1960, 11.

Phlebotomus fever.[42] Even in 1910, the Medical Surgeon of Health, Dr. Parsons was not convinced that the only mode of infection for undulant fever was from drinking goats' milk, but felt that 'the virus' could be acquired from the sand fly.[43] Doctors also found it difficult to collect blood samples for testing and confirmation of diagnosis, since many patients, especially the 'uneducated,' were not compliant.[44] A significant complication was that civilian doctors, who faced strong competition for patients in a location with a limited clientele, needed to maintain a good rapport with their patients. They were keenly aware of the stigma under which those of a lower class would suffer if they were diagnosed with a notifiable and infectious disease. Consider the fact that 'the patient and house are marked, and liable to visitations by the servant of the sanitary authorities, of whom people of this class are always in some dread.'[45] As stated by Fowler, it was no wonder that doctors' 'conscience became dull' and that they turned a blind eye to cases of undulant fever.

Historically, the epidemic experience of Gibraltar and Malta represents two distinct patterns that underlie the inherent complexity of undulant fever etiology. In Gibraltar, undulant fever was typically mild and sporadic in nature, found predominantly among the troops, whereas in the sister colony of Malta, undulant fever was endemic, interspersed with mild to severe epidemics until milk pasteurizations became compulsory in 1957 (see Figure 2).

Gibraltar: the Civilian Community

The first description of what might be plausibly considered undulant fever in the civilian population dates back to 1879 from the Public Health Report.[46] It draws attention to the nature and scope of the disease, and possible causes, as pointed out by the Medical Officer, Stokes:

> in every month of the year and in every part of the central and southern districts there were cases of remittant catarrhal fever. ... Some public alarm was caused by the knowledge of the presence of so many cases of fever, and it was generally rumoured that there had never been so much fever in the city. .... The disease was not of a severe character and therefore not reported to the sanitary commissioners by the medical attendants. It lasted from seven to ten days, left patients very weak, but they soon recovered under the use of tonics, or change of air, they were subject to relapses.' ... The number of deaths from fever was large (25) exceeding the average of the last few years. Every case of the fever that was reported was visited and placed under sanitary inspection.

As to causation, Stokes remarked:

> The disease appeared to be quite independent of atmospheric changes, prevailing in all

[42] C. E. P. Fowler, Mediterranean Fever in Gibraltar in 1909, *Journal of the Royal Army Medical Corps.*, vol.15, 1910, 55-58.
[43] L. E. Parsons, "Surgeons Report for the Colonial Hospital for the year 1910," *GGA,* 1911, 16-17.
[44] Similarly; Major McCulloch, Major Weir and, Staff-surgeon Clayton, *The Reports for the Investigation into Mediterranean Fever Commission Report*, 1907, part VII, 257, reported that less than 25% of suspected cases of undulant fever were confirmed with blood tests.
[45] Fowler,1910, 57.
[46] The first formal accounts of undulant fever date back to 1878 in the Army Medical report.[46]

winds, and in different degrees of temperature. An ailment which was so general and so constant must have had its origin in some malarious source. In the majority of cases a nuisance or cause was found in the dwelling, or near it, which probably had given rise to the disease; viz: an untrapped or defective drain which permitted a free influx of sewage gas into the dwelling, day and night. This subtle poison does not effect all alike. The weak and depressed or those exhausted by bodily fatigue are most liable to be affected by it. The poison enters the system slowly, accumulates and multiplies itself, or ferments, till the patient is at last thrown on his back to undergo a long and dangerous illness. Patents who could be removed from this impure atmosphere in which they were living quickly recovered.'

Specific reference to undulant fever was made in 1883 in a report by Dr. Turner, the surgeon of the Colonial Hospital. Reflecting on Turner's report, Horrocks noted that, in 1883, civilians suffered from outbreaks of a fever which were not enteric fever and had a very low death rate. We quote Dr. Turner in reporting that during 1882 to 1883, many of the approximately 785 cases of fever, 'Rheumatism is undoubtedly present in varying degrees of intensity in a large proportion of the cases.'[47] It was not until the micrococcus was discovered by Bruce in 1887 and with the advent of serum diagnosis in 1897 that cases of Mediterranean fever were confirmed and recorded in the Annual Health Reports.

The first unambiguous reference to 'Mediterranean fever' was made in 1904. The Medical Officer of Health reports that there were two deaths[48] from Mediterranean fever, but he regretfully acknowledges that 'we have no idea how many cases occurred in the town.' At this time, there was considerable disagreement as to the source of the disease: some suggested that the mosquito might be a vector and others, referring to the research conducted in Malta, implied that 'dry infected dust is the probable cause of this disease.'[49] By 1910, Medical Health Authorities knew full well that goats' milk was the main source of infection. Horrocks, reported that it was probable that each year would return a few cases of this particular fever as the goats continued to show 10 to 15% of their number yielding a reaction with the Malta Fever organism. 'Unless milk is pasteurized or boiled there may therefore be danger of imbibing a dose of the offending germs.'[50]

Over the 50 year study period, the morbidity pattern of brucellosis in Gibraltar is remarkably stable, typically presenting less than a handful of cases. Most of these originated from drinking milk in Spain or from milk sold to Gibraltarians by Spanish milk vendors. Lesser numbers were caused by milk from imported Maltese goats, and fewer cases still were contracted among travelers abroad (e.g. to Malta and South America).[51]The only exceptions to this pattern occurred in 1916, 1922, 1923 and 1962. In 1916 and 1992, six cases of undulant fever occurred. The origins of the infections in 1916 were traced back to Spain; in 1922, the source of the infection was unknown since sampled milk entering Gibraltar tested negative for the micrococcus. In 1923, there were twelve cases, for none of which was it possible to trace the source of infection. The year 1962, when 15 cases of undulant were reported, was atypical. No mention is made about the origin of the infections; however, taking into account the evidence of the years

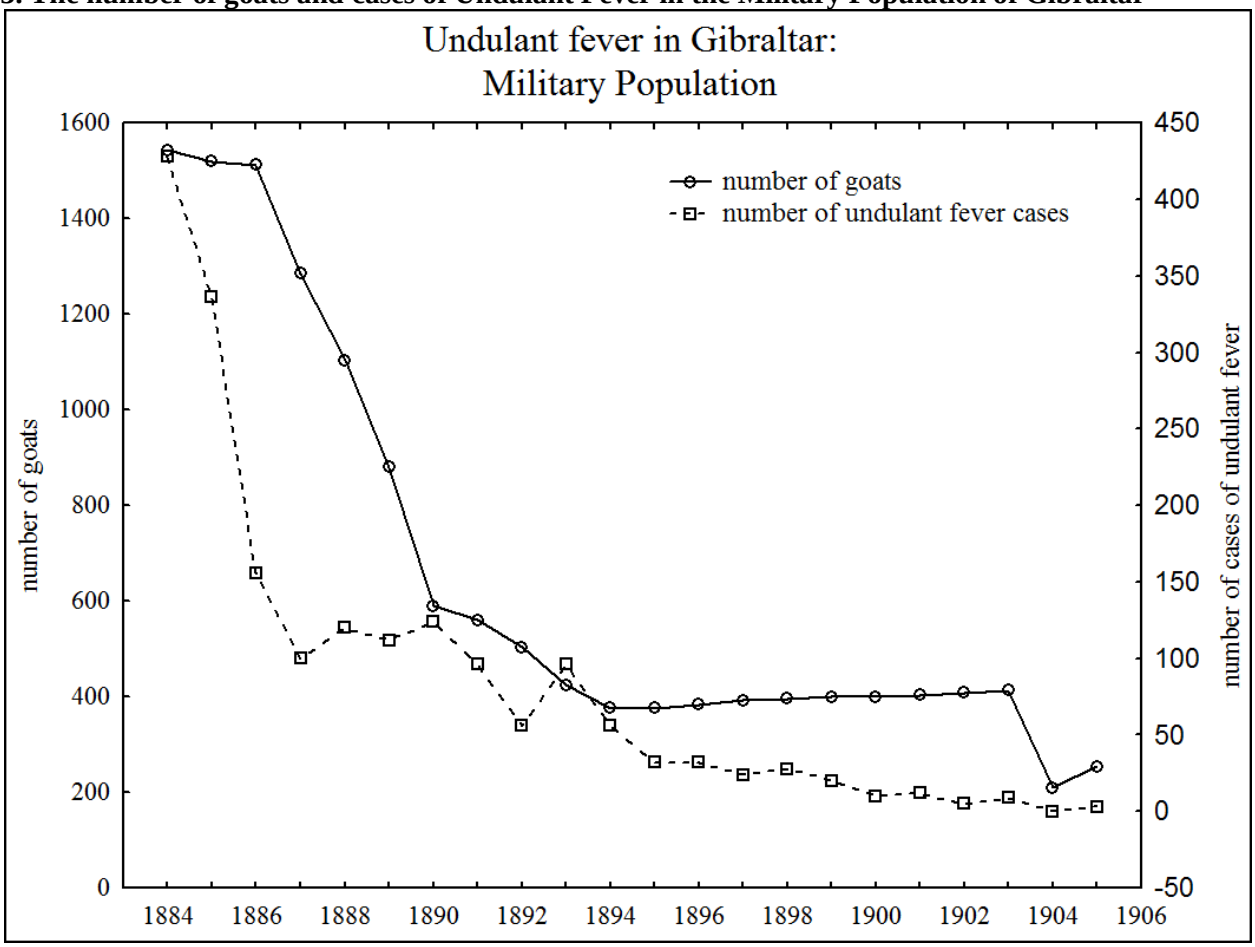
[47] Horrocks, 1907, 54.
[48] one male 35-44 years old and one male between 45-54 years of age.
[49] William Heaton Horrocks, *Annual Report on the Public Health of Gibraltar for the year 1904*, 1905, 6.
[50] C. E. P. Fowler, *Annual Report on the Public Health of Gibraltar for the year 1909*, 1910 8.
[51] Because of War World II, the government of Gibraltar did not publish annual health reports from 1940-1944. 1967 is the last year for which we could access the public Health Reports

preceding and following 1962, we suspect that the disease probably originated in Spain from consumption of fresh cheese.

Undulant Fever among the Military

The first mention of Mediterranean fever among the troops comes from the 1878 Medical Department Report, and by 1880, 194 cases of undulant fever were reported. The first systematic empirical accounts begin in 1884 when Admission and Discharge books became available. As we can see from Figure 3, undulant fever appears to have peaked in 1884 with approximately 428 cases and continued to fall until no cases were reported in 1908. There was, however, a resurgence of the disease, a cluster of 14 cases in 1909.

Figure 3. The number of goats and cases of Undulant Fever in the Military Population of Gibraltar



Our final observation notes the discovery made by Horrocks[52] on June 23rd 1906 which linked the number of goats to the number of cases of Mediterranean fever.[53] In Gibraltar, undulant fever among the

[52] It should be noted that Dr. T. Zammit had already discovered that goats were the reservoir for *B. melitensis* as early as 1904, and, as a fellow member of the Mediterranean Fever Commission (MFC), Horrocks was well aware

military was (1) never as severe as that in Malta and (2) fell to insignificant numbers after the 1909 epidemic.

Malta

As Figure 2 illustrates, the experience of undulant fever in Malta stands in sharp contrast to that of Gibraltar. The rates were at least ten times higher than those experienced in Gibraltar, and significantly, undulant fever in Malta was endemic to the islands. The history of undulant fever in Maltese Islands is well documented, and the reader here is advised to consult numerous authorities that address such issues as the history of discovery, epidemiology, prevalence figures, health policies and initiatives. Our examination is focused on using the Maltese experience as a foil against which undulant fever in Gibraltar can be more clearly understood.

Three points of interest, nonetheless, warrant repeating here. First is the fact that among the civilian population, the occurrence of undulant fever remained high as opposed to the experience of the military community in 1906. As a case in point, the average number of cases from 1899 to 1905 among the Navy was 240. Still, there were temporary periods of respite; in 1906, there were only 105 cases of undulant fever in the Navy.[54] The reduction was the direct result of the 1906 Mediterranean Commission measure that forbade Navy and Military officers to consume goats' milk but supplied them with condensed or tinned milk. A similar reduction in the number of cases was observed among the troops in 1906. The intervention by military authorities represents a classic illustration of how removing the source of infectious disease can break the chain of infection. The second feature, unusual for Malta, was a noticeable decline in undulant fever cases after the opening of the pasteurization centre in 1938 and in the period from the beginning of World War II until 1946. This first significant decline observed in Malta was due to the simple fact that food sources for goats were difficult to find, and many goats were sacrificed to feed a population also in dire need of sustenance.[55] A third remarkable feature to note when tracking the case prevalence of undulant fever in Malta is the dramatic, but short-lived, increase in 1946, 1947 and 1948. After this spike, the number of cases continued to decline well into the 21st century.[56]

Goat-herding in Gibraltar and the Malta Nexus

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of this discovery. He was Zammit's supervisor at the time and tried to take credit for Zammit's discovery; see Wyatt, 453.

[53] As important as this observation was, it must be recognized that the actual number of goats as the predictor for undulant cases may not be the significant factor. For example, in 1909 when goat numbers were much lower than in the previous years, an outbreak of undulant fever occurred because of four infected goats imported from Malta.

[54] Major D. J. Vassallo, "The Corps Disease: Brucellosis and Its Historical Association with the Royal Army Medical Corps," *Journal of the Royal Army Medical Corps*, vol.138, no.3, Fall 1992, 143; J. W. H. Eyre and M. S. Durh, "The Incidence of Mediterranean Fever in Malta and its relationship to the size of the goat population," The Lancet, vol. 179, no. 4611, Winter, 1912, 88.

[55] Cassar, 246; S. Busuttil, "Agriculture in Malta: A historical note," in *Options Méditerranéennes: Série B. Etudes et Recherches no. 7, Malta: Food, agriculture, fisheries and the environment,* ed. S. Busuttil, F. Lerin, and L. Mizzi, (CIHEAM- IAMM, Montpellier), 1993, 21.

[56] For more information on the Maltese civilian experience: H. Vivian Wyatt, "Brucellosis and Maltese goats in the Mediterranean", *Journal of Maltese History,* vol. 1, no. 2, Fall 2009, 10-13.

The presence of domestic goats on the Rock dates back to at least 1827. Andrew Bigelow, traveler[57] to the Mediterranean region, noted that there was a limited, but nonetheless important, local supply of milk derived from goats grazing on the upper portions of the mountain. While the goats were owned by separate families, they milled together in one herd. At sunrise, 'two of three goatherds set forth to collect them, beginning at one end of the town and proceeding through the principal streets, to issue at the opposite gates…They seem to have instinctively come under the military discipline that reigns throughout the garrison.' Much like the civilians of Gibraltar, the lives of the goats appeared to be regulated according to the demands of the fortress. After milking, the seemingly intelligent and docile creatures were left to their own devices, and just before gun-fire, 'they form themselves again in battalion' and, ostensibly unaware of their surroundings, they would march back home. Bigelow remarks on the comical scene 'of a motley herd' entering through the grand gates, 'whimsical enough especially in contrast with the objects around.'

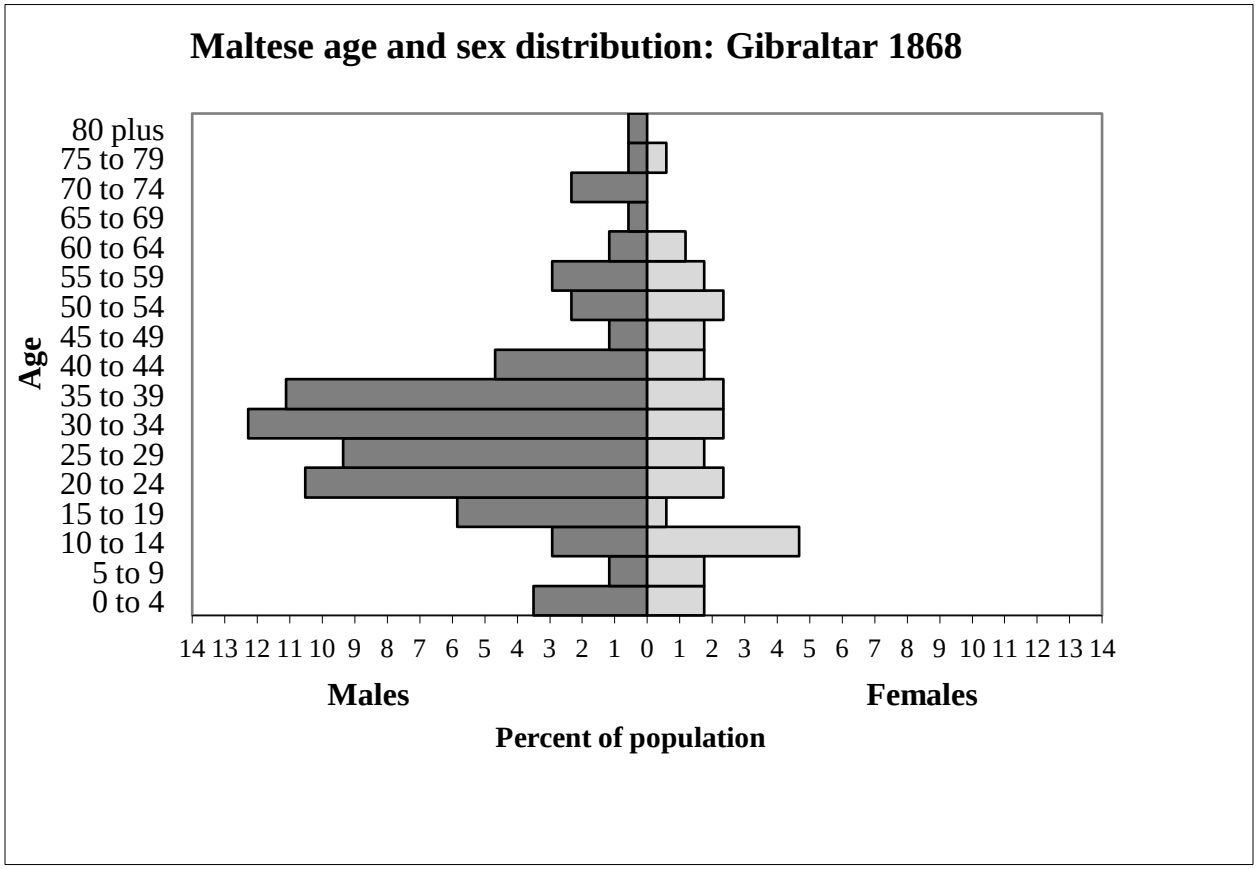
Gibraltar's Officer of Health, John Hennen,[58] adds to Bigelow's account affirming the practical need of goats' milk as local source of food to the garrison particularly during periods of hostility between Spain and Gibraltar when the free exchange of food stuffs between the two locals would be interrupted. A similar conviction was expressed fifty years later when E. B. Ewart of Royal Engineers wrote to the Inspector General of Fortification, stating that goats were a welcome commodity in Gibraltar '...in order that the inhabitants both military and civilians may reap the benefit of a cheap and abundant supply of milk.'[59] He also reiterated the need for 'proper regulation' of the whereabouts and number of goats on the Rock; goats were allowed to graze on the upper portions of the western side of the Rock only if passes were granted to the goat keepers by the royal engineers.

The Maltese goat-herder emerged as a milk supplier around 1834 when the census of that year shows that the population of Maltese on the Rock was less than 1% of the approximate 15000 civilians. While the Maltese had opportunistically filled the labour void[60] as coal heavers, they came to dominate the milk trade in Gibraltar. The tradition of goat-herding, the Maltese goat's reputation as a high yielding[61] producer of good quality milk, the fact that the Maltese were part of the British Empire, and 'the poverty of grazing' on the Rock reinforced the status of the Maltese goat as a reliable and convenient food supply as opposed to milk from Spanish goats or pasture-hungry cows. From a mere handful of individuals, the Maltese presence on the Rock grew to 171 strong by 1868. Like many migrant groups, the Maltese community was predominantly male,[62] the majority of them being aged 15 to 44 (see Figure 4). For example, in 1868, there is evidence that there was an increasing number of goat-herders (n=26) in

[57] Andrew Bigelow, "Chapter III: Gibraltar -Animal Sagacity," in *Travels in Malta and Sicily with Sketches of Gibraltar in 1827* (Carter Hendee and Babcock, Boston), 1831, 76-77.
[58] John Hennen, "A Sketch of a Plan for Memoirs on medical topography," in *Sketches on the medical topography of the Mediterranean comprising an account of Gibraltar, the Ionian Islands and Malta,* (Thomas and George Underwood, Fleet Street, London), 1830, 56.
[59] E. B. Ewart, *Royal Engineers to the Inspector General of Fortification Report*. May 1st, 1882.
[60] Lawrence A. Sawchuk and Stacie D. A. Burke, "The Barefooted Foreigner: A Case Study of the Scapegoat in Nineteenth- Century Gibraltar," *Current Anthropology*, vol. 49, no. 3, Summer 2008, 512.
[61] Maltese goats are known to have the highest milk yield, of 357 kg per lactation, days in milk (DIM); J. M. Serradilla,, "Use of high yielding goat breeds for milk breeding." *Livestock Production Sciences,* vol. 71 no., 2001, 63.
[62] Sex Ratio was 271.74, or approximately 272 males for every 100 females.

Gibraltar, and the majority were of Maltese origin. As the Maltese population grew in numbers, [63] so did their dominance in the milk industry.[64]

Figure 4. Age and sex profile for the Maltese population resident in Gibraltar, 1868



In Gibraltar, the tradition of goat-herding and using raw goats' milk continued well into the 20th century, although their laws regarding goat's milk consumption (i.e. boiling milk prior to consumption) had come into full force. As Gibraltarian Benady notes, goats were kept by Simon (El Cabrero) on the Upper Rock, and he would herd them into town and milk them for each household.[65] Even though the goats' movements were strictly regulated by the military, there was a social and communal aspect to the presence and function of goats on the Rock because they were part of the everyday life of the Gibraltarian. One Gibraltarian, R. Garcia recounts a personal recollection of the daily interaction of a goat and his mother in the late 1920s:

'A goat would be brought to the doorstep of [my mother's] flat and milked on the doorstep. She would feed the goat a slice of bread, which the goat thoroughly enjoyed. One day, the milkman brought a different goat instead of the regular one, and this new goat got the slice of bread. A while later, that same

[63] Between the censuses of 1871 and 1881, the number of immigrants grew from 650 to 702 (a growth rate of 12% per annum). The Maltese community reached its maximum size in the 1890s with roughly 1000 inhabitants.
[64] By 1881 for example, there were thirteen milk sellers: three from Spain, three local and seven from Malta.
[65] Samuel M. Benady, *Memoirs of a Gibraltarian*, (Gibraltar Books Ltd, Grendon and Northants), 1993, 8.

morning, there was a noise as if someone were pushing against the front door of the apartment. When they went to see what it was, my mother found that the regular goat had managed to evade its owner and had made its own way to the flat in search of its slice of bread! It was duly rewarded.'[66]

Figure 5. Women milking goats in Gibraltar. ca. 1906

Source: (Robert J. Urie`s, A Trip to the Orient: A story of a Mediterranean Cruise, 1907)

Despite the amicable relationship between Gibraltarians and the goat-herding tradition, the number of goats permitted in Gibraltar after 1885 progressively declined as did the number of goat-herders.[67] In the period from 1891 until 1900, twenty-nine goat herders remained; by 1911, there were four; then in 1921, seven goat and cow herders remained.[68] The question arises: why was there a reduction in the number of grazing passes and in turn the goats on the Rock? There are a number of possible reasons. First, there was the issue of nuisance and degradation to the environment. In a limited area such as Gibraltar, the predominantly woody topography of the top of the Rock offered a delectable buffet for the goats' voracious feeding habits. Unlike Bigelow's 'docile' and obedient goat, these animals caused major environmental damage and degradation by consuming virtually all organic material on site such as leaves on bushes and trees. Furthermore, inexperienced herdsmen can find it difficult to control goats because they can easily jump over fences and barriers, climb trees, cliffs, rocks, and other areas that are not accessible by other ruminants.[69] Medical Officer of Health, Major Fowler in 1909 noted, 'the

[66] Personal communication from Richard Garcia to author, L. Sawchuk, 2013.
[67] This stands in strong contrast to the Malta experience. These goats were sent to Malaga, La Linea Oran, Algiers, and Tangier; Horrocks, 1907, 64.
[68] Gibraltar Government, *Gibraltar census, 1921*.
[69] P. Morand-Fehr, A. Bourbouze, H. N. Le Houerou, C. Gall, and J. G. Boyazoglu, "The role of Goats in the Mediterranean Area," *Livestock Production Science*, vol. 10, no.6, Winter 1983, 569, 579, 573 and 579.

damage caused by goats to trees and to vegetation, as I have on many occasion seen them trespassing on parts of the Rock, where they should not have been...'[70] It appeared that complaints of nuisance were common. As goat-herders openly defied, 'any restrictions on the wandering of their flocks, although grazing passes were suppose to limit such areas.'[71]

Second, there was the issue of hygiene, since goats created unsanitary conditions as they were herded through the streets.[72]And, 'the accumulation of manure in the vicinity of every cow or goat-shed…form the breeding ground of myriads of these flies of various sorts, but more especially the ordinary house-fly.'[73] The presence of the goats on the upper portions of the Rock, posed a significant threat to the contamination of the water supply catchments that were newly erected at the beginning the twentieth century for both the military and civilian populations.

Finally, by the 1870s, attitudes regarding the Maltese presence on the Rock began to worsen with calls for halting Maltese immigration. Perhaps the most noteworthy of these came from Gibraltar's Bishop Scandella who, depicting the Maltese in uncharitable terms, recommended cutting off their immigration to the Rock. His reasons were:[74]

1. With some honourable exceptions, only the scum of that people betakes itself hither: the worthless, and particularly those who, on the expiration of their imprisonment, have to look elsewhere for that subsistence which they cannot honestly earn in their own country.
2. Employers have no means of satisfying themselves as to the honesty, ability and activity of those immigrants.
3. Once they have landed here, it is not easy to send them back to their island home or to get rid of them, particularly as they are excessively hardy and inured to want, so that they need but little to live on, and that little is readily found among their own. Were a Maltese unable to eke out a livelihood here, it is not probable that he could maintain himself on his own barren island.
4. As is the case with every British subject habituated to vice, the Maltese becomes, in general, a lasting calamity for this place...
5. As in virtue of their nationality, they cannot be compelled to leave the Garrison, they prove a source of a very serious evil in time of war of epidemic.

The year 1885 was the breaking point in relations with the Maltese immigrants because they now served as a convenient scapegoat for being the source of the dreaded cholera.[75] Shortly after the cessation of the epidemic, *The Times* out of London ran a series of three columns describing conditions in Gibraltar and their link to cholera. In the column titled, 'Cholera in Spain: The Housing of the Poor at Gibraltar,' we see the local perceptions of the Maltese reaffirmed in most unflattering terms:

During the last few years Gibraltar has been *invaded* by more than 1000 Maltese British subjects. There are inhabitants who can remember the time when there were only two Maltese in the entire colony: but in an evil hour, a firm sought to defeat a strike of Spanish coalheavers by the importation of Maltese

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[70] C. E. P. Fowler, *PMO Rem., No. 128 688,* 1909, 1; Fowler went so far as to proclaim that the restriction on grazing passes were actually ineffective at regulating the number of goats on the rock, as '[a]ny resident can buy and breed goats so long as overcrowding does not take place and nuisance is not caused by their presence.' The restriction on passes, 'would however on the other hand, tend to interfere with the well being of the animals in so much that many of the others would be entirely stall-fed.'
[71] Fowler, 1909, 18.
[72] Benady, 8.
[73] Fowler, 1909, 18.
[74] Gibraltar Government Archives, *Bishop Scandella to Governor Napier, 7th October*, 1876.
[75] Sawchuk and Burke, 511.

labour. This gave an impulse in a new direction to the flow of emigration from the island of Malta, and the new comers proved to be the *most troublesome* section of the population…These *unwelcome* British subjects, who speak a *bastard* Arabic, are a *bloodthirsty set*. They never wear shoes, but *creep* about silently on bare feet. The criminals among them, of whom, unfortunately, there is a goodly proportion, can scarcely be qualified as the bold burglar type. They are better described as what are technically called 'area sneaks.' [*emphasis added*]

From the colonial perspective, the Maltese represented a real problem of overcrowding. They were British subjects, and, once in Gibraltar, they could not be compelled to leave. By the 1890s, it was clear that colonial officials were no longer tolerant of continued Maltese immigration to Gibraltar. In a letter to the Colonial Secretary dated May 25th 1894,[76] Gibraltar's Governor wrote:

It is most necessary that this addition to the resident population should be prevented and I request that I will have the authority to prohibit their entry and the governor of Malta may be moved to issue a notice warning inhabitants of Malta from coming here for, as they will not be allowed to work here. There will be no difficulty obtaining Spanish labour which will not be more costly and will have the great advantage of not increasing the resident population[77]

Ironically, curtailing Maltese immigration along with their goat-herding tradition had little connection with undulant fever at this time. During this period, the etiology of undulant fever was poorly understood with little thought given to the goat as a source of the disease.[78]

Milk Consumption Traditions

By the 1890s, when the milk supply began to come under scrutiny from the health authorities, we gain a clearer understanding of the milk drinking customs in Gibraltar. Four aspects of the situation in particular became apparent. First, although there was a longstanding tradition of goat-herding in Gibraltar, there was no distinct preference for consuming either goats' milk or unpasteurized milk. Although many Gibraltarians drank goats' milk, it was not uncommon to drink a mixture of milk from both cows and goats imported from Spain. The upper class, on the other hand, disdained goats' milk, and consumed cows' milk instead. It has also been noted that goats' milk was used only for baking purposes in the hospital, and cows' milk was reserved for drinking. Second, only a small proportion of the milk consumed in Gibraltar was locally derived, since many of the goat farms on the Rock were abolished by 1893.[79] Most of it, 5/7[80] came from Spain. Third, until the 1890s, Gibraltar authorities had little control

[76] The stimulus for this statement came from concern over employing the Maltese for work on the dockyard that was to begin in October 1894.

[77] Gibraltar Government Archives, *CO 91/403, Gibraltar Governor Robert Biddulph to the Colonial Secretary May 25th*, 1894.

[78] In fact even in Malta; Gibraltar Government Archives, *The Report of the Public Health of the Civil population of Malta for 1899,* 4, states numerous possibilities regarding the cause of undulant fever, including air-borne or water-borne modes of transmission through drainage systems. Interestingly, in 1907 when the goat was known to be the carrier of undulant fever, in Horrocks' seminal piece, he holds the Maltese goat responsible for undulant fever in Gibraltar: "whereas in 1883 all the goats on the Rock were Maltese and Malta Fever was then very common, the disease had disappeared in 1904 with cessation of importation of Maltese goats due to the withdrawal of grazing passes and the increase in the cost of shipment, and their replacement by Spanish goats;" In the years to follow, examination of cases would indicate that the majority of cases were coming from goats in Spain. Horrocks,1904, 143; Horrocks, 1907, 56- 58.

[79] New New goat sheds are constructed in 1893, however; W. G. Macpherson, *Annual Public Health Report on the Health of Gibraltar for the year 1892*, 1893, 12-14.

over the quality or purity of the milk supply from Spain. Fourth and last, milk from Spain came in two forms: *leche pura* and *leche con agua*. *Leche pura* cost more at 3d or 4d and was most likely purchased by the affluent. *Con agua* cost 2d and 2 1/2 a pint, but 60% of it was water drawn in all probability from a surface well in La Linea. Those of lower socio-economic status probably did not know that they were purchasing a diluted commodity.[81]

Unlike Gibraltar, the preferred drink in Malta was goats' milk of local origin, with 'sheep and cow's milk being used only exceptionally.'[82] Furthermore, the only form of goat milk was fresh milk.[83] The important point here was the culturally entrenched preference for unpasteurized goats' milk. The goat was considered to be 'a household feature of Maltese culture and daily life.'[84] The reasons for this were: environmental factors, a belief system and not least, poverty. Like much of the Mediterranean, Malta lacked refrigeration. The high concentration of the population and short distances between villages and towns, and 'the poverty of grazing land,' such that the wasteland served as natural grazing land,[85] made the goat an ideal candidate for distributing milk to customers' doorsteps.[86] The belief system was based on conviction that boiling milk:

1. Ruined the quality and flavour of milk;[87]
2. Was considered superfluous by the people because they knew that the Maltese goat did not suffer naturally from tuberculosis for which the precautions of boiling had been advocated abroad by members of the Mediterranean Fever Commission; [88]
3. Was unnecessary because having the goat milked at the door meant that contamination or adulteration of the milk was not possible.[89] This had proven true in other locations. In Gibraltar, it was found that milk brought in from Spain was adulterated. In some cases 60% of that 'milk' was water;
4. Was irrelevant. They believed any problem associated with goat milk occurred because the goat had eaten a poisonous plant (Euphorbiaceous plants or in the vernacular – as Tenhout);[90]
5. Was an unproven technique. With their distrust of scientific findings, 'the general public has yet to be convinced that an apparently normal beverage drawn straight from the familiar goat can be productive of a deadly fever';[91]
6. Was impractical because the poor simply did not have the means to boil milk;[92]

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[80] W. G. Macpherson, *Annual Public Health Report on the Health of Gibraltar for the year 1891*, 1892, 21.
[81] Lawrence A. Sawchuk, Stacie D. A. Burke and Janet Padiak, "A Matter of Privilege: Infant Mortality in the Garrison Town of Gibraltar, 1870-1899."*Journal of Family History*, vol. 27, no. 399, Fall 2002, 422.
[82] Themistocles Zammit, "Milk Poisoning In Malta," *The British Medical Journal*, vol. 1, no. 2054, Spring 1900, 1151.
[83] One traditional delicacy is the goats' milk that is still consumed today: cheeselets, "gbejniet"; Vassallo, 144.
[84] Azopardi, 22.
[85] Busuttil, 21.
[86] Azopardi, 22.
[87] Zammit, 1900, 1151; H. Vivian Wyatt, "Brucellosis and Maltese goats in the Mediterranean," *Journal of Maltese History*, vol. 1, no. 2, Fall 2009, 10.
[88] Cassar, 245; Zammit points out that even if the milk in the goat is uncontaminated, during milking, the skin of the animal, the hands of the milker and the tin measure that collects milk afford ample opportunity for pathogenic microbes to enter into the goat; Zammit, 1900, 1152.
[89] Zammit, 1900, 1152; J. E. H. Gatt, "Undulant Fever in Malta," *The British Medical Journal*, vol. 1, no. 4025, Winter 1938, 454.
[90] This theory was proven false by the researchers appointed by the Commission; Zammit, 1900, 1151.
[91] Themistocles Zammit, "Undulant Fever in the goat in Malta," *Annals of Tropical and Medical Parasitology*, vol. 16, no. 6, 1922, 5.

The Introduction of Dairy Legislation

After the last appearance of cholera in 1885, as there was no longer a 'single, great corrupter of death,'[93] the Medical Officers of Health continued to press for sanitary reform. Their attention, however, was now focused on the excessive number of deaths in infants and children. Amounting to almost a third of all deaths, the mortality rate for infants and children was considered, 'one great blot on the sanitation of Gibraltar.'[94] Armed with the growing knowledge of germ theory, public health officials set in motion new, effective measures, such as ensuring a good supply of milk.[95] The milk byelaws of 1893, focused on milk adulterated by the addition of impure water to cows' and goats' milk from Spain, would prove to be forward thinking and most likely contributed to keeping undulant fever at bay.

In 1894, new byelaws were introduced, imposing fines on vendors for adulterating milk and requiring milk shops to be licensed. Other efforts to ensure that Gibraltarians were consuming pure milk included the purchase of a milk sterilizer for use by the station hospital and the establishment of a bacteriology laboratory in 1897.[96]

In April of 1907, a new law was passed requiring that all milk introduced into Gibraltar, from Spain in particular, had to be boiled.[97] By 1913, an extensive series of byelaws was introduced under the heading, *Control of the Milk Supply of Gibraltar and with respect to Dairies, Cowsheds, Goat sheds, and diseased Cows and Goats in Gibraltar*. This piece of legislation was the first to state explicitly that milk from a diseased cow or goat was not to be mixed with any other milk. It also stipulated that milk from diseased ruminants should not be sold or used for humans, or sold or used for food of other animals unless it had been boiled. The law specified two diseases in animals: tuberculosis and Malta Fever.[98]

Steps taken by the Health Authorities' efforts to minimize attacks of undulant fever began in 1905, when major advances in understanding Mediterranean Fever began to unfold. First, the disease was made notifiable. 1905 was also the year that saw a small resurgence of eleven cases as opposed to the usual morbidity rate of zero to four cases. Consequently, the Health Authority in Gibraltar issued warnings to the civilian population regarding the dangers of drinking unboiled goats' milk. Pamphlets were issued by the public health department.[99] Third, in 1906, the Sanitary Commissioners sanctioned the performance of the 'blood test' in the laboratory free of charge. In 1909, the troops in garrison were not allowed to consume any fresh milk whatsoever. Gibraltarians again were warned against drinking raw

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[92] Wyatt, 2009, 12.

[93] Sawchuk, 277; Staples, *The Chronicle,* 1886.

[94] Gibraltar Government Archives, *Sir Lothian Nicholson to the Marques of Ripon, May 18th,* 1893.

[95] Sawchuk, 277.

[96] Sawchuk, Burke and Padiak, 422.

[97] In 1910, about two-thirds of goats' milk came from Spain and a similar quantity of cows' milk that was produced locally was imported from Spain. The Sanitary Inspectors continually sampled imported milk to ensure milk was indeed boiled before reaching the consumer. However, locally produced milk was not required to be boiled; Fowler, 1910, 58.

[98] The point of labeling Mediterranean fever as "Malta fever" should not be lost on the reader. In 1909, Fowler suggested that in order to enforce registration of goat keepers and purveyors of milk on the Rock, and in turn gradually reduce the number of goats, clauses from sections 6 and 34 of the "Dairies, Cowsheds and Milkshops Order" should be introduced into the Public Health Ordinance of Gibraltar. This would give the Sanitary Commission freedom to limit the number of goats owned by an individual.

[99] Sir William Heaton Horrocks, *Annual Report on the Public Health of Gibraltar for the year 1905,* 1906, 16.

fresh milk, as 'they incur the grave risk of contracting this most obstinate disease.'[100] Finally in 1916, the Medical Officer of Health announced that no goats would be imported unless found free of infection.

In Malta, prior to the Mediterranean Fever Commission Report, there was health legislation regarding goat keeping and dairying. The Malta Sanitary Ordinances (No. III of 1904, Chapter II, Section V, Articles 79-100) was not intended to minimize undulant fever per se, but rather to ensure healthy goats and good quality milk. Pertinent to the transmission of undulant fever were the measures regarding the cleanliness of cow and goat sheds:

1. *All purveyors of milk be licensed and the license shall only be granted on condition that the dairy is well built, fitted with impervious floors, well ventilated, and otherwise sanitary and;*
2. *Dairies are to be kept clean and periodically lime washed; and*
3. *Vessels and utensils used for preservation and sale of milk are to be kept clean*

Such measures would have effectively curtailed disease among goats because undulant fever is passed in excrement and urine. Two years after implementation of the Malta Sanitary Ordinance however, the Mediterranean Fever Commission noted that most of these recommendations were not being carried out. When the Commission tried to enforce washing dairies with lime and laying down impervious floors, they were met with resistance and non-compliance. The goat herders felt they were being blamed for undulant fever in Malta. They believed that the government wanted to ruin them and went on strike from May to June1906.[101]

Changes to Milk Health Policy Emerge in Malta

Despite opposition by the goat herders and the public, the government was successful in implementing a number of progressive steps to combat undulant fever in Malta in the decades following the Mediterranean Fever Commission. Beginning in 1905, as in Gibraltar, Health authorities issued pamphlets on the dangers of drinking unpasteurized goats' milk, and disseminated this information through the clergy as well. In 1909, the health authorities gained increased control over 'purification of the milk supplies', and by 1910, the number of goats found to be infected and then slaughtered was no less than 461.[102]

More than a decade later than in Gibraltar and beginning in 1923, regulations for boiling milk were put into place. The focus was outside the home setting, and the legislation stipulated that unboiled milk could not be kept, sold or supplied in any hotel, coffee or other shop.[103] The second step, in 1931, came about because the government recognized that the best method of eradicating undulant fever in the population would be to find the sources of the disease and destroy the goat. Nevertheless, the government also realized that '[t]he goat-herds are an uneducated class, and much prejudiced against what they consider unnecessary innovations. It will probably take a long time before these prejudices are overcome, and the only alternative appears to be dairies or depots under government control.'[104] Accordingly, in 1932, a special committee was set up to facilitate the process of pasteurization. In 1933, the committee published a recommendation for the pasteurization of milk and, by 1938, the Milk Pasteurization Center

[100] C. E. P. Fowler, *Annual Report on the Public Health of Gibraltar for the year 1909,* 1910, 9.
[101] Major McCulloch, Major Weir and, Staff-surgeon Clayton, 1907, 259.
[102] Eyre and Durh, 89.
[103] Cassar, 245.
[104] Major McCulloch, Major Weir and, Staff-surgeon Clayton, 1907, 259.

was opened to improve milk consumption and nutrition. As the Medical Officer of Health noted there was '...no other single measure which would do more to improve heath, development and resistance to disease of the rising generation than a large consumption of milk.'[105] In an effort to increase milk consumption in Malta, the government intended to make pasteurized milk available at a lower price than the current charge for raw goats' milk. Health authorities were primarily concerned that neither children nor adults were consuming adequate amounts of milk or dairy products.[106] In addition to the pasteurization scheme, an educational program was launched with the aim of changing Maltese perceptions about milk consumption. It involved 'healthy propaganda' about the value of clean and safe milk, and the free distribution of the pasteurized milk in government schools.[107] In 1939, goats were prohibited from entering Valletta. During this year, the sale of goats' milk was banned in Malta. Not until 1957, would raw milk be prohibited in Malta.[108]

Quarantine Measures and surveillance of goats

When Zammit discovered, in 1905, that the goat was the reservoir of *B. melitensis*, the Sanitary Commission in Gibraltar took immediate steps to ensure that undulant fever would not prove to be a nuisance among the troops. In 1907, the Medical Officer of Health adopted the following measures:[109] Part of this step in combating the disease was taken in 1907 with the passing of a milk byelaw requiring Gibraltarians to boil imported milk, described above.

> (1) Regular and systematic examination of all goats now living in Gibraltar. Blood and milk from each goat have been examined twice during the year…..Meanwhile the public have been warned that all goats' milk obtained from herds in Gibraltar should be boiled before consumption.
> (2) Quarantine [110]all goats which are brought to Gibraltar until examination of the blood and milk have shown that they are free from infection. This will be done in the future and the Commissioners are now preparing a goat shed at the North Front, where owners desiring to bring goats into Gibraltar will have to keep them until they have been declared free from disease.

The Health Authorities in Gibraltar seem to have been proactive in their efforts to eradicate undulant fever from the Rock given the fact that, at this time in 1907, no such regulation of the sale of milk existed in Malta.[111] A year later, Medical Officer of Health Fowler gave a resounding accolade to his predecessor and fellow Health officials for their management of the disease in Gibraltar:

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[105] Dr. G Apap, *GMR, Notes on the Milk Supply of the Islands of Malta, and Measures being taken by the Government to Increase and Improve the supply and Consumption of Milk*, 1937, IX Appendix C.
[106] S. F. Barnes, *GMR, Notes on the Milk Supply of the Islands of Malta, and Measures being taken by the Government to Increase and Improve the supply and Consumption of Milk,* 1937, Appendix I.
[107] Gatt, 1938, 454; J.E.H Gatt, "Health and Milk Supply of Malta (Correspondence)," *The British Medical Journal,* vol.1, no. 3989, Summer 1937,1282.
[108] Cassar, 246.
[109] These measures were also published in the Department of the Army Medical Department Report in the following year
[110] In 1909 quarantine was limited to 14 days. Unfortunately, this proved to be ineffective, as the bacteria can last in a goat for 2 years and post birth secretions are higher in bacteria.
[111] J. F. Anderson, "The relation of Goat's milk to the spread of Malta Fever," *Hygienic Laboratory---Bulletin No. 41: Milk and its relation to the Public Health,* 1908, 199.

> No case was reported during the year, which speaks well for the late medical officer of health, Major Horrocks, and shows the *enlightened views* [*emphasis added*] taken by the authorities of this Colony as compared with Malta, where the incidence of the disease amongst the civil population has diminished but little, though practically extinct amongst the Navy and Army.[112] Fowler also claims to have personally inspected most goats on the Rock.[113]

The Effectiveness of legislation

From the standpoint of the Health Authorities, the legislation implemented successfully reduced contact with undulant fever in Gibraltar. Time and again, the Medical Officer of Health in Gibraltar referred to evidence of declining rates of undulant fever in the population and declining rates of micrococcus in goats. By 1912, Fowler credited the legislation implemented in 1907 with the positive result due to the fact 'that the infection amongst the goats is dying out,' as only 5% of goats yielded a reaction *B. melitensis*, compared to 10% a few years before. By 1913, no case of *B. melitensis* was detected in the milk of goats in Gibraltar, and Fowler was pleased to speculate that undulant fever 'will soon be a thing of the past.'[114] There was a slight resurgence of 7% of goats yielding a positive reaction to the micrococcus in 1915, but, significantly, no case of undulant fever was contracted from locally produced milk over the previous six years and there never would be another case that originated from goats in Gibraltar.[115] Reaffirmation of the need to uphold the legislation on restricting the importation of goats and the sale of unboiled milk was based on the fact that, immediately across the border in Spain, goats were still 'badly infected'[116] and that all cases were of Spanish origin. Even though Health Authorities in Gibraltar had no jurisdiction to monitor the health of goats and the quality of milk, their hands were not completely tied as they required milk vendors to provide up-to-date lists giving the names and localities of the farms in Spain from which milk was obtained.[117]

Arising from the observation that rates of undulant fever was declining in Gibraltar, we pose the question: why were legislations successful in minimizing outbreaks of undulant fever in Gibraltar, but not in Malta? The primary cause of failure to control undulant fever in the goat in Malta was structural scale effect issues relating to (1) legislation and (2) enforcement of recommendations. In Gibraltar, the careful and regular inspection of goats for *B. melitensis* and milk supplied from Spain, a seemingly easy task, required adequate staffing and a concerted, vigilant attitude. Second, the compliant nature of the civilians of Gibraltar, who trusted and respected the Health Authorities, was strongly reinforced by the fact that members of their own community were members of the Sanitary Commission.

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[112] William Heaton Horrocks, *Annual Report on the Public Health of Gibraltar for the year 1908*, 1909, 7
[113] C. E. P. Fowler, 1909.
[114] G. Dansey-Browning, *Annual Report on the Public Health of Gibraltar for the year 1913*, 1914, 7.
[115] G. Dansey-Browning, *Annual Report on the Public Health of Gibraltar for the year 1915*, 1916, 25.
[116] G. Dansey-Browning, *Annual Report on the Public Health of Gibraltar for the year 1917*, 1918, 20.
[117] G. Dansey-Browning, *Annual Report on the Public Health of Gibraltar for the year 1922*, 1923, 35.

A case from 1914 highlights how diligently the bye-laws were upheld and enforced. The Sanitary Commission imposed a fine on two vendors, Mr. Vega and Mr. Balloqui, for selling adulterated milk to Gibraltarians.[118] This particular incident illustrates the first and second of four factors that Heckathorn[119] has identified as important in intra-group compliancy: the strength of the sanctions, monitoring capacities, and the efficacy and cost of intra-group control.

Ironically, the quarantine measures actually had little impact on lowering the rates of undulant fever among the goats, because, although goats can appear free from infection, they can, at a later time, pass the micrococcus in their milk or to their offspring,[120] 'This points out what little value there is in quarantine regulations with regard to these animals, and also the emphasis on the care that should be exercised in allowing the importation of goats to the Rock.'[121] Quarantine was, however, an effective deterrent for further importation to Gibraltar. In 1907, a few Maltese goat herders wanting to take up the trade in Gibraltar, upon hearing of the quarantine measures that their goats would be subjected to upon arrival on the Rock, decided against pursuing migration to the Rock.[122]

Unlike Gibraltar, Malta lacked inspectors for routine inspections of livestock. The shortage of qualified staff perpetuated the cycle of infection when healthy and unhealthy goats were allowed to mingle. By comparison, Gibraltar's quarantine methods and legislation were superior to the haphazard and periodic inspections that were commonplace in Malta.[123] Here again, the scale effect exacerbated the problem in Malta where goats numbered in the 10,000s as opposed to the very small number on the Rock. So even with high rates of inspection in Malta, the scope of the problem was daunting. Matters were further complicated by the lack of coordination on the government's part in regulating both the dairy and agriculture industries.[124] Inspection and monitoring were easier in fortress Gibraltar where ingress and egress were carefully guarded when the gates opened and closed at sunrise and sunset. Consider the court testimony by one of Gibraltar's sanitary inspectors:

> At about 3pm on the 9th instant I meet the defendant in Town Range carrying a can of milk, … I stopped him and asked him to come with me to the Sanitary Commissioners Office to sell a pint of milk. He agreed but said he must fetch another can which he had in a yard opposite the place I met him and he said he made a mistake that the can was in another yard further up, I again went with him in another yard … where he pretended to slip and upset the can of milk in the yard, I picked up the can and found an ounce or so remaining in it, I showed it to the sanitary assistant

[118] It should be noted however, that many of the milk vendors were boys 12 to 15 years of age and were not likely to be convicted if caught selling impure or previously unboiled milk.

[119] Douglas D. Heckathorn, 1990, "Collective Sanctions and Compliance Norms: A Formal Theory of Group-Mediated Social Control," *American Sociological Review*, vol. 55, no. 3, Summer 1990, 366.

[120] Quarantine was limited to 14 days as the bacteria can last in a goat for 2 years and post birth secretions are higher in bacteria.

[121] Fowler, 1910, 8; once infected, a goat can secrete this germ at irregular intervals, and that when it is apparently cured the germ can be recovered from its secreta or its internal organs after post mortem examination.

[122] Williams Heaton Horrocks, *Annual Report on the Public Health of Gibraltar for the year 1907*, 1908, 10.

[123] The examination and destruction of infected animals was "haphazard" given the fact that there was no complete registration and no complete marking of goats; National Archives Malta, *Report on the Health of Malta during 1936-37*, 1937, 14.

[124] Up until 1955, there was no coordinated Government policy on aid to agriculture. A Department for the sector existed, but it cannot be claimed that farming and dairying problems were treated with any efficiency. No sustained efforts to help farms to increase their output were made. This was due in part to a virtually complete absence of personnel with any specialized knowledge; Busuttil, 1993, 25.

> who in the presence of the defendant and the medical officer of health divided it into three portions … only to find it adulterated, deficient of milk fat. [125]

The zeal shown by the inspector in tracking a 'suspicious milk vendor' coupled with the ability to take immediate action by the Health authorities speaks directly to the efficiency and ease by which disease prevention could occur in the confines of a small-scale society. This particular example reinforces Heckathorn's second measure of intra-group compliancy in terms of monitoring the population to ensure compliance with health byelaws, which was also demonstrated in the scenario below.

A Most Telling Outbreak

The case study of an outbreak in 1909 is yet further testimony to the ease of tracking the disease source in a small-scale setting.[126] In October of 1909, there was a recrudescence of undulant fever among the troops of fourteen cases. At this time, most of the regiments stationed in Gibraltar used only tinned or condensed milk occasionally supplemented by milk from the market or that brought by a few married families. But headquarter companies for Norfolk and Bedford Regiment used milk that was supposed to be boiled before consumption as required and recommended by the health Authorities. The milk supplier for these regiments and the Hospital was Mr. Debono, a Maltese immigrant.

Dr. Fowler compiled statistics of the outbreak, and from that, he drew a number of conclusions. Eight of the subjects drank infected milk while in hospital, and three others drank Debono's milk supplied in their rations. The officer's daughter is most definitive example of the association between contaminated milk and cases of undulant fever. Milk supplied to her came solely from Debono, and, above all else, she openly admitted that she did not boil the milk before drinking it. The evidence showing that the outbreak was confined to a defined group and did not spread to the surrounding civilian population adds weight to contaminated milk as the sole source of the disease.

Further inquiry into the origin of the goats proved equally telling. After the outbreak, investigation revealed that a few months earlier Debono had purchased fifteen goats and two kids from Malta. All animals had been given a clean bill of health from the veterinary surgeon to the Public Health Department of Malta. Upon arrival in Gibraltar, the goats were placed in quarantine at the North Front for fourteen days, and the blood of each was examined on three separate occasions for *B. melitensis*. Two goats yielded a positive reaction and were ordered to be disposed of outside Gibraltar. The other fifteen goats were passed over to Debono. At a subsequent examination on October 4th, four were found positive. One of these goats bore a suspicious resemblance to a condemned goat from the quarantine period in April.

Armed with this information, Fowler took immediate action and ordered that Debono's goats be removed from the food chain. Debono promptly sold the animals to a buyer in Tangier. After the

[125] Sanitary Commissioner's Report, *Letter to the Colonial Secretary by W. Cerutti, Sanitary Inspector, Oct 12th,* 1914.

[126] We should note, as well, that in order for an outbreak to occur, the minimum requirement is for only one infective goat to supply multiple patrons.

unfortunate episode, Debono, like many of his fellow goat-herders, returned to Malta. Fowler vowed never again to import goats from Malta. It is possible that, as of 1909, no more goats were ever exported to Gibraltar, as records indicate no more goats were imported from Spain.[127] By 1911, the Medical Officer of Health reported that no 'strange goats' from Spain or Malta had been introduced in Gibraltar.[128]

The second cause we must consider when comparing the undulant fever in Gibraltar and Malta, in concert with the scale effect operating on enforcement of legislation, is the largely non-compliant population in Malta. Their intransigence was driven by the goat-herders and milk vendors who refused to abide by the Mediterranean Fever Commission recommendations and other health authorities warnings. Their beliefs stemmed mainly from mistrust of government authorities and they feared losing their livelihoods.

Mistrust and non-compliancy: The uneducated goat-herder, the milk vendor and the disobedient civilian

Although there was opposition to milk legislation by goat herders and milk vendors in Gibraltar, there did not exist the widespread intra-group non-compliance as was observed in Malta. In Malta, the larger community of goat-herders could rally together and make their voices heard. Goat herding was not only an economic enterprise, but also a sophisticated, complex network that the civilian population depended on, and 'the government could not sacrifice the goat herder to minimize its own losses.'[129] The goat-herders in Gibraltar, however, had very little political or economic clout since they were few in number and largely of Maltese and Spanish origin. Both nationalities stood on the bottom rung of Gibraltar's social ladder.

Initially, after the creation of the Commission, five reasons account for the report's failure to alter the skepticism about the transmission of undulant fever among the Maltese public. First, they believed that the fever had no connection with goats' milk, but was due to inhalation of infected dust and dirt during the rebuilding of Malta's new water supply and drainage system. Second, they believed that the association between the goat milk and undulant fever was 'post hoc and the evidence was adduced by the Mediterranean Fever Commission as to the infectivity of the goats' milk…'[130] Others still believed that improvement of sanitary conditions, such as the removal of the military garrison to modern barracks was the actual impetus for the decline in the incidence of undulant fever.[131] Fourth, the Royal Commission of 1912 was told that the sanitary authorities blamed spread of undulant fever on the goat as an excuse for destroying them and, ultimately, ruining the goatmen.[132] Adding to their mistrust of the health authorities was the fact that goat-herders and milk vendors, being of the lowest class, were uneducated and largely illiterate and consequently unable to understand warnings published in pamphlets. However, even after warnings from the clergy, they did not take heed. The milk vendors were afraid of losing their livelihood because the public demanded fresh goats' milk, and they devised crafty ways to circumvent the 1923 bye-law. For example, the vendors would tether a goat to the door outside their shops so that they could serve

[127] G. Dansey-Browning, *Annual Report on the Health of Gibraltar for the year 1916*, 1917, 25.
[128] C. E. P. Fowler, *Annual Report on the Health of Gibraltar for the year 1911*, 1912, 8.
[129] Busuttil,1993, 22.
[130] Eyre and Durh, 88.
[131] Eyre and Durh, 88.
[132] Cassar, 245.

their customers fresh milk and avoid keeping a supply of milk on the premises.[133]Furthermore, after the opening of the pasteurization centre in 1938, many milk vendors did not want to stop supplying raw milk to hospitals and orphanages because it would mean breaking existing contracts, and destroying the multi-generational family tradition of supplying milk to these institutions. The deeply entrenched tradition of goat-herding partly explains why there was an illegal trade of raw milk in Malta.

Finally and most significantly, public confidence over the danger of consumption of raw milk was further weakened when both foreigner and local experts, expressed doubt on the veracity of the Mediterranean Fever Commission's findings. In particular, Agositino Levanzin, a pharmacist and local medical practitioner, Dr. Peter Aguis, who both owned and edited local newspapers, directly challenged the findings of the Commission. One eminent British Doctor, Hadwen, made personal attacks on the department of Medical Health and the Chief Medical Officer, adding great weight to the argument that the goat was not the only factor in spreading undulant fever. [134] A further illustration of the undermining of the department of public health was the scandal of 1911, when one of the Public Health employees was convicted of failing to destroy an infected goat, and in fact resold the goat for profit.[135]

The non-compliant attitude extended to the civilian population who were equally complicit in refusing to abide by the recommendations set out by the Health Authorities. As recounted by Zammit, [136] there was resistance by the local community who remained 'obdurate, or careless.' Gatt also reported in 1937 the Maltese were 'apathic and prejudicial even to passive resistance on the part of a considerable section of the community and the vested interests of the goat owner and milk vendor have proved insurmountable...'[137] Warnings spread by school teachers and publicized through educational health films, the clergy, and musical bands were all unable to change the opinion of the Maltese civilian.[138] Even as late as 1948, the Medical Officer of Health remarked that people continued to drink unboiled goats' milk, 'in spite of the fact that this year we made it a point to hammer this 'warning' into the peoples' heads.'[139] In 1954, in areas where the sale of raw goats' milk was forbidden, it was noted that goat-pens were found in the outskirts of all the villages and milk could be obtained cheaper when bought directly from the goatherd.[140] This example shows that consumers willfully flouted the law by purchasing raw goat milk. It also shows the vendors placed the milk in convenient locations to dodge the problem of entering villages and towns to sell milk. Here both the actor (the goat-herder/vendor) and group (the milk consumers) worked defiantly in concert to circumvent the health policy set out by Maltese authorities.

The year 1908 saw small improvements in milk consumption habits in parts of the Maltese population. Many affluent individuals had taken heed of the public health department's admonitions and

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[133] "Pasteurisation of Milk," *Report of the Commission appointed to Investigate and Report upon the Feasibility of introducing a supply of Pasteurised Goats Milk in the Islands,* 1932.
[134] John Rizzo Naudi, *Brucellosis: The Malta Experience, A Celebration 1905*-2005, (Publishers Enterprises Group Ltd, Malta), 2005, 107.
[135] The employee was 'sentenced to 7 years hard labour and perpetual interdiction by the presiding judge.' It is noteworthy that the public was well aware of this case, as it was reported in the Malta Herald 13th March 1912 and this individual was known to have been in a habit of repeatedly committing the aforementioned offence. Rizzo,113.
[136] Zammit, 1922, 10.
[137] Gatt, 1937, 1282.
[138] Azopardi, 23; Cassar, 245
[139] National Archives Malta, *Report on the Health of the Maltese Islands during 1948-49*, 1949.
[140]J Galea, *Report on the Health Conditions of the Maltese Islands and on the Work of the Medical and Health Department for the year 1954,* 1955, 26.

were either drinking condensed milk or boiling the fresh variety.[141] Substantial changes in perception among the general population probably began with educating children on the dangers of consuming raw milk as there may have been a psychological impact from lessons on the benefits of pasteurization. This, coupled with free pasteurized cows' milk for students brought about the result: children lost their preference for goats' milk and, in particular, fresh milk.[142] However, this change in attitude would take many generations before adopted by the population at large and, in turn result in a substantial decline in undulant fever cases.

One final point on the subject of undulant fever in Malta that deserves mention is how life in that time of high background mortality[143] shaped the world view of the civilian population. While we draw heavily on official public health reports, 'the voice of the insider' is conspicuously absent from this paper as well as the Maltese attitude toward policies set by perceived 'outsiders.' How could 'the outsider' understand or empathize with those who experienced a life filled with hardship, misery, and fatalism when nearly one third of children born died before their first birthday? It is clear that various health policies regarding undulant fever were well intentioned, but it was often lost on a suspicious public whose world view on health matters was deeply rooted in the culture of generations past.

Conclusion

Undulant fever lives on as a disease that wreaks misery, sickness, economic hardship, and death at both the individual and community level. Our understanding of this disease emerged in the latter part of the nineteenth century when colonialism and imperialism flourished on the global stage.

Despite the commonality of control under British colonial administration and a region distinguished by a combination of the temperate Mediterranean climate with a scarcity of grazing land, Malta and Gibraltar showed marked differences in experience, management and acceptance of knowledge transfer with undulant fever. The preceding discourse argues that a complex interplay of colonialism acting on cultural milk practices together with the scale effect's impact on the creation, implementation, and enforcement of health policy, can explain differences in the disease experience between the two colonies. Specifically, we can account for the lower rates of undulant fever in the Rock because Gibraltar had: (1) a non-exclusive tradition of consuming raw goats' milk; and (2) effective health-directed policies that dealt with herding and milk consumption; (3) and not least in importance, greater enforcement of policies, and higher levels of intra-group compliancy.

[141] Eyre and Durh, 89.
[142] Busuttil, 1993, 21.
[143] For example during the period, 1919 to 1950, the average infant mortality rate for hot late summer months August and September stood at 314 and 343 per 1000 livebirths respectively.

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