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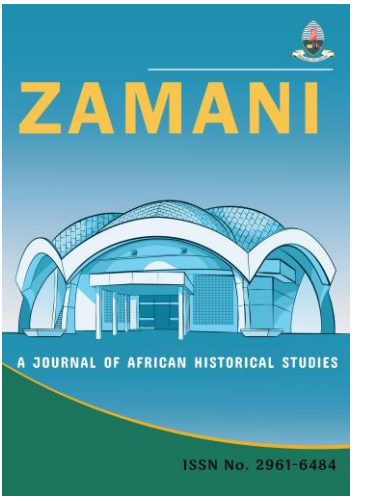

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Research Article: Smallpox outbreaks and immunization policies in Tanzania from the late nineteenth century to the First World War.

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Smallpox outbreaks and immunization policies in Tanzania from the late nineteenth century to the First World War.

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Abstract

An estimated 300 million people died globally from smallpox in the 20th century alone. There was very much a North/South divide in the existence of the disease in that period, with countries across South America, Africa and Asia recording the majority of cases. In 1966 the World Health Organization launched an intensive effort to finally eliminate the disease. The last known endemic case of smallpox was reported in Somalia in 1977, and that outbreak was promptly contained. In 1980 smallpox was declared eradicated – the only infectious disease affecting humans to achieve this distinction. This remains among the most notable and profound public health successes in history. This essay steps back to the first two decades of the twentieth century and considers the smallpox context that evolved in the political entity of German East Africa but alters it slightly to correspond more closely to the modern state of Tanzania, in short, paying minor attention to the residencies of Ruanda and Urundi and rather more attention to the Zanzibari islands in the Indian Ocean.

Keywords: Smallpox, German colonialism, Immunization policies, Zanzibar, Tanzania.

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Introduction: The German landscape

The disease of smallpox was ubiquitous in Europe at the end of the eighteenth century, its periodic appearance disproportionally targeting children. The discovery at that time that an animal-based disease ('cowpox') could create a material that could train the human body to reject smallpox pathogens was a significant moment in the history of modern medicine. This material (and its original bovine source) are the etymological origins of the

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term 'vaccine' and 'vaccination'.[1] Yet it took nearly a century before it could be said that smallpox had been effectively suppressed in the metropolitan German landscape. The lengthy delay in that implementation can be attributed to three interrelated obstacles.

The first was a personal distrust of technology, a distrust that might be personal, familial, or religious; it would fit into the modern idiom of the 'anti-vax' ideologies. The second was the lack of professional standardization among putative medical personnel and the variable financial cost of approaching those personnel. The third was a fragmented political structure that prevented a uniform solution and enforcement to all the first two issues. It was only in 1874 that a bill was passed in the German *Reichstag* that made smallpox vaccination compulsory, initially in the year following birth with re-vaccination at the age of twelve. Yet, there continued to be a substantial public opposition, only gradually alleviated by continuing improvements to the public health infrastructure as well as vaccination procedures. One of those improvements was the shift from the more distressing 'arm-to-arm' vaccination processes to the use of vaccines produced in laboratories. There was one section of society where immunisation was rigidly enforced from the beginning and that was the military. By the time German colonial agents began to penetrate the East African space they were effectively protected from this particular disease. Smallpox would be seen as an African disease in the territory that would become Tanzania.[2]

Local Research Contexts

When dealing with the former German colonies, modern researchers often struggle with practical linguistic constraints as well as the destruction of substantial archival resources, but they are also at times blinded by an irrational assumption that German colonial scientists and officials ceased to

[1] I tend to largely use the more modern etymology of 'vaccine' and 'vaccination' in the essay rather than the more contemporary equivalents of 'lymph' and 'inoculation'.

[2] Claudia Huerkamp, "The History of Smallpox Vaccination in Germany: A First Step in the Medicalization of the General Public," *Journal of Contemporary History* 20, no. 4 (1985): 617-35; Malte Thiessen, 'Security, Society, and the State: Vaccination Campaigns in 19th and 20th Century Germany,' *Historical Social Research / Historische Sozialforschung* 46, no. 4 (2021): 211–315.

produce any significant academic output after the First World War. That blinkered view would have missed an important 1925 historical survey on smallpox by Dr Otto Peiper, one of the most observant medical field officers to operate in German East Africa.[3] That essay incorporated unpublished official data that was in the possession of another prominent colonial medical official, Dr Emil Steudel. Wolfgang Eckart, in his monumental volume detailing medicine in the German colonies, devotes one paragraph to smallpox in German East Africa.[4] It omits Peiper's smallpox consideration but it does utilize a slightly earlier summary consideration by Steudel.[5] There is also a tendency in contemporary and modern scholarship to emphasize the later German colonial period, when a tighter administrative control had been initiated and where it was considered that statistics and reality had more of a congruence, where it could be demonstrated that a colonial administration was proactive not reactive. We will also be incorporating that less-controlled, more chaotic, earlier period.[6]

The Zanzibari Smallpox Events, 1896-99

Accounts of Zanzibari history usually note the bombardment of the Zanzibar harbour complex by British warships in August 1896, a brief event that seems to have injured or killed some 400 individuals. What is deemed less newsworthy is the unfolding of a local smallpox epidemic in that year,

[3] Otto Peiper, "Pocken und Pockenbekämpfung in Deutsch-Ostafrika," *Veröffentlichungen aus dem Gebiete der Medizinverwaltung* XX, no. 6 (1925):1-19 followed by unpaginated tables and photographs.

[4]Wolfgang U Eckhardt, *Medizin und Kolonialimperialismus Deutschland 1884-1945* (Paderborn: Ferdinand Schoningh, 1997), 305. Across his wide-ranging interest in East African history Juhani Koponen has considered smallpox in a succession of similar summary interpretations, the most recent contained in *Development for Exploitation: German colonial policies in Mainland Tanzania, 1884-1914*, 2nd Edn. (Helsinki: Finnish Historical Society, 1995), 471-75.

[5] Emil Steudel, "Aus den Jahres-Medizinal-Berichte 1912/1913 der tropischen deutschen Schutzgebiete," *Beihefte zur Archiv fur Schiffs-und Tropenhygiene* 28, 1 (1924): 6-7. Eckart's second source is a more extensive coverage in *Medizinal-Berichte über die Deutschen Schutzgebiete f*ür *das Jahre 1910/11* (1913): 28-34.

[6] For a more regional comparative context consider Marc Harry Dawson, "Socioeconomic change and disease: smallpox in colonial Kenya, 1880-1920." In *The Social Basis of Health and Healing in Africa* edited by Steven Feierman and John M Janzen, (Berkeley: University of California Press, 1992): 90-103; CJ Roberts, "The Origins of Smallpox in Central Africa" *Central African Journal of Medicine* 13 (1967), 31-3; Andrew Offenburger, "Smallpox and Epidemic Threat in Nineteenth-Century Xhosaland." *African Studies* 67, no. 2 (2008):159-82.

repeated on a more extensive scale in the following year. A German physician resident in Zanzibar described that major outbreak of smallpox on the southern island in the middle of 1897.[7] He estimated that some 2,000 people had died, most of them African, presumably many of them slaves. He noted the descending order of ethnic vulnerability: African, Arab, Indian, European. Three Europeans were impacted in each year, including the death of a lay member of the Universities Mission to Central Africa who had only arrived at the beginning of 1897.[8] The same observer considered the disease endemic, with three-quarters of the African population in Zanzibar carrying physical markers of previous infections. There is no indication given as to whether endemicity derived from previous infestations in the islands or whether it derived from a previous residency on the East African mainland; there is a note however of a temporary quarantine arrangement on the main port facilities.[9] The focal point of the disease appeared to have been the southern island of Zanzibar (Unguja); the northern island of Pemba with its less extensive marine connections seems to have been relatively unaffected. The severity of this particular infection arguably triggered the first concerted attempt at an inoculation program against smallpox in Zanzibar. Vaccines were shipped directly from France and even secondary shipments were briefly tried via French-controlled Madagascar. Friedrichsen noted that there were also non-European approaches to disease control, instances of local *waganga* (healers) applying a version of the 'arm-to-arm' application. This so-called variolation technique used an incision in the forehead of the patient and applied material from a person previously affected.

The isolation of the northern Pemba Island was breached in 1898 and 1899. The direction of contamination was via the southern island of Zanzibar. There was an initial reluctance to accept vaccination but this was

[7] Dr. Friedrichsen, 'Überblick über die gesundheitlichen Verhältnisse der Insel Zanzibar,' *Archiv fur Schiffs- und Tropen-Hygiene* 5 (1901): 11.

[8] *Central Africa* 17, no. 177 (1897): 138. The missionary magazine omits any additional mention of smallpox in Zanzibar other than this short obituary.

[9] In 1892 a smallpox epidemic in Dar es Salaam had killed 600 people, roughly ten per cent of the inhabitants. The origin of that infection was seen as caravans coming from the interior. "Bericht des Oberarztes Dr. Becker über Schutzpockenimpfungen in Deutsch-Ostafrika in den Monaten August und September 1892 und im Monat Januar 1893," *Deutsches Kolonialblatt* IV, 7 (1893): 174.

gradually overcome by the public example of a few ranking Arab officials and their entourage. The British vice-consul (a doctor) noted in an 1899 report that:

> All classes began to present themselves—Arabs, slaves, Wa-Pemba and British Indians; soon they came literally in crowds from all parts of the island, until at length I used to have hundreds of applicants upon those days in each week I vaccinated…. I estimate the total number of victims of all classes claimed by the epidemic at about 20,000—a truly formidable mortality for one year.[10]

Another German researcher of the offshore islands documented epidemics in 1898 and 1901, where "thousands were taken away on both islands".[11] He was also to note the activities of local medical practitioners, but in a less positive sense. He felt *waganga* discouraged official attempts at immunization because it competed with their own business model. A later publication by our resident German physician now observed for 1904 that "Smallpox has only been noted in isolated cases among the coloured population."[12] Port officials across the channel at Tanga, in addition to increased vigilance concerning the plague (*Pest*) potentially transferred by rats on ships traversing the Indian Ocean, were also increasingly aware of local dhow sailing traffic and how that might transfer disease from the Zanzibari island smallpox outbreaks in the 1890s.

This concise observation of disease made by the resident German physician is usefully married with another medical observation made from roughly a decade earlier, a reference that is connected to the so-called Emin Pasha Relief Expedition led by the traveller and self-publicist, Henry Morgan

[10] Dawson's article cited above mentions the outbreaks in Pemba but he neglects to give a source. His doctoral dissertation does. The relevant reports of Vice-Consul Dr. O'Sullivan-Beare are contained in The National Archives (hereafter UKNA) at Kew in the United Kingdom. See UKNA FO 403/281, pgs. 136-138 for 1898 and UKNA FO 403/294 pgs. 117-118 for 1899. These consular reports are also published as self-contained units but can be very difficult to physically locate. See *Report by Vice Consul O'Sullivan on the Island of Pemba, 1898* (London: Harrison & Sons, 1899) and *Report by Vice Consul O'Sullivan on the Island of Pemba, 1899* (London: Harrison & Sons, 1900).

[11] Dr. Alfred Voeltzkow, *Reisen in Ostafrika in den Jahren 1903-1905* Vol. 1, (Stuttgart: Schweizerbart'sche, 1923), 168.

[12] Dr. Friederichsen, "Gesundsheitsbericht für die Monate April bis Juni 1904," *Archiv fur Schiffs- und Tropen-Hygiene* 9, no. 2: 58.

Stanley. The personnel of that expedition contained a medical doctor whose diary of the entire journey is a detailed description of disease.[13] We are not concerned with the land-based component of this journey but rather with the lengthy maritime approach that would eventually terminate at the mouth of the Congo River. The initial expedition left Egyptian ports in 1887 with a basic recruitment of Sudanese ('Nubian') and Somali personnel; it then proceeded by ship down the East African coast to its first major stop at Zanzibar. The expedition physician (Dr Thomas Parke) detected a suspected case of smallpox in one of the Sudanese before they emerged from the Red Sea and promptly recommended a comprehensive vaccination of all expedition members. Of the nine Europeans (one of which was actually Canadian) in the expedition at that moment, only one initially refused the vaccination. He was an "anti-vaccinationist" according to Parke.

A three-day stop in Zanzibar saw a major logistical reorganization of the expedition. It also was an opportunity for Parke to have smallpox conversations with the resident British consular surgeon, Dr Hussey. The latter indicated that he had "used the contents of six tubes which he had procured from England, from which he had not succeeded in obtaining a single successful vaccination." This dissatisfaction with British sources may partially explain the later inclination to prefer French sources. More generally Hussey maintained that there had been "an enormous proportion of failures occur among the vaccinations performed in Zanzibar and the adjacent parts of the African coast."[14]

Stanley's expedition took on a final shape in Zanzibar. Some 623 Zanzibari personnel were recruited. A total of 804 people now departed Zanzibar for the mouth of the Congo on a substantially larger ship. Parke continued his forensic smallpox examination of every 'captive' person in his charge, examining individual medical histories, vaccinating and re-vaccinating until he was satisfied that he had done his utmost to protect every individual. When the vaccines initially obtained in Europe were

[13] Thomas Parke, *My Personal Experiences in Equatorial Africa* (London: Sampson, Low, Marston & Co., 1891). A summary of medical conditions based on Parke's book is contained in Janina Konczacki, "The Emin Pasha Relief Expedition (1887-1889): Some Comments on Disease and Hygiene," *Canadian Journal of African Studies / Revue Canadienne des Études Africaines* 19, no. 3 (1985): 615-25.

[14] Parke, *Experiences*, 28-9 details these conversations.

exhausted, he created his own vaccine from his own charges. He noted that "a large proportion of our Zanzibaris have been already vaccinated, comparatively recently, and a good many of them have had smallpox…. more than a fourth of the total number vaccinated present distinct scars left by the disease."[15] He would subsequently see this work as a highlight of his medical career; no one was to die of smallpox on the expedition. He recalled, however, however, that in the eastern Congo "the unvaccinated Manyuema all around them contracted the most virulent forms of the disease and died in large numbers." [16] The 'rescued' Emin Pasha would soon return to the area where he had first encountered Stanley; he would be killed there. However, just prior to his death, he had sent the bulk of his expeditionary force back to the coast, concerned by a major outbreak of smallpox near Lake Albert.[17]

Localized Medical Knowledge

The interaction of localized w*aganga* and smallpox was not restricted to Zanzibar. In late 1895 and early 1896 the German administration on the mainland had solicited data on local medical practitioners across a designated list of conditions and practices, including smallpox.[18] In Bagamoyo the forehead variolation technique was also noted; it was considered quite successful but was not a widespread practice. An understanding of the infectious spread of smallpox seemed widely understood in that location. The ill were isolated, any carers came from previous survivors of the disease, and clothing of the sick was either buried or washed extensively in seawater. Across the colony, the station at Ujiji had

[15] Ibid., 24.

[16] For general context see Katharine Zöller. "Crossing Multiple Borders: 'The Manyema' in Colonial East Central Africa," *History in Africa* 46 (2019): 299-326.

[17]Franz Ludwig Stuhlmann, *Mit Emin Pascha ins Herz von Afrika* (Berlin: Dietrich Reimer,1894). It was not the only expedition along the central chain of lakes that was severely impacted by smallpox in the early 1890s. See Joseph Thompson, "To Lake Bangweolo and the Unexplored Region of British Central Africa," *Geographical Journal* I, no.2 (1893): 97-115. This article is a transcription of a talk given at the Royal Geographical Society. The audience response documented in the next number of the journal throws up other contemporary examples from Central Africa. See JA Grant, VL Cameron, Dr. Maloney, Crichton Browne, Mr. Arnot, and Commander Keane. "To Lake Bangweolo and the Unexplored Region of British Central Africa: Discussion," *The Geographical Journal* I, no. 2 (1893): 115–21.

[18]"Heilverfahren bei afrikanischen Völkerschaften," A*rbeiten aus den Kaiserlichen Gesundheitsamte* XIV (1898): 647-67.

no information about smallpox, but the Bukoba area also recorded the forehead technique, the substance used derived from blood as well as pustule extractions. The Maasai people near Kilimanjaro were well-acquainted with the forehead technique and combined it with herbal drinks. However, the neighbouring Chagga seemed to have no knowledge of vaccination techniques! The German doctor at Tabora had not heard of any vaccination practices among the Nyamwezi but couldn't rule out that they might exist. The Gogo employed the forehead technique on news of any outbreak.[19] Back again at the coast at Pangani it was maintained that an itinerant Bondei *mganga* had carried out an extensive vaccination campaign in 1893, although resident migratory Nyamwezi and Manyema seemed to express some indifference to his efforts.[20] The neighbouring Shambaa seemed to rely on total isolation of those affected, with the subsequent destruction of their property and residences.[21] Back across the colony again, in the vicinity of Lake Rukwa, the existence of the disease was seen as an affliction spread by a wandering spirit in the shape of a human (*'ndui ni mtu'*), occasionally placated but more often not. [22] A decade later, the ubiquitous Peiper also discussed localized treatment for smallpox in the Kilwa area, treatment that utilized combinations of heat and smoke to treat adult sufferers. He would later note that the variolation technique also existed in Kilwa.[23]

A Southern Complexity: 1899-1900

[19] Heinrich Claus, "Die Wagogo," *Baessler-Archiv: Beiheft II* (1911): 41.

[20] In 1898 this localized effort was reinforced by a government-sponsored campaign at Pangani that saw 14,440 people vaccinated. "Die Impfungen welche vom 1. Juli 1896–30. Juni 1898 durch die Aerzte der Kaiserlichen Schutztruppe ausgeführt worden sind," *Arbeiten aus dem Kaiserlichen Gesundheitsamtes* XV (1899): 357-60. A contemporary account detailing scarification in regard to other protective purposes is considered in Godfrey Dale, "An Account of the Principal Customs and Habits of the Natives Inhabiting the Bonde Country, Compiled Mainly for the use of European Missionaries in the Country," *The journal of Anthropological Institute of Great Britain and Ireland* 25 (1896): 181-239.

[21] A Karasek," Beiträge zur Kenntnis der Waschambaa," Baessler-*Archiv* 1 (1911): 203.

[22]Michael Singleton, "Smallpox in Person. Personification or Personalization (Africa)?," *Anthropos* 71, no. 1/2 (1976): 169-79.

[23]Otto Peiper, "Der Suaheli-Arzt," *Archiv fur Schiffs- und Tropen-Hygiene* XIV, 18 (1910), 564.

In 1899 a smallpox epidemic was raging in southwestern Tanzania, from the shores of Lake Nyasa as far as the middle juncture of the major trade route that connected Songea to Kilwa on the coast. In that latter area people perished, ripening crops were abandoned, and the survivors fled to the bush convinced that evil *shetani* spirits were to blame.[24] The small German administrative post at Barikiwa, on the western edge of the Kilwa district, was concerned by unharvested crops as a byproduct of the epidemic. Not only did this impact on the long-term health of local inhabitants, but it also severely constrained the long-term provisioning capabilities of an extensive caravan traffic supporting the lucrative wild rubber trade. The post hired twenty workers from Kilwa to facilitate harvesting, but this contingent also became infected. Several died, others were retained in a hastily constructed isolation compound, with the remaining crew sent back to Kilwa. The non-commissioned officer at Barikiwa had little choice but to treat the smallpox infestation as a logistic priority rather than a public health emergency. He had no medical training, no access to vaccines and the nearest qualified medical doctors were located more than two hundred kilometres in any direction.

The account of the above conditions around Barikiwa was published in a territorial newspaper several days before a specialist geological expedition departed from Dar es Salaam with that outpost as an interim destination. It was composed of three Europeans and eighty-five African porters and support personnel. The official account of that expedition makes little mention of disease and nothing at all of smallpox.[25] That is not true of a diary maintained by the 'unofficial' member of the same expedition, a certain Dr Kurt Pfund.[26] Pfund notes smallpox destruction in the areas of Uzaramo and Ukhutu that neighboured Dar es Salaam. He details the wide

[24]An account of this area is "Die Pockenerkrankung im Kilwabezirk," *Deutsches Kolonialblatt* X (1899): 659. This mirrors "Aus Kilwa" in *Deutsch-Ostafrikanische Zeitung* I, 15 (10th June 1899). For a more contextual description of this 'middle' area at this time, see Lorne Larson, "The Ngindo: Exploring the Center of the Maji Maji Rebellion," in *Maji Maji: Lifting the Fog of War,* edited by James Giblin and Jamie Monson (Leiden: Brill, 2010).

[25] Karl Dantz,"Die Reisen des Bergassessors Dr. Dantz in Deutsch-Ostafrika in den Jahren 1898,1899, 1900," *Mitteilungen aus den deutschen Schutzgebieten* XV, no. 4 (1902): 213-35 specifically.

[26] Kurt Pfund, *Kreuz und quer durch Deutsch-Ostafrika* (Berlin: Private publication, 1912).

variety of smallpox impact along their diagonal line of march: villages completely abandoned, villages partially abandoned, villages where only women seemed to be survivors, villages where there was apparently no impact. The question of smallpox became more personal. On the thirteenth day of their journey, a porter was detected with smallpox. The caravan would reach the post of Barikiwa and then proceed to Songea. They would lose six porters to smallpox in that period.

When they reached the military post of Songea in mid-September 1899, after fifty days on the road, they would find the local military doctor in a frenzy of vaccination activity, focussing on the Ngoni settlements just north of his post.

> Unfortunately, the population is strongly impacted by smallpox and some villages are completely depopulated. *Oberarzt* Dr. Stierling has already vaccinated thousands of the blacks. Many more come on scheduled days for they have come to appreciate the value of this protection.[27]

Stierling had arrived from Dar es Salaam some nine months previously. He had received vaccine in Dar es Salaam from Dresden, used that resource to vaccinate all his porters, as well as using arm-to-arm techniques to subsequently inoculate any porters acquired on his initial journey to Songea. His attention to medical detail on that journey echoes that of Pierce on his journey from Zanzibar to the mouth of Congo. Once he had reached his post, Stierling sought to productionize vaccine in a variety of ways. His first strategy was to choose ten *askari* soldiers who had not had the disease previously and had not been vaccinated previously. These would comprise a stationary cohort who would be expected to have the most pronounced reaction to any type of inoculation, who would be most likely to exhibit prominent pustules from which significant material could be extracted for vaccine production for local usage. And seven of the ten individuals selected did exactly that. He would also be the first German official in the interior to experiment with using a bovine animal (a calf) to provide a basic replication of the process used back in Dresden.[28]

[27] Pfund, *Kreuz,*104.

[28]Stierling's initial operations are described in *Arbeiten aus dem Kaiserlichen Gesundheitsamtes* 17 (1900), 535-36.

Stierling would then hand off the vaccination effort northwards delivering African personnel to Langenburg, personnel who had been vaccinated in arm-to-arm operations. Dr Friederich Fülleborn, a medical doctor, was interim district administrator at that location. Peiper's later smallpox analysis would see Fülleborn as the "veteran" (*Altmeister*) in this period, as a pivotal figure who took the lead in organizing itinerant vaccination journeys as well as enlisting the help of the German evangelical missionaries concentrated in the area close to Langenburg and Wiedhafen.[29] (There is unfortunately almost no contemporary description of how Fülleborn established vaccine production capabilities; we can only assume he essentially copied Stierling's techniques.) Once this doctor was satisfied that his core administrative areas had been adequately covered, he then pushed further eastwards. On 15 May 1899 he showed up unannounced at the nascent Protestant missionary station at Kidugala, responding to the outbreak of smallpox among the Sangu and Bena. In one day, he vaccinated 1,000 people, instructed the young missionary Paul Gröschel in vaccination techniques, left vaccine, and departed. The subsequent local response was overwhelming, from all ages and sex. The solitary missionary eventually managed to vaccinate 20,000 people, restricting access to only women and children as his vaccine supplies came to an end. He then collapsed with general illness and exhaustion.[30]

At the Iringa military station there had been contemporary concerns about smallpox. The wife of the commander *Hauptmann* Tom Prince expressed her concerns in September 1898:

> Smallpox has again appeared at the station, and this time it is fairly serious. Fortunately, the people are very sensible, and they bring forward

[29] "Ausbruch der Pocken in Wiedhafen und Langenberg," *Deutsches Kolonialblatt* XI, 1 (1900): 65. Originally published as "Pockenepidemie und Hochwasser," *Missionsblatt aus den Brüdergemeine* 63, 11(1899): 345-6. These German evangelical missionary enclaves are considered in Marcia Wright, *German Missions in Tanganyika, 1891–1941: Lutherans and Moravians in the Southern Highlands*. (New York: Oxford University Press. 1971). For contemporary context also see Friedrich Fülleborn, *Das deutsche Nyassa- und Ruvuma-Gebiet, Land und Leute* (Berlin: Dietrich Reimer, 1905). This significant publication frustratingly lacks any detail of the localized production of vaccine by the author.

[30] Paul Gröschel, *Zehn Jahre christlicher Kulturarbeit in Deutsch-Ostafrika* (Berlin: Berliner Mission, 1911), 39-44.

> those who are sick, when the slightest symptoms appear. The caravans are carefully inspected as they arrive. A smallpox hospital has been established about a half an hour from the station. How I wish that the vaccine would finally arrive from the coast, so that we could all get vaccinated.[31]

In fact, Dresden-produced vaccine did arrive in Iringa on 18 December 1898 but the experimentations with that shipment were to initially remain very localized and limited. It was only four months later, when the Princes were to accidentally meet Fülleborn on the boundary of their respective jurisdictions, ten days after he had departed Kidugala, that the Iringa commander was to come into possession of substantive vaccine supplies. "He gave us plenty of vaccine, and we were able to perform extensive vaccinations during the remainder of our journey."[32] Prince would take this vaccine and push it even further eastwards to the edge of his district authority. The missionaries at Muhanga, site of the most eastern of the evangelical German missionary posts, would be given access to Prince's vaccine supply so they could pursue their own medical efforts. In a more modest effort than that of Kidugala they would vaccinate 700 (almost exclusively adults) out of an estimated local population of 1,600; some 250 inhabitants were estimated to have died in the vicinity in the first quarter of 1899.[33] The Muhanga station further noted that just eastwards, off the escarpment into the floodplain of the Kilombero river, smallpox was still "terribly evident". This area was under indeterminate administrative control at that moment, and that would only be theoretically changed on 7 August 1899 when the Mahenge military district was created. This observation from Muhanga essentially brings us back full circle to the documented panic at the Barikiwa substation considered earlier. Both Muhanga and Barikiwa were looking at the same corner of the outbreak, but from different directions.

The manufacturing innovations by Stierling and Fülleborn partly hides the fact that in late 1899 and early 1900 European-sourced vaccines were

[31] Magdalene Prince, *Eine deutsche Frau im Innern Deutsch-Ostafrkas* (Berlin: E. S. Steiner, 1903), 186.
[32] Prince, *Frau,* 200.
[33] *Deutsches Kolonialblatt* XI, 10 (1900), 383.

also penetrating further into the interior; Iringa is an example. This also needs to be understood at a technical level. The debate in the previous decade, both on the mainland and in Zanzibar, had been about the shelf-life and quality of vaccines transported from Europe.[34] The experiments with mass vaccination had been largely restricted to the main coastal settlements. There were lamentations from coastal medical staff that the optimum season (winter) for shipping vaccine from Europe coincided with the lowest seasonal flow of porters from the interior. In addition to the evolving political consolidation within the colony, one must also consider the practical transport infrastructure issues. There were no roads or railways across the colony at this time. Experiments on animal transport by a series of government-financed private contractors had proved disastrous. German postal communications with the north Lake Nyasa took a circuitous route through Portuguese and British-controlled territories.[35]

In 1898, however, a replacement postal delivery structure was put in place that was primarily land-based. It reflected the increased confidence of a colonial administration that considered it had now consolidated its civil and military power in the area assigned to it. Kilwa was initially the pivotal transfer point on the Indian Ocean, inaugurating a scheduled monthly *Postboten* (post runner) transfer that crossed by land to Songea, then to the Lake Nyasa deepwater port of Wiedhafen (today called Manda) to connect with a steamer connection to Langenburg. The entire outward route was scheduled to take 33 days. Whereas the transport of postal objects required waterproof packaging, a new innovation in vaccine transport required the opposite. Insulated cooler boxes were designed, wrapped in an absorbent material, finally packaged in permeable canvas equipped with long carrier straps. "The messenger was instructed to dip the container into every stream and waterhole they passed; the subsequent cooling evaporation of

[34]A comparative debate in British territories is contained in Kristin Brig, "Stabilising Lymph: British East and Central Africa, 'Tropical' Climates, and the Search for Effective Smallpox Vaccine Lymph, 1890s–1903," *The Journal of Imperial and Commonwealth History* 50, no. 5 (2022): 890–914.

[35]For changing flows of telecommunications traffic, see Lorne Larson, "Telecommunications and Conflict in German East Africa: 1891-1907," *Tanzania Zamani* 14, no. 2 (2022): 1-41.

the padded box was sufficient to protect the vaccine."[36] The level of documentation concerning the timing and volume of this specialized traffic, as well as the routes taken to maintain frequent water access, is frustratingly sparse. Peiper, while in Kilwa, would use the same technology in later years on extensive district field trips, estimating that he could maintain the virulence of vaccine for a month in that peripatetic environment. This technical innovation also needs to be paired with the fact that the refrigeration facilities on transport steamers from Europe were being steadily improved, as well as stationary refrigeration facilities in Dar es Salaam and the major coastal ports.

Our emphasis on the southwest in this period should not be exclusionary. In 1899 the mission station at Mamba, sitting on the northern colonial boundary near Moshi took action in the context of news about an outbreak of smallpox around Mount Meru. They acquired vaccine from the district doctor, vaccine that had originated in Germany and had been shipped up the Pangani Valley from Tanga. They then inoculated the small community associated with their mission station.[37] The German evangelical missionaries in the Langenburg area would use their occasional role as immunization auxiliaries to counter the power of local religious leaders as late as 1904.[38] Yet there could be a 'reversal' of that trend. In 1901 a local *mganga* by the name of Mtoko helped to organize an attack on a small government patrol on the Makonde plateau in the hinterland of Lindi. His stated rationale for this action was that his medicines would only be effective on a local outbreak of smallpox when local colonial occupation was eliminated. A wider military force was called into action very rapidly, he was captured, and no serious military retributive action was initiated.[39] A

[36] "Gesundheitsverhältnisse in Deutsch-Ostafrika im Jahre 1899/1900, *Arbeiten aus dem Kaiserlichen Gesundheitsamtes* XIX (1902):363. This basic technology is familiar to the author. As a senior Boy Scout he was required to build a sell-cooling water canteen to support long-distance hikes. The constructional layer was a discarded whiskey bottle, wrapped in old winter stockings, and then encased in discarded canvas cut and sown to size, along with a long strap constructed from an old horse bridle. In action, it was periodically thrown into streams and dams as the hike progressed.

[37] "Nach der Monatschronik von Miss. Althaus," *Evangelisch-Lutherisches Missionsblatt* Nr. 20 (15 October 1899): 408-11.

[38] Wright, *German Missions*, 102.

[39] *Deutsch-Ostafrikanische Zeitung* XXI, no. 36 (14 September 1901).

significant vaccination effort from the Lindi district authorities was shortly in progress. Indeed, in the 1901/1902 reporting year the territorial immunization effort remained concentrated in the South generally, with Lindi and Kilwa districts by themselves accounting for 62.78% of the action.[40]

The Peopling of the Immunization Process

It is also useful to look at the personnel (as well as the target populations) involved in the vaccination process in a later period, a period which no longer depended on the opportunistic recruitment of commercial or missionary personnel. The number of German medical personnel would continue to expand in the latter part of the colonial period but Peiper would insist in 1925 that the primary operational decisions just prior to the First World War rested with just nineteen people, essentially the district medical officers.[41] Some districts like the minute Rufiji district had no medical officer, and that particular function was run from the Kilwa station. Each of these district medical officers would encounter a unique combination of geographical environments, population concentrations, and political conditions. Each of these individuals would trigger action, proactive or reactive. Each would decide which subordinates, German or African, needed to be involved. Peiper's very personal view of the centrality of the district doctor should not blind us to the fact that a second layer of German medical expertise, the equivalent of the military non-commissioned officer, could be opportunistically shifted around the colony to deal with medical emergencies. The 'Africanization' of infrastructure management was increasingly common across areas like transport and communications infrastructure. It was to be the same in the area of health. In Iringa, for example, the local production of smallpox vaccine was now done by three trained African members of the military detachment. At Mwanza a cadre of

[40]Dr. Steuber, "Gesundheitsverhältnisse in Deutsch-Ostafrika im Jahre 1901/1902," *Arbeiten aus dem Kaiserlichen Gesundheitsamtes* XXI (1904): 46.

[41]Steudel's 1924 survey would indicate that there were fifty-five government doctors active in the 1912/13 reporting year. Peiper is using that number 'nineteen' in a figurative sense. He is acknowledging the fact that there were nineteen civil districts in the colony, along with two military districts and the loosely controlled *Residenturen* in the northwestern edge of the colony.

senior school students were trained in vaccination and accompanied the district doctor on periodic trips. In administrative centres that had hospital/infirmary structures, the 'hospital boy' organized mass vaccination events, instructed participants, and kept the event running smoothly. Compulsion was implied, but never officially employed. A scheduled event would be described for Kilwa town. "The best opportunity was offered by the daily market in the cool market halls. A mobile inoculation unit was erected. Hospital personnel as well as police *askari* would organize the visitors: inhabitants of the town (Indians as well as coloured), caravan porters from the interior, market visitors from the surrounding area. Adults as well as children of either sex were present."[42]

We are fortunate in having photographs of these events attached to Peiper's article. These photographs emphasize the gender and ethnic differentiation in queues, but they also reveal a small surprise that is absent from any written documentation. In early 1911 Otto Peiper married another professional doctor (Irma Peiper) in Germany and brought her back to East Africa. The captions note that she specialized in dealing specifically with the vaccination of women and children in the environs of Dar es Salaam. Peiper was again adamant that compulsion was never employed in these exercises, but the presence of a woman *mganga* expedited the acceptance of vaccination and probably did so even more where Muslim women were concerned. Women were rarely passive objects in these exercises. An urban medical event appears to have transpired in Lindi town in 1909. A German woman visitor at this time was temporarily housed in a ward of the local hospital because of a shortage of hotel space in town. On the following morning, she was awakened early by a loud clamour. Her enquiry elicited the response that "… six hundred native women had already gathered for the purpose of obtaining a vaccination, since smallpox was having a strong impact on the natives of Lindi."[43] Within weeks she was travelling with a hunting party along the Mbwemkuru river, the dividing line between Kilwa and Lindi administrations. Within a short time, the news had spread that

[42] Peiper, "Pocken," 377.

[43]Margarethe von Eckenbrecher, *Im dichten Pori: Reise- und Jagdbilder aus Deutsch-Ostafrika* (Berlin: Ernst Siegfried Muller, 1912): 64-86.

she was an *mganga* and she was swamped by women seeking generalized treatment for their children.

It was accepted that an itinerant male population that flowed across the colony engaged in wage labour as porters or seeking stationary work on the plantations or railways, were far more likely to encounter immunization scenarios than the women and children left behind in more isolated rural environments. This particular gender grouping increasingly became the focus of more targeted district field trips. If we can visualize the Kilwa and Lindi districts as two rectangular boxes stacked on each other in the southeast corner of the colony, then we know that two medical field trips unfolded in 1909, independent of each other. These journeys essentially skimmed the northern and southern edges of this combined administrative construct. We know little of the southern trip by Dr Ernst Lürz but we have more data to reconstruct the northern Kilwa trip. One of the reasons we know more about this other voyage is because it generated another seminal publication by Dr Otto Peiper, one on infant mortality.[44] This northern field trip encompassed eighteen conurbations; the largest was the far western village of Madaba, coincidentally traversed by the Dantz expedition in 1898. Some 472 women were interviewed on the trip and one might assume that they had their current children immunized, of which there were 453 in total. Historically, smallpox ranked at position four in specified infant mortality causes in these interviews, behind gastroenteritis, malnourishment, and malaria.[45] This field trip also needs to be placed in a wider medical agenda that extends beyond smallpox vaccination. Peiper was also checking for hookworm (*Ancylostomiasis*) infections in adults and treating with the contemporary drug of choice (*thymol*). Having also articulated a new territorial vision of leprosy settlements for the colony, he created the basis of five such district settlements on this trip, the most western being again at the village of Madaba. Peiper took his most senior African medical employee, *Hospital boy* Bakari, to assist him. They utilized a minimum two-

[44]Otto Peiper, "Über Säuglingssterblichkeit und Säuglingsernahrung im Bezirke Kilwa (Deutsch-Ostafrika)," *Archiv fur Schiffs- und Tropen-Hygiene* XIV, no. 8 (1910): 233-59.

[45] This is after military violence has been removed from the statistical list.

day vaccination process in each community, a concession to the villagers' need to maintain a rotational crop protection duty at this time of the year.

The Structured Years 1910-1914

When Peiper was transferred to Dar es Salaam in 1910, the medical responsibility of the southeast districts was temporarily allocated to one medical doctor based at Lindi. That individual decided in 1910 to concentrate smallpox vaccination efforts on that small district of Mohoro (Rufiji) that encompassed the mouth of the Rufiji River and the Matumbi Hills.[46] He noted considerable scarification from an older outbreak of smallpox which oral evidence suggested may have dated from 1897 or 1898. He vaccinated 20,000 individuals, some of which travelled for ten hours to reach vaccination sites. The vaccines used were of European origin; their effectiveness not diminished by a negligible journey from the coast to their implementation site. The district doctor involved would declare there were no smallpox incidents in his southeastern districts in the reporting year and that appeared to be the case across the entire southern third of the colony, with the exception of the Mahenge military district; that district was one of nine in that timeframe that did report smallpox on a minor scale. The majority of those other instances now occurred in the Bukoba and Mwanza districts adjoining Lake Victoria, areas that always had ambiguous areas of control along both British and Belgian borders. The completion of the Uganda Railway in 1901 triggered a significant reconfiguration of porterage traffic that used to flow to Bagamoyo; a new Central Railroad would only later connect Dar es Salaam and Tabora in early 1912. Trade now increased significantly between the port of Mwanza and Tabora, and special checkpoints were established to monitor the immunization status of those individuals utilizing that route. Very similar measures were taken immediately to the east in the Kondoa-Irangi district where increased porterage traffic from the Kilimanjaro area intersected the towns of Kilimatinde and Dodoma, again on the Central Railway. African medical personnel manned district border posts and it was said that "…scarcely a

[46] Medizinal-*Berichte über die Deutschen Schutzgebiete Deutsch-Ostafrika, Kamerun, Togo, Deutsch-Südwestafrika, Neu-Guinea, Karolinen, Marshall-Inseln und Samoa, für das Jahr 1910/11* (1913): 168

single coloured person entered or left the district without being immunized".[47]

Moving even further eastwards the theme of transient populations was a factor in medical activities in the 'northern' districts (Bagamoyo, Pangani, Tanga, Wilhelmsthal). The ring of protection around Kondoa-Irangi proved to be slightly porous on the western side. Migrant workers heading for work on the European plantations of the Pangani corridor had brought smallpox with them. This was dealt with swiftly by the government doctor based at the Amani research institute in the East Usambaras. This reactive work also coincided with a more proactive vaccination campaign that targeted plantations, other population conurbations as well as workers on the Pangani Railway that was stuttering its way to completion at Arusha. In this northeastern region Some 54,484 people were vaccinated in 1909/10 using vaccines produced in Dar es Salaam, Mpwapwa and Arusha.[48] The priority was on the Handeni area of the Pangani district but the vaccination effort was widespread. The ability to utilize the local Usambara railway as well as horse-drawn transport facilitated the more rapid distribution of vaccine.

These examples of regional variations need to be finally set in a territorial perspective. The number of vaccinations (primary and secondary) substantially increased starting in the reporting year 1908/09 where a total of 117,766 instances were recorded; this jumped dramatically to 892,162 in the following reporting year.[49] In the five years spanning 1908/09 and 1912/13 some 3,248,407 people were inoculated in German East Africa, slightly more than 43% of the total population.[50] The use of imported vaccines always proved to be somewhat problematic. The primary European origin of smallpox vaccine for German East Africa was a production facility in Dresden, and sometimes in Hamburg, although some limited experiments were made with a different construct of vaccine manufactured in Switzerland. The success rate with imported vaccine

[47] Ibid., 30.

[48] Ibid., 155-8, 347-8.

[49] Reporting years involved the last nine months of one calendar year and the first three of the following

[50] I am using the table in Peiper, "Pocken", 18-19. Also see Medizinal-*Berichte über die Deutschen Schutzgebiete Deutsch-Ostafrika, Kamerun, Togo, Deutsch-Südwestafrika, Neu-Guinea, Karolinen, Marshall-Inseln und Samoa, für das Jahr 1910/11* (1913): 29-32.

hovered roughly around twenty per cent. By early 1912 the procurement of imported vaccine ceased. Beginning in 1907 external supply was being rapidly replaced by a network of territorial production centres, both regional and district based. By 1911 it could be said that vaccine production capability existed in nearly all districts (with the exception of Lindi). In 1912/13 some 248 animals (from rabbits to cattle) were involved in the territorial production cycle and surpluses were now being exported northwards into British East Africa as well as across to Zanzibar. Sales would also be made to large commercial enterprises like the one constructing the Central Railroad. [51] One should not solely concentrate on vaccines to the exclusion of the 'arm-to-arm' technique. This technique continued to have a number of advantages in local contexts. It was generally agreed to have a 90% effectiveness, it was a highly convenient source for a geographically extensive vaccination tour, and (arguably) it was culturally attuned to the localized variolation ('arm-to-forehead') technique. In 1909/10, the peak year for territorial action, this method was used in just over ten percent of the vaccinations.

Conclusion

The German colonial authorities in German East Africa made substantive progress in dealing with smallpox, in many aspects reflecting the historical evolutionary progress with the disease in Germany, as outlined at the beginning of the essay. This was to be substantially disrupted by the local dynamics of the First Word War, then by a global recession, then by another global conflict, all of which constrained the type and number of human and technical resources that could be concentrated on the colonial medical arena. That chaotic disruption would create an opportunity for Christian missionary societies to exert an increasingly assertive role in establishing independent medical infrastructures. But there would always be room for the individual quixotic event, just as there had been in the period of German control. The rectangular administrative unit of Kilwa that had created Peiper's reputation was further divided into two squares under British administration. The western district office was based at Liwale, very close

[51]Emil Steudel, "Aus den Jahres-Medizinal-Berichten 1912/13 der tropischen deutschen Schutzgebiete", *Beihefte zur Archiv für Schiffs-und Tropenhygiene* 1 (1924):7.

to where the young German non-commissioned officer had panicked over a looming smallpox epidemic in 1899. Four decades later this administrative post had a high personnel turnover and no medical infrastructure. In 1942 a new district officer would arrive accompanied by a wife who had trained in medicine at university but had been forced to drop out for financial reasons. For the next several years she would adopt a highly peripatetic role, dispensing medical care in the company of her touring husband. She would, in effect, replicate the local roles of both Otto and Irma Peiper.

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